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Promotion and protection of all human rights, civil, political, economic, social and cultural rights, including the right to development

Report submitted by the Special Rapporteur on the right to food, Olivier De Schutter

Summary

The reinvestment in agriculture, triggered by the 2008 food price crisis, is essential to the concrete realization of the right to food. However, in a context of ecological, food and energy crises, the most pressing issue regarding reinvestment is not how much, but how. This report explores how States can and must achieve a reorientation of their agricultural systems towards modes of production that are highly productive, highly sustainable and that contribute to the progressive realization of the human right to adequate food.

Drawing on an extensive review of the scientific literature published in the last five years, the Special Rapporteur identifies agroecology as a mode of agricultural development which not only shows strong conceptual connections with the right to food, but has proven results for fast progress in the concretization of this human right for many vulnerable groups in various countries and environments. Moreover, agroecology delivers advantages that are complementary to better known conventional approaches such as breeding high-yielding varieties. And it strongly contributes to the broader economic development.

The report argues that the scaling up of these experiences is the main challenge today. Appropriate public policies can create an enabling environment for such sustainable modes of production. These policies include prioritizing the procurement of public goods in public spending rather than solely providing input subsidies; investing in knowledge by reinvesting in agricultural research and extension services; investing in forms of social organization that encourage partnerships, including farmer field schools and farmers' movements innovation networks; investing in agricultural research and extension systems; empowering women; and creating a macro-economic enabling environment, including connecting sustainable farms to fair markets.

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I. Introduction

1. In this annual report submitted to the Human Rights Council in accordance with Council resolution 13/4, the Special Rapporteur on the right to food shows why agriculture should be fundamentally redirected towards modes of production that are more environmentally sustainable and socially just, and how this can be achieved. The report is based on a large range of submissions received from experts from all regions, as well as on an international expert seminar on agroecology convened by the Special Rapporteur in Brussels, Belgium, on 21-22 June 2010, with support from the King Baudouin Foundation.

2. Agriculture is at a crossroads. For almost thirty years, since the early 1980s, neither the private sector nor governments were interested in investing in agriculture. This is now changing. Over the last few years, agri-food companies have seen an increase in direct investment as a means to lower costs and ensure the long-term viability of supplies:[1] Foreign direct investment in agriculture went from an average US$ 600 million annually in the 1990s to an average US$ 3 billion in 2005-2007.[2] The shock created by the 2007-2008 global food price crisis led to the establishment or strengthening of further initiatives, such as the Aquila Food Security Initiative, the Global Agriculture and Food Security Program (GAFSP) or NEPAD's Comprehensive Africa Agriculture Development Program (CAADP) in Africa. Governments are paying greater attention to agriculture than in the past.

3. But increasing food production to meet future needs, while necessary, is not sufficient. It will not allow significant progress in combating hunger and malnutrition if it is not combined with higher incomes and improved livelihoods for the poorest – particularly small-scale farmers in developing countries. And short-term gains will be offset by long-term losses if it leads to further degradation of ecosystems, threatening future ability to maintain current levels of production. It is possible, however, to significantly improve agricultural productivity where it has been lagging behind, and thus raise production where it needs most to be raised (i.e. in poor, food-deficit countries[3]), while at the same time improving the livelihoods of smallholder farmers and preserving ecosystems. This would slow the trend towards urbanisation in the countries concerned, which is placing stress on public services of these countries. It would contribute to rural development and preserve the ability for the succeeding generation to meet its own needs. It would also contribute to the growth of other sectors of the economy by stimulating demand for non-agricultural products that would result from higher incomes in rural areas.

4. To achieve this, however, pouring money into agriculture will not be sufficient; what is most important is to take steps that facilitate the transition towards a low-carbon, resource-preserving type of agriculture that benefits the poorest farmers. This will not happen by chance. It can only happen by design, through strategies and programmes backed by strong political will, and informed by a right-to-food approach. This report explores how agroecology, a mode of agricultural development that has shown notable success in the last decade (see Section III), can play a central role in achieving this goal.

[1] See A/HRC/13/33.

[2] United Nations Conference on Trade and Development (UNCTAD), *World Investment Report 2009. Transnational Corporations, Agricultural Production and Development*, New York/Geneva, 2009.

[3] Although this report focuses on these countries, the Special Rapporteur is convinced that the transition towards low external input and sustainable agriculture is needed in all regions, including industrialized countries.

II. Diagnosis: three objectives of food systems

5. Ensuring the right to food requires the possibility either to feed oneself directly from productive land or other natural resources, or to purchase food. This implies ensuring that food is available, accessible and adequate. Availability relates to there being sufficient food on the market to meet the needs. Accessibility requires both physical and economic access: physical accessibility means that food should be accessible to all people, including the physically vulnerable such as children, older persons or persons with disabilities; economic accessibility means that food must be affordable without compromising other basic needs such as education fees, medical care or housing. Adequacy requires that food satisfy dietary needs (factoring a person's age, living conditions, health, occupation, sex, etc), be safe for human consumption, free of adverse substances and culturally acceptable. Participation of food-insecure groups in the design and implementation of the policies that most affect them is also a key dimension of the right to food.

6. Consistent with obligations assumed by States under international human rights treaties to take effective measures towards the realization of the right to food, food systems should be developed in order to meet the following three objectives.

7. First, food systems must ensure the availability of food for everyone, that is, supply must match world needs. The most widely cited estimates state that an overall increase in agricultural production should reach 70 per cent by 2050,[4] taking into account demographic growth, as well as changes in the composition of diets and consumption levels associated with increased urbanization and higher household incomes. This estimate, however, needs to be put in an appropriate perspective, since it takes the current demand curves as a given. At present, nearly half of the world's cereal production is used to produce animal feed, and meat consumption is predicted to increase from 37.4 kg/person/year in 2000 to over 52 kg/person/year by 2050, so that by mid-century, 50 per cent of total cereal production may go to increasing meat production.[5] Therefore, reallocating cereals used in animal feed to human consumption, a highly desirable option in developed countries where the excess animal protein consumption is a source of public health problems, combined with the development of alternative feeds based on new technology, waste and discards, could go a long way towards meeting the increased needs. The United Nations Environmental Programme (UNEP) estimates that, even accounting for the energy value of the meat produced, the loss of calories that result from feeding cereals to animals instead of using cereals directly as human food represents the annual calorie need for more than 3.5 billion people.[6] In addition, food losses in the field (between planting and harvesting) may be as high as 20 to 40 per cent of the potential harvest in developing countries, due to pests and pathogens, and the average post-harvest losses, resulting from poor storage and conservation, amount at least to 12 per cent, and up to 50 per cent for fruits and vegetables.[7] Finally, as a result of policies to promote the production and use of agrofuels, the diversion of crops from meeting food needs to meeting energy needs contributes to tightening the pressure on agricultural supplies. Although these are all domains in which measures could be adopted, the need to meet the supply-side challenge remains.

[4] J.A. Burney, et al., "Greenhouse gas mitigation by agricultural intensification," *Proceedings of the National Academy of Sciences*, 107:26, 2010, pp. 12052-12057.

[5] Food and Agriculture Organization (FAO), *World Agriculture: towards 2030/2050,* Interim Report, Rome, 2006.

[6] United Nations Environment Programme (UNEP), *The environmental food crisis – The environment's role in averting future food crises*, 2009, p. 27.

[7] Ibid., pp. 30-31.

8. Second, agriculture must develop in ways that increase the incomes of smallholders. Food availability is, first and foremost, an issue at the household level, and hunger today is mostly attributable not to stocks that are too low or to global supplies unable to meet demand, but to poverty; increasing the incomes of the poorest is the best way to combat it. Cross-country comparisons show that GDP growth originating in agriculture is at least twice as effective in reducing poverty as GDP growth originating outside agriculture.[8] But some types of investments are more effective than others in achieving that objective. The multiplier effects are significantly higher when growth is triggered by higher incomes for smallholders, stimulating demand for goods and services from local sellers and service-providers. When large estates increase their revenue, most of it is spent on imported inputs and machinery, and much less trickles down to local traders.[9] Only by supporting small producers can we help break the vicious cycle that leads from rural poverty to the expansion of urban slums, in which poverty breeds more poverty.

9. Third, agriculture must not compromise its ability to satisfy future needs. The loss of biodiversity, unsustainable use of water, and pollution of soils and water are issues which compromise the continuing ability for natural resources to support agriculture. Climate change, which translates in more frequent and extreme weather events, such as droughts and floods and less predictable rainfall, is already having a severe impact on the ability of certain regions and communities to feed themselves. It is also destabilizing markets.[10] The change in average temperatures is threatening the ability of entire regions, particularly those living from rain-fed agriculture, to maintain actual levels of agricultural production.[11] Less fresh water will be available for agricultural production, and the rise in sea level is already causing the salinization of water in certain coastal areas, making water sources improper for irrigation purposes. By 2080, 600 million additional people could be at risk of hunger, as a direct result of climate change.[12] In Sub-Saharan Africa, arid and semi-arid areas are projected to increase by 60 million to 90 million hectares, while in Southern Africa, it is estimated that yields from rain-fed agriculture could be reduced by up to 50 per cent between 2000 and 2020.[13] Losses in agricultural production in a number of developing countries could be partially compensated by gains in other regions, but the overall result would be a decrease of at least 3 per cent in productive capacity by the 2080s, and up to 16 per cent if the anticipated carbon fertilization effects (incorporation of carbon dioxide in the process of photosynthesis) fail to materialize.[14]

10. Most efforts in the past have focused on improving seeds and ensuring that farmers are provided with a set of inputs that can increase yields, replicating the model of industrial

[8] World Bank, *World Development Report 2008: Agriculture for Development,* Washington D.C., 2007, p. 6. See also J. Alston et al., "A meta-analysis of rates of return to agricultural R&D," Research report 113, Washington D.C., International Food Policy Research Institute (IFPRI), 2002.

[9] Ulrich Hoffmann, "Assuring food security in developing countries under the challenges of climate change: Key trade and development issues of a profound transformation of agriculture," Discussion Paper No. 201, UNCTAD, November 2010, p. 15.

[10] For a fuller review of the impacts of climate change on human rights, including the right to food, see A/HRC/10/61.

[11] "Stern Review on the Economics of Climate Change," Cambridge, UK, Cambridge Univ. Press, 2007, p. 67.

[12] United Nations Development Programme (UNDP), *Human Development Report 2007/2008. Fighting climate change: Human solidarity in a divided world,* New York, 2007, p. 90.

[13] Intergovernmental Panel on Climate Change (IPCC), "Climate Change 2007: Impacts, Adaptation and Vulnerability." Working Group II contribution to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge, UK, Cambridge Univ. Press, chapter 9.

[14] William R. Cline, *Global Warming and Agriculture. Impact Estimates by Country*, Washington D.C., Center for Global Development/Peterson Institute for International Economics, 2007, p. 96.

processes in which external inputs serve to produce outputs in a linear model of production. Instead, agroecology seeks to improve the sustainability of agroecosystems by mimicking nature instead of industry.[15] This report suggests that scaling up agroecological practices can simultaneously increase farm productivity and food security, improve incomes and rural livelihoods, and reverse the trend towards species loss and genetic erosion.

11. The following sections explain what agroecology is, and how it contributes to the realization of the right to adequate food in its different dimensions: availability, accessibility, adequacy, sustainability and participation (Section III). However, in moving towards more sustainable farming systems, time is the greatest limiting factor. Whether or not we will succeed will depend on our ability to learn faster from recent innovations and to disseminate works more widely. Section IV is dedicated to public policies that States should adopt to scale up agroecology.

III. Contribution of agroecology to the right to food

12. Agroecology is both a science and a set of practices. It was created by the convergence of two scientific disciplines: agronomy and ecology. As a science, agroecology is the "application of ecological science to the study, design and management of sustainable agroecosystems."[16] As a set of agricultural practices, agroecology seeks ways to enhance agricultural systems by mimicking natural processes, thus creating beneficial biological interactions and synergies among the components of the agroecosystem. It provides the most favourable soil conditions for plant growth, particularly by managing organic matter and by raising soil biotic activity. The core principles of agroecology include recycling nutrients and energy on the farm, rather than introducing external inputs; integrating crops and livestock; diversifying species and genetic resources in agroecosystems over time and space; and focusing on interactions and productivity across the agricultural system, rather than focusing on individual species. Agroecology is highly knowledge-intensive, based on techniques that are not delivered top-down but developed on the basis of farmers' knowledge and experimentation.

13. As a way to improve the resilience and sustainability of food systems, agroecology is now supported by an increasingly wide range of experts within the scientific community,[17] and by international agencies and organizations, such as the United Nations Food and Agriculture Organization (FAO), UNEP[18] and Biodiversity International.[19] It is also gaining ground in countries as diverse as the United States, Brazil, Germany and France.[20]

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[15] Miguel A. Altieri, *Agroecology: The Science of Sustainable Agriculture*, 2nd ed., Boulder, Colorado, Westview Press, 1995; S. Gliessman, *Agroecology: the ecology of sustainable food systems*, Boca Raton, Florida, CRC Press, 2007.

[16] M.A. Altieri, *Agroecology: The Science of Sustainable Agriculture*, cited above n. 15.

[17] International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD), *Summary for Decision Makers of the Global Report*, approved by 58 governments in Johannesburg, April 2008, see Key Finding 7; see A. Wezel et al., "A quantitative and qualitative historical analysis of the scientific discipline of agroecology," *International Journal of Agricultural Sustainability*, 7:1, 2009, pp. 3-18 (showing the rising interest for agroecology in scientific literature).

[18] Miguel A. Altieri and Clara I. Nicholis, *Agroecology and the Search for a Truly Sustainable Agriculture*, UNEP, Mexico, 2005.

[19] Sustainable Agriculture and Rural Development (SARD) Policy Brief 11, 2007.

[20] For a review of the developments in these four countries, see: A. Wezel et al., "Agroecology as a science, a movement and a practice. A review," *Agronomy for Sustainable Development*, 29, 2009, pp. 503-515.

14. Agroecology is a coherent concept for designing future farming systems as it is strongly rooted both in science and in practice, and because it shows strong connections with the principles of the right to adequate food (Section III). It can be seen as encompassing – or closely related to – approaches such as "ecoagriculture"[21] and "evergreen agriculture,"[22] while the concepts of "ecological intensification" and "conservation agriculture" often follow certain agroecological principles. Agroecology is also linked to the "ecosystem approach to sustainable crop production intensification" recently supported by the FAO Committee on Agriculture (COAG).[23] Discussion of the detailed differences among these concepts is beyond the scope of this report.

15. Crop breeding and agroecology are complementary. For instance, breeding provides new varieties with shorter growing cycles, which enable farmers to continue farming in regions where the crop season has already shrunk. Breeding can also improve the level of drought resistance in plant varieties, an asset for countries where lack of water is a limiting factor. Reinvesting in agricultural research must consequently mean continued efforts in breeding. However, agroecology is more overarching as it supports building drought-resistant agricultural systems (including soils, plants, agrobiodiversity, etc.), not just drought-resistant plants.

A. Availability: agroecology raises productivity at field level

16. A wide panoply of techniques based on the agroecological perspective have been developed and successfully tested in a range of regions.[24] These approaches involve the maintenance or introduction of agricultural biodiversity (diversity of crops, livestock, agroforestry, fish, pollinators, insects, soil biota and other components that occur in and around production systems) to achieve the desired results in production and sustainability. *Integrated nutrient management* reconciles the need to fix nitrogen within farm systems with the import of inorganic and organic sources of nutrients and the reduction of nutrient losses through erosion control. *Agroforestry* incorporates multifunctional trees into agricultural systems. In Tanzania, 350,000 hectares of land have been rehabilitated in the Western provinces of Shinyanga and Tabora using agroforestry;[25] there are similar large-scale projects developed in other countries including Malawi, Mozambique and Zambia.[26] *Water harvesting* in dryland areas allows for the cultivation of formerly abandoned and degraded lands, and improves the water productivity of crops. In West Africa, stone barriers built alongside fields slow down runoff water during the rainy season, allowing an improvement of soil moisture, the replenishment of water tables, and reductions in soil erosion. The water retention capacity is multiplied five- to ten-fold, the biomass production

[21] Miguel A. Altieri and Clara I. Nicholis, *Agroecology and the Search for a Truly Sustainable Agriculture*, cited above n. 18.

[22] D.P. Garrity et al., "Evergreen Agriculture: a robust approach to sustainable food security in Africa," *Food Security* 2:3, 2010, pp. 197–214.

[23] Report of the 22nd Session of the Committee on Agriculture (COAG), Rome, 16-19 June 2010 (CL 140/3 (C 2011/17)).

[24] See Jules Pretty, "Agricultural sustainability: concepts, principles and evidence," Philosophical Transactions of the Royal Society B, 363(1491), 2008, pp. 447-465.

[25] C. Pye-Smith "A Rural Revival in Tanzania: How agroforestry is helping farmers to restore the woodlands in Shinyanga Region," *Trees for Change* No. 7, Nairobi, World Agroforestry Centre (ICRAF), 2010, p. 15.

[26] D.P. Garrity et al., "Evergreen Agriculture: a robust approach to sustainable food security in Africa," *Food Security* 2:3, 2010, p. 200; K. Linyunga et al., "Accelerating agroforestry adoption: A case of Mozambique," ICRAF Agroforestry Project, Paper presented at the IUFRO Congress, Rome, 12-15 July 2004.

multiplies by 10 to 15 times, and livestock can feed on the grass that grows along the stone barriers after the rains.[27] *Integration of livestock into farming systems*, such as dairy cattle, pigs and poultry, provides a source of protein to the family, as well as a means of fertilizing soils; so does the incorporation of fish, shrimps and other aquatic resources into farm systems, such as irrigated rice fields and fish ponds.

17. Such resource-conserving, low-external-input techniques have a proven potential to significantly improve yields. In what may be the most systematic study of the potential of such techniques to date, Jules Pretty et al. compared the impacts of 286 recent sustainable agriculture projects in 57 poor countries covering 37 million hectares (3 per cent of the cultivated area in developing countries). They found that such interventions increased productivity on 12.6 millions farms, with an average crop increase of 79 per cent, while improving the supply of critical environmental services.[28] Disaggregated data from this research showed that average food production per household rose by 1.7 tonnes per year (up by 73 per cent) for 4.42 million small farmers growing cereals and roots on 3.6 million hectares, and that increase in food production was 17 tonnes per year (up 150 per cent) for 146,000 farmers on 542,000 hectares cultivating roots (potato, sweet potato, cassava). After UNCTAD and UNEP reanalyzed the database to produce a summary of the impacts in Africa, it was found that the average crop yield increase was even higher for these projects than the global average of 79 per cent at 116 per cent increase for all African projects and 128 per cent increase for projects in East Africa.[29]

18. The most recent large-scale study points to the same conclusions. Research commissioned by the Foresight Global Food and Farming Futures project of the UK Government reviewed 40 projects in 20 African countries where sustainable intensification was developed during the 2000s. The projects included crop improvements (particularly improvements through participatory plant breeding on hitherto neglected orphan crops[30]), integrated pest management, soil conservation and agro-forestry. By early 2010, these projects had documented benefits for 10.39 million farmers and their families and improvements on approximately 12.75 million hectares. Crop yields more than doubled on average (increasing 2.13-fold) over a period of 3-10 years, resulting in an increase in aggregate food production of 5.79 million tonnes per year, equivalent to 557 kg per farming household.[31]

19. Sometimes, seemingly minor innovations can provide high returns. In Kenya, researchers and farmers developed the "push-pull" strategy to control parasitic weeds and insects that damage the crops. The strategy consists in "pushing" away pests from corn by inter-planting corn with insect-repellent crops like *Desmodium*, while "pulling" them towards small plots of Napier grass, a plant that excretes a sticky gum which both attracts

[27] A.M. Diop, "Management of Organic Inputs to Increase Food Production in Senegal," in *Agroecological innovations. Increasing food production with participatory development*, N. Uphoff (ed.), London, Earthscan Publications, 2001, p. 252.

[28] Jules Pretty et al., "Resource-conserving agriculture increases yields in developing countries," *Environmental Science and Technology*, 40:4, 2006, pp. 1114−1119. The 79 per cent figure refers to the 360 reliable yield comparisons from 198 projects. There was a wide spread in results, with 25 per cent of projects reporting a 100 per cent increase or more.

[29] UNEP-UNCTAD Capacity Building Task Force on Trade, Environment and Development (CBTF), *Organic Agriculture and Food Security in Africa*, New York/Geneva, United Nations, 2008, p. 16.

[30] Such as improvements on cassava, for which NaCRRI developed locally-developed resistant varieties in Uganda, or improvements on tef in Ethiopia, where the Debre Zeit Agricultural Research Centre developed a new variety called Quncho.

[31] J. Pretty et al., "Sustainable intensification in African agriculture," *International Journal of Agricultural Sustainability*, 9:1, forthcoming in 2011.

and traps pests. The system not only controls pests but has other benefits as well, because *Desmodium* can be used as fodder for livestock. The push-pull strategy doubles maize yields and milk production while, at the same time, improves the soil. The system has already spread to more than 10,000 households in East Africa by means of town meetings, national radio broadcasts and farmer field schools.[32] In Japan, farmers found that ducks and fish were as effective as pesticide for controlling insects in rice paddies, while providing additional protein for their families. The ducks eat weeds, weed seeds, insects, and other pests, thus reducing weeding labour, otherwise done by hand by women, and duck droppings provide plant nutrients. The system has been adopted in China, India, and the Philippines. In Bangladesh, the International Rice Research Institute reports 20 per cent higher crops yields, and net incomes on a cash cost basis have increased by 80 per cent.[33]

20. Agroecology is also gaining ground in Malawi, a country that has been at the centre of attention in recent years. Malawi successfully launched a fertilizer subsidy programme in 2005-2006, following the dramatic food crisis due to drought in 2004-2005. However, it is now implementing agroforestry systems, using nitrogen-fixing trees, to ensure sustained growth in maize production in preparation for the medium-term situation when fertilizer subsidies may have to be scaled back or withdrawn.[34] By mid-2009, over 120,000 Malawian farmers had received training and tree materials from the programme, and support from Ireland has now enabled extension of the programme to 40 per cent of Malawi's districts, benefiting 1.3 million of the poorest people. Research shows that this results in increased yields from 1 t/ha to 2–3 t/ha, even if farmers cannot afford commercial nitrogen fertilizers. With an application of a quarter-dose of mineral fertilizer, maize yields may surpass 4 t/ha. However, this shows that, while investment in organic fertilizing techniques should be a priority, this should not exclude the use of other fertilizers. An optimal solution that could be an exit strategy from fertilizer subsidy schemes would be to link fertilizer subsidies directly to agroforestry investments on the farm in order to provide for long-term sustainability in nutrient supply, and to build up soil health as the basis for sustained yields and improved efficiency of fertilizer response.[35] Malawi is reportedly exploring this "subsidy to sustainability" approach.[36]

B. Accessibility: agroecology reduces rural poverty

Sustainable on-farm fertility management

21. By enhancing on-farm fertility production, agroecology reduces farmers' reliance on external inputs and state subsidies. This, in turn, makes vulnerable smallholders less

[32] Z. Khan et al., "Push-pull technology: a conservation agriculture approach for integrated management of insect pests, weeds and soil health in Africa," *International Journal of Agricultural Sustainability*, 9:1, forthcoming in 2011.

[33] "Integrated rice-duck: a new farming system for Bangladesh," in *Innovations in Rural Extension: Case Studies from Bangladesh*, P. Van Mele et al. (eds.), Oxfordshire, UK/Cambridge, USA, CABI Publishing, 2005.

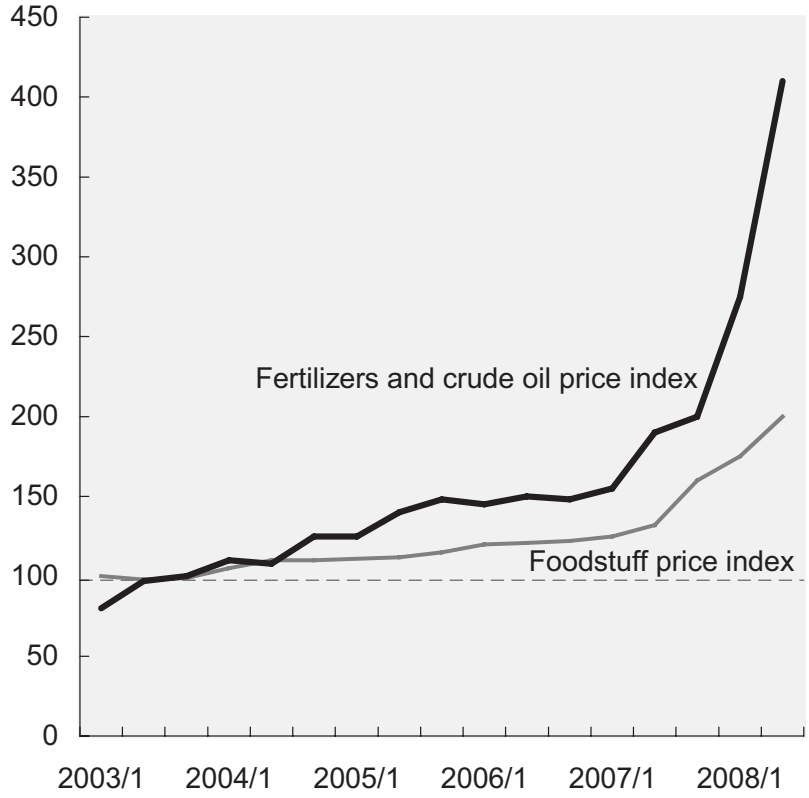
[34] D.P. Garrity et al., "Evergreen Agriculture: a robust approach to sustainable food security in Africa," *Food Security* 2:3, 2010, p. 203.

[35] See O.C. Ajayi et al., "Labour inputs and financial profitability of conventional and agroforestry-based soil fertility management practices in Zambia," *Agrekon*, 48, 2009, pp. 246–292: "[…] agro-ecological methods of soil fertility management are compatible with mineral fertilisers, and their combined use has synergistic yield effects," (p. 288).

[36] D.P. Garrity et al., "Evergreen Agriculture: a robust approach to sustainable food security in Africa," *Food Security* 2:3, 2010, p. 204. For assessments of this experience, see Ann Quinion et al., "Do agroforestry technologies improve the livelihoods of the resource poor farmers? Evidence from Kasungu and Machinga districts of Malawi," *Agroforestry Systems*, 80:3, 2010, pp. 457-465.

dependent on local retailers and moneylenders. One key reason why agroecology helps to support incomes in rural areas is because it promotes on-farm fertility generation. Indeed, supplying nutrients to the soil does not necessarily require adding mineral fertilizers. It can be done by applying livestock manure or by growing green manures. Farmers can also establish a "fertilizer factory in the fields" by planting trees that take nitrogen out of the air and "fix" it in their leaves, which are subsequently incorporated into the soil. That, in essence, is the result of planting *Faidherbia albida*, a nitrogen-fixing acacia species indigenous to Africa and widespread throughout the continent. Since this tree goes dormant and sheds its foliage during the early rainy season at the time when field crops are being established, it does not compete significantly with them for light, nutrients or water during the growing season; yet it allows a significant increase in yields of the maize with which it is combined, particularly in conditions of low soil fertility. In Zambia, unfertilized maize yields in the vicinity of *Faidherbia* trees averaged 4.1 t/ha, compared to 1.3 t/ha nearby, but beyond the tree canopy. Similar results were observed in Malawi, where this tree was also widely used. The use of such nitrogen-fixing trees avoids dependence on synthetic fertilizers, the price of which has been increasingly high and volatile over the past few years, exceeding food commodity prices, even when the latter reached a peak in July 2008. In this way, whatever financial assets the household has can be used on other essentials, such as education or medicine.

Figure 1



Source: Global Challenges for Food and Agriculture: FAO's Long-term Outlook for Global Agriculture, Rome, 2008, available at www.fao.org.

22. Agroforestry or comparable techniques such as the use of leguminous-cover crops to fix nitrogen also have a huge potential.[37] This matters particularly to the poorest farmers, who are least likely to be able to afford to buy inorganic fertilizers, and whom fertilizer distribution systems often do not reach, particularly since the private sector is unlikely to invest into the most remote areas where communication routes are poor and few economies of scale can be achieved. But it is also of great importance to low-income countries, which import to meet their inorganic fertilizer needs. In sub-Saharan Africa, part of the reason why the use of fertilizers is very low (average 13 kilograms (kg) of fertilizer nutrients per hectare)[38] is because of the considerable fiscal costs involved in the import and distribution of fertilizers.

Multiplier effects for rural development: job creation, increased incomes

23. Agroecological approaches can be labour-intensive during their launching period, due to the complexity of the tasks of managing different plants and animals on the farm, and recycling the waste produced. However, research shows that the higher labour-intensity of agroecology is a reality particularly in the short term.[39] In addition, while labour-saving policies have generally been prioritized by governments, creation of employment in rural areas in developing countries, where underemployment is currently massive, and demographic growth remains high, may constitute an advantage rather than a liability and may slow down rural-urban migration. Moreover, the cost of creating jobs in agriculture is often significantly lower than in other sectors: in Brazil, data from INCRA, the agency responsible for land reform, showed that each job generated in a settlement costs the government 3.640 USD, while the cost would be 128 per cent more expensive in industry, 190 per cent more in trade, and 240 per cent more in services.[40] According to peasant organizations, agroecology is also more attractive to farmers, because it procures pleasant features for those working the land for long hours, such as shade from trees or the absence of smell and toxicity from chemicals.[41]

24. In Burkina Faso, rather than migrating, work groups of young men specialized in land rehabilitation techniques, such as tassas and zai planting pits, go from village to village to satisfy farmers' growing interest in improving their own lands. Farmers are now buying degraded land for improvement and paying these labourers to dig zai pits and construct the rock walls and half-moon structures which can transform yields.[42] This is one of the reasons why more than 3 million hectares of land in Burkina Faso are now rehabilitated and productive.

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[37] On a global scale, leguminous cover crops could fix enough nitrogen to replace the amount of synthetic fertilizer currently in use: see C. Badgley et al., "Organic agriculture and the global food supply," *Renewable Agriculture and Food Systems*, 22, 2007 pp. 86-108.

[38] Nicholas Minot and Todd Benson, *Fertilizer subsidies in Africa: Are vouchers the answer?* IFPRI Issue Brief 60, July 2009.

[39] See O.C. Ajayi et al., "Labour inputs and financial profitability of conventional and agroforestry-based soil fertility management practices in Zambia," *Agrekon*, 48, 2009, pp. 246–292: research on agroforestry in Zambia does not support "the popular notion that agroforestry practices are more labour intensive." (p. 279).

[40] Miguel Carter (org.), *Combatendo a desigualdade social: O MST e a reforma agrária no Brasil*, São Paulo, Editora Unesp, Centre for Brazilian Studies, Universidade de Oxford, NEAD, MDA, 2010, p. 69.

[41] P. Rosset et al. *Revolución agroecológica: El Movimiento de Campesino a Campesino de la ANAP en Cuba*, Havana, La Via Campesina and ANAP, 2010.

[42] J. Pretty et al., "Sustainable intensification in African agriculture," *International Journal of Agricultural Sustainability*, 9:1, forthcoming in 2011.

25. Although they can create jobs, agroecological approaches are fully compatible with a gradual mechanization of farming. The need to produce equipment for conservation agricultural techniques such as no-till and direct seeding actually results in more jobs being created in the manufacturing sector. This is true in particular in Africa which still imports most of its equipment, but which increasingly manufactures simple equipment[43] Employment could also result from the expansion of agroforestry. In Southern Africa, farmers produce trees as a business, supported by a financing facility established by the World Agroforestry Centre (ICRAF). During its first year, the Malawi Agroforestry Food Security Programme distributed tree seeds, setting up 17 nurseries that raised 2,180,000 seedlings and establishing 345 farmer groups.[44]

C. Adequacy: agroecology contributes to improving nutrition

26. In the past, Green Revolution approaches have focused primarily on boosting cereal crops. However, rice, wheat and maize are mainly sources of carbohydrates: they contain relatively little protein, and few of the other nutrients essential for adequate diets. The shift from diversified cropping systems to simplified cereal-based systems thus contributed to micronutrient malnutrition in many developing countries.[45] Indeed, of the over 80,000 plant species available to humans, rice, wheat and maize supply the bulk of our protein and energy needs.[46] Nutritionists now increasingly insist on the need for more diverse agro-ecosystems, in order to ensure a more diversified nutrient output of the farming systems.[47]

27. The diversity of species on farms managed following agroecological principles, as well as in urban or peri-urban agriculture, is an important asset in this regard. For example, it has been estimated that indigenous fruits contribute on average about 42 per cent of the natural food-basket that rural households rely on in southern Africa.[48] This is not only an important source of vitamins and other micronutrients, but it also may be critical for sustenance during lean seasons. Nutritional diversity, enabled by increased diversity in the field, is of particular importance to children and women.

D. Sustainability: agroecology contributes to adapting to climate change

28. Agroecology improves resilience to climate change. Climate change means more extreme weather-related events. The use of agroecological techniques can significantly cushion the negative impacts of such events, for resilience is strengthened by the use and

[43] In East Africa, this development was facilitated by the exchange of technology from Brazilian manufacturers to their counterparts in East Africa: see Brian Sims et al., "Agroforestry and Conservation Agriculture: Complementary practices for sustainable development," 2nd World Congress of Agroforestry, Nairobi, Kenya, 23-28 August 2009.

[44] C. Pye-Smith, *Farming Trees, Banishing Hunger: How an agroforestry programme is helping smallholders in Malawi to grow more food and improve their livelihoods*, Nairobi, World Agroforestry Centre, 2008, p. 10.

[45] M.W. Demment et al., "Providing micronutrients through food based solutions: a key to human and national development," *Journal of Nutrition*, 133, 2003, pp. 3879-3885.

[46] E. Frison et al., "Agricultural biodiversity, nutrition and health: making a difference to hunger and nutrition in the developing world," *Food and Nutrition Bulletin*, 27:2, 2006, pp. 167-179.

[47] See B.J. Alloway (ed.), *Micronutrient deficiencies in global crop production*, Springer Verlag, 2008, 354 pp.; and F.A.J. DeClerck et al., "Ecological Approaches to Human Nutrition," *Food and Nutrition Bulletin*, forthcoming in 2011.

[48] B. Campbell et al., "Local level valuation of Savannah resources: A case study from Zimbabwe," *Economic Botany*, 51, 1997, pp. 57–77.

promotion of agricultural biodiversity at ecosystem, farm system and farmer field levels, which is materialized by many agroecological approaches.[49] Following Hurricane Mitch in 1998, a large-scale study on 180 communities of smallholders from southern to northern Nicaragua demonstrated that farming plots cropped with simple agroecological methods (including rock bunds or dikes, green manure, crop rotation and the incorporation of stubble, ditches, terraces, barriers, mulch, legumes, trees, plowing parallel to the slope, no-burn, live fences, and zero-tillage) had on average 40 per cent more topsoil, higher field moisture, less erosion and lower economic losses than control plots on conventional farms. On average, agroecological plots lost 18 per cent less arable land to landslides than conventional plots and had 69 per cent less gully erosion compared to conventional farms.[50]

29. More frequent and more severe droughts and floods can be expected in the future; agroecological modes of farming are better equipped to support such shocks. The agroforestry programme developed in Malawi protected farmers from crop failure after droughts, thanks to the improved soil filtration it allowed.[51] Indeed, on-farm experiments in Ethiopia, India, and the Netherlands have demonstrated that the physical properties of soils on organic farms improved the drought resistance of crops.[52]

30. In addition, the diversity of species and of farm activities that agroecological approaches allow are ways to mitigate risks from extreme weather events, as well as from the invasion of new pests, weeds and diseases, that will result from global warming. The agroecological practice of cultivar mixtures bets on genetic diversity in the fields in order to improve crop resistance to diseases. In the Yunnan Province in China, after disease-susceptible rice varieties were planted in mixtures with resistant varieties, yields improved by 89 per cent and rice blast disease was 94 per cent less severe than when the varieties were grown in monoculture, leading farmers to abandon the use of fungicidal sprays.[53]

31. Agroecology also puts agriculture on the path of sustainability by delinking food production from the reliance on fossil energy (oil and gas). It contributes to mitigating climate change, both by increasing carbon sinks in soil organic matter and above-ground biomass, and by avoiding carbon dioxide or other greenhouse gas emissions from farms by reducing direct and indirect energy use. The Intergovernmental Panel on Climate Change (IPCC) has estimated the global technical mitigation potential for agriculture at 5.5 to 6 Gt of CO_2-equivalent per year by 2030.[54] Most of this total (89 per cent) can come from

[49] "The use of agrobiodiversity by indigenous and traditional agricultural communities in adapting to climate change," Synthesis paper, Platform for Agrobiodiversity Research – Climate Change project, Bioversity International and The Christensen Fund, 2010.

[50] Eric Holt-Giménez, "Measuring Farmers' Agroecological Resistance After Hurricane Mitch in Nicaragua: A Case Study in Participatory, Sustainable Land Management Impact Monitoring," *Agriculture, Ecosystems and the Environment*, 93:1-2, 2002, pp. 87-105.

[51] F.K. Akinnifesi et al., "Fertiliser trees for sustainable food security in the maize-based production systems of East and Southern Africa. A review," *Agrononomy for Sustainable Development*, 30:3, 2010, pp. 615-629.

[52] F. Eyhord et al., "The viability of cotton-based organic agriculture systems in India," *International Journal of Agricultural Sustainability*, 5, 2007, pp. 25-38; S. Edwards, "The impact of compost use on crop yields in Tigray, Ethiopia," FAO International Conference on Organic Agriculture and Food Security, Rome, 2-4 May 2007.

[53] Y.Y. Zhu, et al., "Genetic diversity and disease control in rice," *Nature*, 406, 2000, pp. 718–722.

[54] IPCC, *Climate Change 2007: Mitigation of Climate Change*, Contribution of Working Group III to Fourth assessment Report, 2007: section 8.4.3.

carbon sequestration in soils, storing carbon as soil organic matter (humus), something which can be done through agroecology.[55]

E. Farmer participation: an asset for the dissemination of best practices

32. The participation of farmers is vital for the success of agroecological practices. So far, agroecology has been developed by grassroots organizations and NGOs, and it has spread through farmer field schools and farmers' movements, such as the Campesino a Campesino movement in Central America.[56] Experience with agroecological techniques is growing everyday within peasant networks such as La Via Campesina and the AgriCultures Network (former LEISA) globally; Réseau des Organisations Paysannes et des Producteurs Agricoles de l'Afrique de l'Ouest (ROPPA), Eastern & Southern Africa Farmers' Forum (ESAFF), and PELUM (Participatory Ecological Land Use Management) network in Africa, MASIPAG network in the Philippines (Magsasaka at Siyentista Tungo sa Pag-unlad ng Agrikultura), or Assessoria e Serviços a Projetos em Agricultura Alternativa (AS-PTA) and Movimento dos Trabalhadores Sem Terra (MST) in Brazil.[57]

33. Farmer field schools have been shown to significantly reduce the amounts of pesticides use, as inputs are being replaced by knowledge. Large-scale studies from Indonesia, Vietnam and Bangladesh recorded 35 to 92 per cent reduction in insecticide use in rice, and 34 to 66 per cent reduction in pesticide use, combined with 4 to 14 per cent better yields recorded in cotton production in China, India and Pakistan.[58] Farmer field schools have also proven to be empowering by helping farmers to organize themselves better, and stimulating continued learning. The successful dissemination of the push-pull strategy (PPS) in East Africa, promoted by the International Centre for Insect Physiology and Ecology (ICIPE), is largely due to the demonstration of fields managed by model farmers, which attracts visits by other farmers during field days, and to partnerships with national research systems in Tanzania, Uganda, Ethiopia and other countries that have made research and development efforts to bring about the necessary adaptations such as choice of maize cultivars.[59] The growth of the Campesino a Campesino movement in Cuba relied on technical advisers and coordinators supported by the National Association of Small Farmers (ANAB). Between 2001 and 2009, the number of "*promotores*" increased

[55] Ulrich Hoffmann, "Assuring food security in developing countries under the challenges of climate change: Key trade and development issues of a profound transformation of agriculture," Discussion Paper No. 201, UNCTAD, November 2010, p. 11. On the mitigation potential of agriculture, see also FAO, *Food security and agricultural mitigation in developing countries: options for capturing synergies*, Rome, 2009.

[56] A. Degrande, et al., *Mechanisms for scaling-up tree domestication: how grassroots organisations become agents of change*, ICRAF, 2006, p. 6; E. Holt-Giménez, *Campesino a campesino: voices from Latin America's farmer to farmer movement for sustainable agriculture*, Oakland, Food First Books, 2006; P. Rosset et al. *Revolución agroecológica: El Movimiento de Campesino a Campesino de la ANAP en Cuba*, Havana, La Via Campesina and ANAP, 2010.

[57] E. Holt Giemenez, "Linking farmers' movements for advocacy and practice," *Journal of Peasant Studies*, 37:1, 2010, pp. 203-236.

[58] Henk Van den Berg and Janice Jiggins, "Investing in Farmers. The Impacts of Farmer Field Schools in Relation to Integrated Pest Management," *World Development*, 35:4, 2007, pp. 663-686.

[59] David M. Amudavi, et al., "Evaluation of farmers' field days as a dissemination tool for push-pull technology in Western Kenya," *Crop Protection*, 28, 2009, p. 226.

from 114 to 11,935, and a total of 121,000 workshops on agroecological practices were organized.[60]

34. State support can build on those efforts. In Brazil, for example, the 2010 Act on extension and technical assistance for family farming and agrarian reform (Lei 12.188/2010)[61] prioritizes support to rural extension activities in ecological agriculture. This Act will accentuate the qualitative shift in the Brazilian extension services which is parallel to quantitative changes in the last decade. Indeed, extension activities organized under the Brazilian National Rural Extension Policy (2003) have increased from an average of 2,000 activities/year in 2004-2005 to an average of close to 30,000/year in 2007-2009.[62] Such efforts enable a rapid dissemination of best practices, including agroecological practices, especially when farmers participate in the system and are not mere receivers of trainings.

IV. Public policies for the scaling up of agroecology

35. Scaling up agroecology in order to maximize its positive impacts on farmers' incomes, productivity and the environment means both (horizontally) increasing the areas cultivated by agroecological techniques and (vertically) creating an enabling framework for the farmers. Innovative ways of ensuring horizontal expansion include the "pilot scaling up" strategy such as the one successfully implemented in the Chinyanja Triangle (Mozambique, Malawi and Zambia) and West and Central Africa by the World Agroforestry Centre for tree domestication. The strategy relies on the identification of Pilot Scaling Up Areas (PSUAs) and the establishment of "scaling up platforms," the formation of "change teams" and the identification of partners: from grassroots organization to private companies.[63] The targeting of the zones where the adoption of agroecology has the greatest potential, based on biophysical criteria, may be facilitated by Geographic Information Systems (GIS), such as those that have been used both in Europe and in Southern Africa in order to identify the suitability areas for the scaling up of agroforestry systems.[64] As mentioned earlier, the dissemination of the push-pull strategy in East Africa by the International Centre for Insect Physiology and Ecology (ICIPE) was based both on demonstration fields managed by model farmers, which attracts visits by other farmers during field days, and on partnerships with national research systems in neighbouring countries that facilitated take-up of this approach. Localized innovations can spread rapidly through such approaches (see Figure 2 below).

[60] P. Rosset, et al., "The Campesino-to-Campesino agroecology movement of ANAP in Cuba: social process methodology in the construction of sustainable peasant agriculture and food sovereignty," *Journal of Peasant Studies*, 38:1, forthcoming in 2011, pp. 29-30.

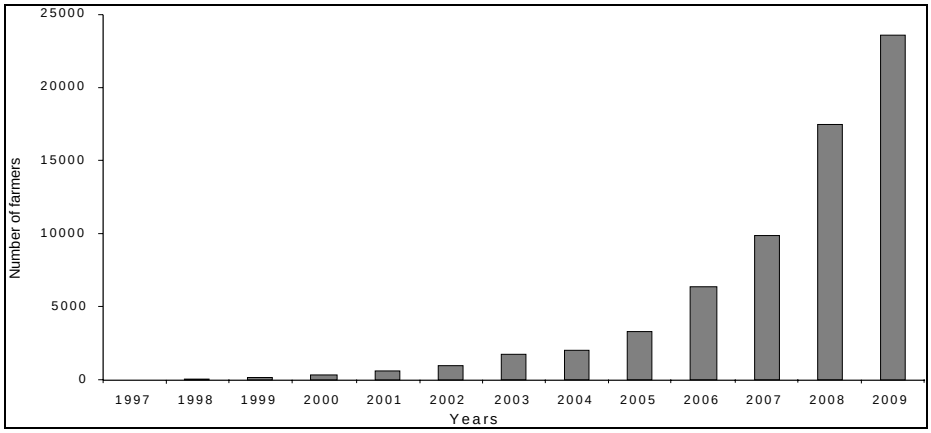
[61] Brazil, Lei 12.188/2010, Assistência Técnica e Extensão Rural para a Agricultura Familiar e Reforma Agrária.

[62] Personal communication from Fransisco Roberto Caporal, General Coordinator, Department of Technical Assistance and Rural Extension, Ministry of Agrarian Development, Brazil, 20 July 2010.

[63] K. Linyunga et al., "Accelerating agroforestry adoption: A case of Mozambique," ICRAF Agroforestry Project, Paper presented at the IUFRO Congress, Rome, 12-15 July 2004.

[64] E.A. Ellis et al., "Computer-based tools for decision support in agroforestry: Current state and future needs," *Agroforestry Systems*, 61-62, 2004, pp. 401-421.

Figure 2



Number of farmers using the push-pull system in western Kenya (1997–2009)[65]

36. This report focuses on the vertical dimension of scaling up agroecology, namely, the establishment of an enabling framework – although this is both a condition and a driver of horizontal scaling up. Governments have a key role to play in this regard, beyond supporting access to land, water and seeds for small-scale farmers.[66] This section identifies a number of principles that could support the scaling up of agroecological practices. Encouraging a shift towards sustainable agriculture may be a delicate process associated with transition costs, since farmers must learn new techniques that move away from the current systems, which are more specialized, less adaptive, and have a lower innovation capacity.[67] Therefore, the following principles should be applied with flexibility. The incentive structures which such policies create to encourage the shift towards sustainable farming should be regularly tested and re-evaluated with the participation of the beneficiaries, transforming policy into a mode of "social learning rather than an exercise of political authority."[68] The move towards agroecology should be based on the farmers themselves - its main beneficiaries. Agroecological techniques are best spread from farmer to farmer, since they are often specific to an agroecological zone.

A. Prioritizing public goods

37. Agroecological practices require the supply of public goods such as extension services, storage facilities, rural infrastructure (roads, electricity, information and communication technologies) and therefore access to regional and local markets, access to credit and insurance against weather-related risks, agricultural research and development, education, and support to farmer's organizations and cooperatives. While this requires funding, the investment can be significantly more sustainable than the provision of private goods, such as fertilizers or pesticides that farmers can only afford so long as they are

[65] Taken from Z. Khan et al., "Push-pull technology: a conservation agriculture approach for integrated management of insect pests, weeds and soil health in Africa," Foresight Food and Farming Futures project of the UK government, 2010, p. 6.

[66] The Special Rapporteur explored these dimensions in previous reports (A/64/170 and A/65/281).

[67] J. Pretty et al., "Sustainable intensification in African agriculture," *International Journal of Agricultural Sustainability*, 9:1, forthcoming in 2011.

[68] A.M. Diop, "Management of Organic Inputs to Increase Food Production in Senegal," in *Agroecological innovations. Increasing food production with participatory development*, N. Uphoff (ed.), London, Earthscan Publications, 2001, p. 252.

subsidized. While many efforts have been made since 2008 to reinvest in agriculture, too little attention has been paid to the differences between the various types of investment required and to understanding their impacts on the reduction of rural poverty. This has led World Bank economists to note that "underinvestment in agriculture is […] compounded by extensive misinvestment"[69] with a bias towards the provision of private goods, sometimes motivated by political considerations.[70] Research based on the study of 15 Latin American countries over the period 1985–2001 in which government subsidies for private goods was distinguished from expenditures in public goods indicated that, within a fixed national agriculture budget, a reallocation of 10 per cent of spending to supplying public goods increases agricultural per capita income by 5 per cent, while a 10 per cent increase in public spending on agriculture, keeping the spending composition constant, increases per capita agricultural income by only 2 per cent.[71] In other words, "even without changing overall expenditures, governments can improve the economic performance of their agricultural sectors by devoting a greater share of those expenditures to social services and public goods instead of non-social subsidies."[72] Thus, while the provision or subsidization of private goods may be necessary up to a point, the opportunity costs should be carefully considered.

B. Investing in knowledge

38. Agroecology is knowledge-intensive. It requires the development of both ecological literacy and decision-making skills in farmer communities. Investments in agricultural extension and agricultural research are key in this regard. While agricultural spending is among the four top contributors to increasing rural welfare, along with public spending in education, health and roads,[73] agricultural research has the greatest overall impact on poverty and agricultural productivity in developing countries. Agricultural research had "the largest impact on agricultural production and second-largest impact on poverty reduction (after rural education) in China, and the second-largest impact on poverty reduction in rural India (after investment in roads)."[74] Research in agroecological practices, in particular, should be prioritized, because of the considerable and largely untapped potential of such practices. Modern science combines with local knowledge in agroecological research. In Central America for instance, the coffee groves grown under high-canopy trees were improved by the identification of the optimal shade conditions, minimizing the entire pest complex and maximizing the beneficial microflora and fauna while maximizing yield and coffee quality.[75] However, perhaps because such practices

[69] D. Byerlee et al., "Agriculture for development: Toward a new paradigm," *Annual Review of Resource Economics*, 1, 2009, pp. 15-31.

[70] World Bank, *World Development Report 2008: Agriculture for Development,* Washington D.C., 2007, p. 41.

[71] Ramón López and Gregmar I. Galinato, "Should governments stop subsidies to private goods? Evidence from rural Latin America," *Journal of Public Economics*, 91, 2007, p. 1085.

[72] Allcott Hunt et al., "Political Institutions, Inequality, and Agricultural Growth: The Public Expenditure Connection," World Bank Policy Research Working Paper 3902, April 2006, p. 24.

[73] S. Fan et al., "Setting priorities for public spending for agricultural and rural development in Africa," IFPRI Policy Brief 12, April 2009, p. 2.

[74] S. Fan, "Public expenditures, growth, and poverty. Lessons from developing countries," IFPRI Issue Brief 51, August 2008.

[75] C. Staver et al., "Designing pest suppressive multistrata perennial crop systems: shade-grown coffee in Central America," *Agroforestry Systems*, 53, 2001, pp. 151–170.

cannot be rewarded by patents, the private sector has been largely absent from this line of research.[76]

C. Strengthening social organisation by co-construction

39. Agroecological practices are best adopted when they are not imposed top-down but shared from farmer to farmer. Extension services play a key role in favouring the scaling up of agroecology. An improved dissemination of knowledge by horizontal means transforms the nature of knowledge itself, which becomes the product of a network.[77] It should encourage farmers, particularly small-scale farmers, living in the most remote areas to identify innovative solutions, by working with experts towards a co-construction of knowledge to ensure that advances will benefit them as a matter of priority, rather than only benefiting the better-off producers.[78] Co-construction is key for the realization of the right to food. First, it enables public authorities to benefit from the experience and insights of the farmers. Rather than treating smallholder farmers as beneficiaries of aid, they should be seen as experts with knowledge that is complementary to formalized expertise. Second, as the Special Rapporteur has previously illustrated in describing participatory plant-breeding,[79] participation can ensure that policies and programmes are truly responsive to the needs of vulnerable groups, who will question projects that fail to improve their situation. Third, participation empowers the poor – a vital step towards poverty alleviation. Lack of power is a source of poverty, as marginal communities often receive less support than the groups that are better connected to government. Poverty exacerbates this lack of power, creating a vicious circle of further disempowerment. Fourth, policies that are co-designed with farmers have a high degree of legitimacy and thus favour better planning of investment and production and better up-take by other farmers.[80] Participation of food-insecure groups in the policies that affect them should become a crucial element of all food security policies, from policy design to the assessment of results to the decision on research priorities. Indeed, improving the situation of millions of food-insecure peasants cannot be done without them.

40. The best of what scientists can offer and the valuable experience of smallholder farmers should be brought together in order to develop participatory modes of learning. The development of participation can go beyond the field technology itself. In West Africa, for instance, citizens' juries on the governance of food and agricultural research were set up by the International Institute for Environment and Development (IIED), the Coordination Nationale des Organisations Paysannes (CNOP) and other partners, resulting in farmers formulating 100 recommendations after having heard experts on the models of agriculture, land tenure and property rights, macroeconomic issues and the governance of agricultural

[76] G. Vanloqueren and P.V. Baret, "How agricultural research systems shape a technological regime that develops genetic engineering but locks out agroecological innovations," *Research Policy*, 38, 2009, pp. 971–983.

[77] K.D. Warner and F. Kirschenmann, *Agroecology in Action: Extending Alternative Agriculture through Social Networks*, Cambridge, USA, MIT Press, 2007.

[78] N. Uphoff, "Institutional change and policy reforms," in *Agroecological innovations. Increasing food production with participatory development*, N. Uphoff (ed.), London, Earthscan Publications, 2001, p. 255.

[79] A/64/170, paras. 54-55.

[80] A well-known example is the process that led to the adoption of the Loi d'orientation agricole in Mali, the 2008 national agricultural policy: see FAO-IIED, "The Right to Food and Access to Natural Resources - Using Human Rights Arguments and Mechanisms to Improve Resource Access for the Rural Poor," Right to Food Study, Rome, FAO, 2008.

research.[81] Not only research and extension services should develop into learning organisations, so too should ministries, and educational and financial institutions.[82] Farmers' organizations and networks have accumulated experience on the dissemination of agroecological practices in the last decade, with proven results. These movements are already functioning as learning organizations; they must now be supported in this role.

D. Gender empowerment

41. Specific, targeted schemes should ensure that women are empowered and encouraged to participate in this construction of knowledge. Culturally-sensitive participatory initiatives with female project staff and all-female working groups, and an increase in locally-recruited female agricultural extension staff and village motivators facing fewer cultural and language barriers, should counterbalance the greater access that men have to formal sources of agricultural knowledge.[83] It is a source of concern to the Special Rapporteur that, while women face a number of specific obstacles (poor access to capital and land, the double burden of work in their productive and family roles, and low participation in decision-making), gender issues are incorporated into less than 10 per cent of development assistance in agriculture, and women farmers receive only 5 per cent of agricultural extension services worldwide.[84] In principle, agroecology can benefit women most, because it is they who encounter most difficulties in accessing external inputs or subsidies. But their ability to benefit should not be treated as automatic; it requires that affirmative action directed specifically towards women be taken.

E. Organizing markets

42. In previous reports, the Special Rapporteur has insisted on the need to facilitate the ability of small-scale farmers to join supply chains.[85] Farmers should also be encouraged to move up the value chain by adding value to raw products through assuming increased roles in packaging, processing, and marketing their produce. Cooperatives can help them achieve economies of scale to facilitate adding value.[86] This can also be supported by novel types of partnerships with the private sector. However, improved access to markets is essential if this is to happen. Better access to markets requires the development of communication routes, particularly rural feeder roads. The marginal returns to public spending on feeder roads for agriculture output and poverty reduction has been estimated to be "three to four times larger than the return to public spending on murram and tarmac roads."[87] In addition, support for agroecological practices will fail to achieve the desired results if markets are not organized to protect farmers from volatile prices and the dumping of subsidized products on

[81] Michel Pimbert et al., *Democratising Agricultural Research for Food Sovereignty in West Africa*, Bamako/London, IIED and others, 2010.

[82] Jules Pretty and Norman Uphoff, "Human dimensions of agroecological development," in *Agroecological innovations. Increasing food production with participatory development*, N. Uphoff (ed.), London, Earthscan Publications, 2001, p. 245.

[83] Sarah Jewitt, "Unequal Knowledges in Jharkhand, India: De-Romanticizing Women's Agroecological Expertise," *Development and Change*, 31:5, 2000, pp. 961–985.

[84] "Women Organising for Change in Agriculture and NRM," Women Leaders' Dialogue, 36th session of the Committee on World Food Security, 13 October 2010.

[85] See A/HRC/13/33, paras. 28-50.

[86] Ibid., para. 31.

[87] Samuel Benin et al., "Agricultural Growth and Investment Options for Poverty Reduction in Malawi," IFPRI Discussion Paper 00794, September 2008, p. 41.

their local markets, which can seriously disrupt local production.[88] Similarly, public procurement systems, fiscal incentives and credit, and land tenure policies – all areas on which the Special Rapporteur has made contributions in the past – must be aligned with the need to make the transition towards low-carbon and low-external-input modes of production in which farmers co-design the policies that affect them. The school-feeding programme in Brazil for instance, has been used as a leverage to support family farming through its public procurement scheme; future public procurements schemes should promote agroecological practices.[89]

V. Recommendations

43. Moving towards sustainability is vital for future food security and an essential component of the right to food. But in order to succeed in this transformation, consistency will be required across a variety of areas. States will need to invest in multi-year efforts, based on strategies identifying the measures that should be adopted in order to make this transition.

44. As part of their obligation to devote the maximum of their available resources to the progressive realization of the right to food, States should implement public policies supporting the adoption of agroecological practices by:

- **making reference to agroecology and sustainable agriculture in national strategies for the realisation of the right to food and by including measures adopted in the agricultural sector in national adaptation plans of action (NAPAs) and in the list of nationally appropriate mitigation actions (NAMAs) adopted by countries in their efforts to mitigate climate change;**
- **reorienting public spending in agriculture by prioritizing the provision of public goods, such as extension services, rural infrastructures and agricultural research, and by building on the complementary strengths of seeds-and-breeds and agroecological methods, allocating resources to both, and exploring the synergies, such as linking fertilizer subsidies directly to agroecological investments on the farm ("subsidy to sustainability");**
- **supporting decentralized participatory research and the dissemination of knowledge about the best sustainable agricultural practices by relying on existing farmers' organisations and networks, and including schemes designed specifically for women;**
- **improving the ability of producers practicing sustainable agriculture to access markets, using instruments such as public procurement, credit, farmers' markets, and creating a supportive trade and macroeconomic framework.**

45. Donors should:

- **engage in long-term relationships with partner countries, supporting ambitious programs and policies to scale up agroecological approaches for lasting change, including genuine multi-polar engagement with public authorities and experts**

[88] See A/HRC/10/5/Add.2, paras. 22-23.

[89] See A/HRC/13/33/Add.6, para. 38. In 2009, procurements by the Brazilian Food Acquisition Programme (PAA) totalled 590.55 million R$ (145.78 million R$ in 2003); food was purchased from 137,169 family farms (from 42,329 farms in 2003), information from Federal Government of Brazil, Execução Global do Programa de Aquisição de Alimentos 2003-2009, Orçamentos MDA e MDS, 16 June 2010.

and existing local organizations of food providers (farmers, pastoralists, forest dwellers) and the networks they form, such as ROPPA, ESAFF, La Via Campesina, and PELUM, which have accumulated experience that could be the basis for rapid scaling-up of best practices;

- **encourage South-South and North-South cooperation on the dissemination and adoption of agroecological practices;**
- **support agricultural development by investing in public goods rather than private goods, and encourage participatory approaches and co-construction in research, extension and public policies;**
- **fund regional and national knowledge platforms to gather and disseminate best practices in agroecology from the field to landscape levels.**

46. The research community, including centres of the Consultative Group on International Agricultural Research and the Global Forum on Agricultural Research, should:

- **increase the budget for agroecological research at the field level (design of sustainable and resilient agroecological systems), farm and community levels (impacts of various practices on incomes and livelihoods), and national and sub-national levels (impact on socio-economic development, participatory scaling-up strategies, and impacts of public policies), and develop research with the intended beneficiaries according to the principles of participation and co-construction;**
- **train scientists in the design of agroecological approaches, participatory research methods, and processes of co-inquiry with farmers, and ensure that their organizational culture is supportive of agroecological innovations and participatory research;**
- **assess projects on the basis of a comprehensive set of performance criteria (impacts on incomes, resource efficiency, impacts on hunger and malnutrition, empowerment of beneficiaries, etc.) with indicators appropriately disaggregated by population to allow monitoring improvements in the status of vulnerable populations, taking into account the requirements of the right to food, in addition to classical agronomical measures.**

47. At its 36th session, the Committee on World Food Security (CFS) requested its High-Level Panel of Experts (HLPE) to examine the respective roles of large-scale plantations and small-scale farming, and to review existing assessments and initiatives on the effects of climate change on food security and nutrition, with a view to informing the 37th CFS session. The HLPE and the CFS should assess the potential of agroecology to meet the current challenges in the areas of food security and nutrition, with a view to informing the preparation of the Global Strategic Framework for Food and Nutrition Security (GSF) in 2012, and to strengthening the consistency between the international agendas in the areas of climate change and agricultural development respectively.