BUILDING A NEW AGRICULTURAL FUTURE

Supporting agro-ecology for people and the planet

Sopheap Meas in her rice field, Cambodia 2012. She uses the system of rice intensification (SRI), an agro-ecology approach which improves yields. Photo: Simon Rawles/Oxfam

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Climate change and the injustice of hunger require urgent attention, and investment in a model of agriculture that is truly sustainable. Agro-ecology is the science of applying ecological concepts and principles to the design and management of sustainable agriculture. An agro-ecological approach provides a range of social, economic, and environmental benefits that, with the right policy support and associated investments, can be scaled up to enable smallholder farming communities to achieve food security.

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INTRODUCTION

The United Nations Food and Agriculture Organization (FAO) estimates that globally, 842 million people are currently undernourished.[1] Shockingly, half of these hungry people are small-scale farmers and their families,[2] for whom agriculture is a livelihood, providing food for their own needs and generating income.[3] A failed harvest due to drought, or the loss of land caused by irresponsible large-scale land investments, can have devastating effects on the livelihoods of farmers.

The 2008 food price crisis triggered renewed investment in agriculture. But the key question is: what type of agriculture is being promoted? In 2013 the United Nations Conference on Trade and Development (UNCTAD)[5] noted that current priorities are still heavily focused on increasing production, mostly under the slogan 'more with less'. This approach is still very much biased towards the expansion of 'somewhat less polluting' industrial agriculture, rather than more sustainable and affordable diversified food production in rural areas.[6]

'Simply distributing seeds and fertilizer, if that's the plan, will fail long term.' – Howard Buffett[4]

Generally, the focus is on high levels of use of inputs and the concentration of a handful of dominant crops in monocultures. This 'solution' does not acknowledge the limited assets that small-scale farmers have available. It fails to account for the real-world heterogeneity and complexity of agriculture or for farmers' increasing need to adapt to the challenges of greater climate variability. It does not tap into the knowledge that farmers possess, and it also bypasses women farmers, who historically have been marginalized from agricultural investment in spite of the work they do.[7] In other words, an approach of this nature will fail the farmers who most need support.

This briefing makes the case for the need to invest not in industrial-style farming but in agro-ecology to achieve truly sustainable agriculture and food security for some of the poorest farmers in the world. Agro-ecology is the science of applying ecological concepts and principles to the design and management of sustainable agriculture. An agro-ecological approach provides a range of social, economic, and environmental benefits that, with the right policy support and associated investments, can be scaled up to enable smallholder farming communities to achieve food security.

WHAT IS SUSTAINABLE AGRICULTURE, AND WHAT ARE THE IMPACTS OF INDUSTRIAL AGRICULTURE?

Sustainable agriculture refers to the capacity of agriculture over time to contribute to people's well-being by providing them with sufficient food and other goods and services in ways that are economically efficient and profitable, socially responsible, culturally acceptable, and environmentally sound.[8] A key idea is stewardship – preserving the resources that allow us to meet current needs, so that future generations can meet theirs too. The implications of this are far-reaching: we cannot continue to farm in ways that deplete soil, pollute water, reduce biodiversity, and impoverish rural communities.

Indeed, the industrial agriculture model needs an overhaul, given the impacts it has. Briefly, these include:

1. Eroding soil nutrient quality and health, with implications for future productivity

The use of synthetic fertilizers has helped to increase yields, but excessive or inappropriate fertilizer use has also led to significant soil degradation and water pollution. Of all the components of the agricultural ecosystem, soil condition is the most crucial, and healthy soil offers the most direct benefits to farmers. The declining soil quality experienced in many regions of the world severely limits productivity.[9] The application of synthetic fertilizer is subject to diminishing returns,[10] with increasingly high input rates required to achieve the same levels of plant growth. In addition, the natural resources used to make synthetic fertilizers are finite (e.g. phosphate rock).

The practice of industrial agriculture has also led to a dramatic decline in the nutrient content of food and animal feed. For example, mineral levels in fruits and vegetables in the UK fell by up to 76 percent between 1940 and 1991, and a similar trend has been seen in the USA.[11] This decline has been attributed to the unintentional selecting out of high-nutrient crop varieties when breeding crops for high yield potential; the use of shallow-rooting annual crops that are unable to tap into soil nutrients at deeper levels; and the failure to return a full complement of nutrients to the topsoil.

2. Contributing to climate change and a loss of resilience

Agriculture is both a source of carbon emissions and a carbon sink, and it both contributes to and mitigates climate change. Major agricultural sources of greenhouse gas (GHG) emissions include the use of fossil fuels and fertilizers and the loss of organic matter in soils resulting from intensive cultivation practices. Estimates vary, but if changes in land use are included in the calculation, 14–24 per cent of total emissions of anthropogenic GHGs can be attributed to agriculture.[12] Most of those emissions are attributable to industrial agriculture.[13]

In the United States, the biggest contributors to GHG emissions are nitrogen fertilizer, followed by enteric fermentation (i.e. methane produced in the digestive process of animals, chiefly cattle).[14] Even without accounting for deforestation, it is clear that the current system of industrial agricultural production is a key cause of climate change.[15]

3. Loss of biodiversity and decline in human health due to indiscriminate use of pesticides

The use of synthetic pesticides, as practised throughout the developing world, poses significant risks to human health and to biodiversity, which is an important source of food and livelihoods for many of the world's poorest people. We have hardly scratched the surface concerning the ways in which biodiversity contributes to the nutrition, health and livelihoods of many of the world's poorest people. It is clear however that broad-spectrum pesticides that impair floral biodiversity, reduce species richness and shorten food chains in agricultural systems limit the capacity of that system to provision the people who live within them.

For example, a study using the most recent risk assessment models to provide the first detailed analysis of pesticide risks in West Africa revealed a number of specific pesticides that pose widespread and significant threats to human health and to wildlife, both terrestrial and aquatic throughout this region, affecting a large proportion of the area under irrigated agriculture.[16] The study found that farm workers and family members, including children, are routinely exposed to high concentrations of toxic organophosphates such as methamidophos and dimethoate while working on crops.[17] Over-use of pesticides makes food supply vulnerable due to the emergence of 'super-weeds' and the severe impacts on natural enemies and pollinators. It also reduces availability of plants for gathering and the animals hunted for food that takes place throughout the developing world. Crop productivity itself is also threatened, for example, nearly one-third of our food supply is linked to pollination: 39 of the leading 57 crops globally benefit from natural pollinators, which are threatened by extensive use of synthetic pesticides.[18]

Genetic variability is the raw material on which breeding for increased production and greater resilience depends. Further loss of genetic diversity in plant crops and animal breeds is dangerous, because it makes our food supply more vulnerable to outbreaks of pests and diseases and to loss of capacity to adapt to changing climatic conditions. For instance, in the 1970s a lack of genetic diversity in US corn varieties resulted in losses of over $1bn as crops lacked resistance to leaf blight.[19] Poor and vulnerable people mostly rely on both on and off-farm biodiversity to protect against food insecurity and risk.[20] By simplifying systems and restructuring them by repeated pesticide use, we may be limiting vital nutritional resources among at-risk populations.

4. Perpetuating dependency and failing to meet the needs of the poorest farmers

For many small-scale farmers, the purchase of manufactured fertilizers and pesticides is constrained by the high costs of these relative to output prices, or simply by their unavailability. Also, the farmers who buy pesticides would still be at risk because the information on how to use them properly is simply not available.[21] Those who buy such inputs often do so by taking out loans, which can push them into a cycle of debt and dependency, especially if their harvests fail. This risk is further increased because oil prices affect agricultural input prices directly and indirectly (through the price of fuel and fertiliser, and the use of petroleum and natural gas in manufacturing the inputs, for example).[22]

WHAT IS AGRO-ECOLOGY?

Agro-ecology is a scientifically grounded approach that has been field-tested by farmers around the world. The International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD), a multi-year study involving hundreds of experts and several UN agencies, has defined agro-ecology as 'the science of applying ecological concepts and principles to the design and management of sustainable agroecosystems'.[23] The key principles of agro-ecology are:[24]

- Enhancing the recycling of biomass, optimizing nutrient availability, and balancing nutrient flow;
- Securing favourable soil conditions for plant growth, particularly by managing organic matter and enhancing soil activity;
- Minimizing losses due to flows of sunlight, air, and water by way of micro-climate management, water harvesting, and soil management through increased soil cover;
- Enhancing species and genetic diversification of the agro-ecosystem;
- Enhancing beneficial biological interactions and synergies among components of agro-biodiversity and the surroundings, thus promoting key ecological processes and functions.

However, agro-ecology is not just a science. Since the 1970s, the concept has come to refer also to an approach to agriculture and to a social and political movement.[25] In reality, these three dimensions are often very closely related. As a movement, agro-ecology essentially seeks to increase the autonomy and control of small-scale farmers over agricultural and food systems, building strategic alliances with consumers and other civil society actors. The movement includes both farmers' organizations and non-government organizations (NGOs) seeking to spread the practice of agro-ecology to more farmers (horizontal scaling up or scaling out), to support and advocate for policy measures and regulations that specifically support agro-ecology, and to challenge obstacles holding back the potential of smallholder agriculture. Critical issues for farmers – and women in particular – include having secure access to and control over land and other natural resources, as well as ensuring their rights to access, breed, produce, conserve, purchase, exchange, and use the seeds that they need.[26]

As an approach, agro-ecology aims to make agriculture economically, ecologically, and socially more sustainable. The realization of agro-ecological principles depends primarily upon mimicking natural processes, thus creating beneficial biological interactions and synergies between the components of the agro-ecosystem. Creating suitable combinations of strategies and practices is context-specific, and is focused on site-specific solutions. It is highly knowledge-intensive, based on the know-how of small-scale producers and on agro-ecological science and experimentation.

Important concepts in agro-ecology include diversification of crops and livestock, crop rotation, and cycles of organic matter. Integrated management of soil nutrients makes use of crop residues, animal manure, and food waste, and enables an increase in soil health while producing more diversified and nutritious food in a way that also increases resilience to climate change.[27] Agro-ecology means finding biological ways to reduce the need for pesticides (with techniques such as integrated pest management) or for chemical fertilizers (for example, by using compost). This produces positive impacts in terms of human health, reduced GHG emissions, and greater protection of biodiversity. Emissions from systems that are managed this way will be reduced, and once established, they should be better cushioned from the impacts of extreme weather events.

For example, a study using a participatory action research approach and simple field techniques found significant differences in agro-ecological resistance between plots on 'conventional' and 'sustainable' farms in Central America after Hurricane Mitch. On average, 'agro-ecological' plots on sustainable farms had more topsoil, higher field moisture, more vegetation, less erosion and lower economic losses after the hurricane than control plots on conventional farms.[28] Another study that examined the vulnerability of coffee agroforestry systems to disturbances related to Hurricane Stan in Chiapas, Mexico found that increasing vegetation complexity within farms may be an efficient strategy to reduce some susceptibility to hurricane disturbance.[29] The attributes of increased complexity, diversity, and reduced disturbance that underlie climate resilience will also render systems less susceptible to invasive pests and diseases, and production may therefore be stabilized. With agroecological practices that diversify agricultural systems, invasive species will spread at slower rates, establish less effectively and have more limited effects on yield and quality.

Practices based on agro-ecological principles include agro-forestry (agricultural systems that combine trees, crops, and animals in order to promote intensification and synergies), water harvesting in dry-land areas, livestock integration into farming systems, reduced tillage, composting and green manure, systems of rice intensification, permaculture, and a whole variety of other techniques. The integration of trees into annual food crop systems has been adopted by tens of thousands of farmers in Malawi, Zambia, Burkina Faso and Niger, leading to increases in household and national food security.[30] A recent review of 286 projects in 57 countries found that crop productivity rose by 79 percent where farmers had adopted agro-ecological practices,[31] while an older study reported food production rising by 73 percent for 4.42 million small-scale farmers growing cereals and root crops.[32] Another successful agro-ecological practice taken up by farmers around the world is the System of Rice Intensification (SRI), described in Box 1.

Box 1: System of Rice Intensification (SRI) – an example of agro-ecology in action

SRI is an agro-ecological approach that originally focused on better husbandry of hand-planted rice crops and has since been adapted for other staples. Key components of SRI include starting with fewer, younger, widely spaced seedlings, grown in mostly aerobic soils instead of constantly flooded fields.[33] The resulting larger, healthier root systems give higher yields with 25–50 percent less water[34] and with fewer inputs such as seeds and less methane gas emissions from paddies.

Oxfam started working on SRI in 2000 and has since expanded its programmes to 12 countries in Asia, West Africa, and Latin America and the Caribbean. As of 2013, over 1.5 million smallholder farmers in groups supported by Oxfam's partners in Cambodia, Sri Lanka, and Viet Nam had benefited from SRI, using both local and improved varieties of rice.[35]

Widespread adoption of SRI led to increases in yields of 68 percent in Cambodia and 30–50 percent in Sri Lanka in the period 2010–13. In Cambodia, incomes increased by $339 per hectare and in Viet Nam by $200–300 per hectare. In addition, with each season of SRI application the soil ecosystem improves, and along with it potential future crop performance. The same husbandry principles are applied to new crop rotations, such as potatoes in Viet Nam. Rice straw and stubble are used as a mulch bed which, as it gradually decomposes, improves the soil ecosystem for the next rice crop. Farmers have saved between 28 percent and 47 percent in terms of labour, while gaining improvements of between 8 percent and 25 percent in yields, earning additional income of $480–950 per hectare.[36] They are also increasingly adopting complementary technologies such as hand-held rotary weeders, which not only improve efficiency but also address concerns over women's labour. Successful scaling up of these innovations requires an enabling policy environment, particularly in terms of building human capital and empowering communities. For example, in its national agriculture strategy the Government of Viet Nam has endorsed SRI as a practice that can increase climate resilience. During the period 2010–13, public funds allocated to extend SRI were nearly five times larger than Oxfam's investment in the six provinces where its programmes were active.[37]

In Ethiopia, the Agriculture Transformation Agency (ATA) is promoting the system of crop intensification for *teff*. Evidence shows that farmers applying SRI principles have seen yields triple, while also making savings on seed of up to 90 percent.[38]

SRI is currently being practised in over 50 countries and is promoted by organizations such as the International Fund for Agricultural Development (IFAD), Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), the US Agency for International Development (USAID), the Asian Development Bank (ADB), FAO, and the World Bank in their development portfolios. Closer collaboration between practitioners and the scientific community is needed to address issues such as labour, nutrition, and health. For example, SRI's potential to relieve the labour burden on rice farmers and to improve their health warrants a close study.[39]

Although millions of farmers worldwide are already engaged in agro-ecology practices, there are some persistent myths about the approach that need to be debunked.

MYTHS ABOUT AGRO-ECOLOGY

Myth 1: Agro-ecology is opposed to science and innovation

Agro-ecology promotes innovative forms of collaboration between farmers and scientific researchers. It aims to 'modernize' agriculture by improving the sustainability of farming systems, while putting farmers in the driving seat of the innovation process. A range of technologies may be helpful for farmers (e.g. embryo culture, marker-assisted selection[40]). What is most important is their accessibility and how they respond to the real issues that farmers face. To address these issues, it is critical that farmers are involved in the process of scientific development. As the new findings about the extent of pesticide risks and lack of effective regulation reveal, farmers will also rely on scientifically based information being made available to assist them in making risk management decisions where laws and conventions are insufficient to protect their health and the productivity of the systems where they farm.

Myth 2: Agro-ecology cannot be scaled up

Some critics dismiss agro-ecology as an isolated practice carried out on a few small farms that cannot be scaled up – but this is not true. The approach can work on farms of different sizes and at different degrees of market integration. In Cuba, for example, some 110,000 family farmers associated with the *Asociacion Nacional de Agricultores Pequeños* (ANAP) have been practising agro-ecological methods. These farmers, who control less than 35 percent of the land, are responsible for more than 70 percent of domestic food production – for example, 67 percent of roots and tubers, 94 percent of small livestock, 73 per cent of rice, and 80 percent of fruits.[41] In Brazil, around 100,000 family farms have adopted agro-ecological farming practices, showing an increase in average yields of 300 percent and a 100 percent increase for black beans and corn, while increasing resilience to irregular weather patterns.[42] With the right policy environment and financial support, agro-ecology can make a big contribution. Farmer-centered approaches to agricultural development, including farmer field schools, are built around concepts of observation and adaptive management and they are less susceptible to unanticipated adverse impacts because of the vigilance and empowerment that lies at the heart of these approaches.

Myth 3: Agro-ecology is subsistence-oriented and incompatible with markets

Virtually all households in rural areas are both producers and consumers, buyers and sellers, but many sell agricultural produce and buy their food at different times of the year. Agro-ecology offers good prospects for increasing yields and improving the sustainability of farming in resource-poor and marginal areas,[43] potentially allowing farmers to sell some of their produce if they wish to. Also, since farmers will be spending less on fertilizers and pesticides, they can actually save money. The relatively small size of agro-ecological farms means that they are more suited to local and regional food markets. A review of 28 case studies of 'eco-agricultural' management practices in Asia, Africa, South and North America, and Europe showed positive economic benefits, while in another five cases such practices had a neutral impact on incomes.[44]

SCALING UP AGRO-ECOLOGY: HOW IT CAN BE DONE

The former UN Special Rapporteur on the Right to Food, Olivier De Schutter, has identified scaling up agro-ecological approaches as one of the main challenges of our time, noting both a need to expand the areas cultivated in this way and to provide an enabling framework for farmers to use these practices.[45]

A number of governments, such as those of Brazil, Viet Nam, Cuba, and France, are showing some support for agro-ecological approaches at national or international level. At the international level, in October 2012 the Committee on World Food Security (CFS) endorsed the Global Strategic Framework for Food Security and Nutrition (GSF), which acknowledges that 'agroecological practices have proved to be important in improving agricultural sustainability as well as the incomes of food producers and their resilience in the face of climate change'. It also stresses 'the importance of local knowledge in promoting food security, particularly as the latter is influenced by the capacity to manage natural assets and biodiversity and to adapt to the localized impact of climate change'.[46] The GSF includes other useful provisions relevant to scaling up agro-ecological approaches, and calls in particular on CFS member states and other stakeholders, including international and regional organizations, to develop programmes, policies, and laws in line with an ecosystem approach at local and national levels, in order to increase agricultural productivity and production in a socially, economically, and environmentally sustainable manner.[47]

Different countries and international organizations have implemented strategies and policy tools to scale up agro-ecology. The following are a few examples of successful experiences.

- **The potential of public procurement:** Governments can secure market preferences for small- and family-scale producers, for instance in public procurement, as has been the case with Brazil's Programa de Aquisiçao de Alimentos (PAA), created in 2003. Under this initiative, farmers are given a purchase guarantee for specific quantities of produce at specific prices, making the operation of thousands of small farms more economically viable.
- **Farmer field schools:** A FAO study showed that Farmer Field Schools (FFS) in Mali that provided farmers with training on alternative methods of pest control enabled cotton to be grown three times more cost-effectively than farms that purchased and used synthetic pesticides.[48] Over an eight year period, the data showed a significant reduction in the use of hazardous insecticides by more than 4,324 cotton growing households. With roughly 20 percent of these

households involved progressively over time in FFS training, insecticide use fell by 92.5 percent for all cotton growing households. Farmers avoided applying more than 47,000 litres of pesticides, and saved nearly half a million dollars. By contrast, pesticide use was unchanged over time in the sector with no farmer training taking place. A survey of 80 alumni-FFS vegetable farmers in the Senegal River Valley showed that improved pest control practices learned during the course of their FFS training had become part of their normal routine 2 years after training. Commercial pesticide use fell by 92 percent, and the percentage of farmers using these chemicals fell from 97 percent to 12 percent.[49]

- **Certification:** Agro-ecology can take advantage of certification. Experience to date with organic or other ethical labels shows that a higher price can be obtained. Because organic certification is expensive, farmers' organizations have been using participatory guarantee systems, which offer a low-cost, locally based system of quality assurance with a heavy emphasis on social control and knowledge building. Countries such as France and Brazil have recognized this system as having equal status to third party certification. Thus it is possible to develop similar schemes for agro-ecological products.
- **Role of the private sector:** There is also room for novel partnerships between farmers using agro-ecological methods and private sector actors who can see beyond simply selling seeds and fertilizers to farmers. In the US, for example, the Community Agroecology Network (CAN), which works to advance agro-ecological systems in Central America, has launched AgroEco Coffee, a single-origin coffee from a small co-operative in Costa Rica, which produces the crop as part of an agro-ecological farm system. In Cuba, producers have emerged to supply biological and pest control products – not chemicals, but insects and bacteria whose natural prey is the pests and diseases that damage crops. There is a huge opportunity for the private sector to develop products for this market.

A critical element in supporting scaling-up efforts is research. Agro-ecological approaches have a wide range of benefits, but in order for them to be scaled up in a specific context there is a need for solutions that contribute to increasing smallholders' productivity and incomes (ideally in the short term but also in the longer term); are sustainable, and do not leave farmers dependent on public subsidies; and find creative solutions to issues of gender equality and labour needs.

Agro-ecological practices are often associated with higher labour requirements than in conventional agriculture.[50] Labour can either be a major constraint to adoption or an employment provider for rural communities: for example, the planting pits used in zero-till agriculture in Africa have created rural employment.[51] There are important gender implications in the adoption of agro-ecological practices, which require further attention and research. Also, the preparation, transportation, and application of organic manure are labour-intensive tasks which may reduce the net benefits for farmers who do not have access to labour or who cannot pay for it. Access to animal manure is often constrained by the size of farmers' plots and also by whether or not they have animals.[52] Labour is one area that requires more investment in research to better understand the dynamics involved, so that farmers have access to a wide range of appropriate practices that can unlock the full potential of agro-ecology in a specific context.

Opportunities now exist to scale up the approach, with agriculture back on the agenda of donors and governments, and the emergence of different initiatives to increase its sustainability. It is critical that efforts to scale up such approaches promote solutions that are evidence-based and create positive impacts for smallholders (see Box 2).

Box 2: Is climate-smart agriculture 'business as usual' or a way to scale up agro-ecology?

'Climate-smart agriculture' (CSA) is an approach that is being promoted by a range of stakeholders – for example, the World Bank, FAO, CGIAR and its Climate Change, Agriculture and Food Security (CCAFS) programme, DFID, the International Food Policy Research Institute (IFPRI), and the Rockefeller Foundation.

FAO defines CSA as 'agriculture that sustainably increases productivity, resilience (adaptation), reduces/removes greenhouse gases (mitigation), and enhances the achievement of national food security and development goals'.[53] It allows for context-specific solutions: 'CSA is not a single specific agricultural technology or practice that can be universally applied. It is an approach that requires site-specific assessments to identify suitable agricultural production technologies and practices.'[54] At the CFS, the concept of CSA was discussed but never agreed upon by member states, notably because of strong opposition from smallholders and civil society organizations (CSOs).

Generally, the concept of CSA is not yet clearly enough defined. This makes possible some uses and interpretations of it that are not consistent with the objective of achieving true agricultural sustainability, notably by including practices that have not been proved to be solutions to tackling hunger or achieving sustainable development, such as the use of genetically modified organisms (GMOs).

Secondly, CSA risks being too focused on climate mitigation. There are concerns that, by prioritizing mitigation, it risks turning smallholder farms into carbon sinks and diverting attention away from the real challenge of mitigating climate change – preventing or reducing emissions by rich countries. In addition, market-based sequestration approaches to agriculture, promoted by a number of supporters of CSA, risk aggravating land and water grabs by increasing the value of arable land.[55]

Finally, if the way in which it is implemented is not clarified, CSA risks being delivered via 'business as usual', top-down, non-participatory approaches that have been shown to be ineffective in the past. Such approaches fail to account for the heterogeneity of farmers' assets and endowments, and overall are disempowering for smallholders.

The concept of CSA is still evolving and initiatives are under way to create an alliance around it. This should be used as an opportunity to clarify what it means and ensure that CSA practices and approaches are consistent with agro-ecology and with IAASTD guidance.

CONCLUSION AND RECOMMENDATIONS

Agro-ecology reduces dependence on energy-intensive inputs, while improving soil fertility, productivity, and biodiversity. Agro-ecological practices give farmers greater control and enable them to meet their own food needs and boost their incomes, while decreasing their exposure to climate shocks. For these outcomes to be achieved, investments and a supportive policy environment are needed.

As noted, all governments have recognized the Global Strategic Framework for Food Security and Nutrition (GSF). Now they should, with the support of donors and international organizations, turn this commitment into practice and systemically scale up agro-ecological approaches by taking the steps outlined below.

Ensure that smallholders and agro-ecological farmers are involved in defining policies and investments in agriculture.

This requires setting up or strengthening multi-stakeholder platforms at local, national, and regional levels which include small-scale food producers.

Develop adequate public incentives to promote agro-ecological practices. This will involve governments:

- Using public food procurement schemes (e.g. for schools, hospitals, etc.) to support agro-ecological farming;
- Exploring, together with smallholder organizations, potential benefits and the sustainability of promoting certification or other tools to improve the marketing of agro-ecological products; more direct incentives (such as payments for ecosystem services) and ways to improve access to finance to support smallholders to transition towards agro-ecological systems; and ways to ensure that the private sector can contribute to efforts to scale up agro-ecology (by establishing incentives and regulations/disincentives);
- Building or strengthening extension and education services for agro-ecological technologies.
- Building or strengthening regulation and compliance systems for hazardous pesticides that can impair systems and delay ecological restoration of intensively managed areas.

Ensure that the right policies are in place to support agro-ecological approaches, notably by:

- Establishing and revising policies on trade, investment, and intellectual property rights to ensure that they protect indigenous peoples' and farmers' rights to select, domesticate, breed, exchange, and use native species of crops and livestock and promote biodiversity;
- Ensuring that all investments in agriculture and food production systems avoid the depletion of natural resources and promote their sustainable use and regeneration by promoting agro-ecology. Governments should start by agreeing to include this recommendation

in the CFS principles for agricultural investment;

- Securing smallholders' access to land and other natural and productive resources;
- Adopting regulations (e.g. on synthetic pesticides) that provide incentives to all farmers to move towards agro-ecological approaches.

Ensure that strong farmer-led, bottom-up knowledge and research systems are in place. This will require:

- Ensuring that research based on farmers' needs is prioritized;
- Ensuring that farmer-led and participatory research approaches are adopted by research institutions;
- Supporting farmer-to-farmer knowledge networks and organizations to develop and share learning on agro-ecology, building primarily on traditional know-how;
- Ensuring that research systems – which should include input from smallholders – develop the knowledge base of agro-ecology, address the implications of agro-ecological management in different contexts, and further develop agro-ecological approaches to production.

NOTES

Note: websites cited were last accessed on 10 March 2014, unless otherwise stated.

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