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FOOD SOVEREIGNTY BRIEF

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HIGHLIGHTS ON AGROECOLOGY

Less than one year away from the next United Nations Conference on Sustainable Development scheduled for June 2012 in Rio (Rio+20), the international community is mobilizing to ensure that tomorrow's major challenges are on the agenda. Among these subjects, the issue of global food security and new challenges governing current and future agricultural models is on the agenda. Industrial farming models have reached their limits, and it is high time to invest seriously in more ecologically, economically and socially sustainable models. "Agroecology"—a concept that will be defined and clarified in this brief—has now frequently been recognized as a forward-looking solution to overcoming the challenge of feeding nine billion mouths in 2050 without sacrificing the planet's natural resources. But how is this possible?

This brief aims to review today's main global food challenges, present the agroecology concept in its many facets, and clarify the key principles and techniques that are currently proven to work. It also questions the agroecology concept in light of the many virtues attributed to it in literature, and elucidates the main challenges that will need to be overcome to develop its dissemination on a larger scale.

1. Facing Global Food Challenges, a New Type of Agriculture is Needed

A. An intensification-Based Agricultural Model Reaching its Limits

The past century has seen a true revolution in agricultural production systems. The spectacular intensification that we have seen mainly developed in Europe and North America but also in South America and Asia where the Green Revolution encountered a degree of success, is characterized by industrialization (chemical products used as inputs), the mechanization of cropping operations, and the standardization of agricultural production. This combination of elements allows for labor force reductions and a substantial increase in yields—a considerable economic gain. R1 R2

However, our "environmental" capital has been seriously affected by these practices. Beyond the well-known damage to the ecosystem (to water, fauna, flora, etc.), it is the land above all that has been depleted, endangering farming itself. While industrial agriculture reached its heyday in the 20th century, recent studies show that it may have reached its limits, especially in terms of increasing productivity. For instance, the yields that had previously been rising from one decade to the next have now leveled off or are even dropping in some geographic zones. R3

Finally, beyond industrial farming's obvious environmental consequences, its social impacts can also appear brutal and disruptive. Although the industrial intensification model is a vector for economic growth and productivity increases, it is in no way a bastion against poverty and can even worsen it.

B. The New Global Food Challenge: More Production, Less Pollution and Better Distribution

For several years, a new global food challenge has been emerging. The world population should reach nine billion people by 2050. To feed these people, agricultural production must urgently and inevitably increase, and must do so by 70% worldwide, to meet the needs[1] R1. All the more will need to be produced as agriculture no longer serves only to feed people, but also to feed rapidly-expanding global livestock, produce agrofuels and meet other rising non-food needs (cornstarch bags, etc.). All this in a context of rising production costs, increasingly frequent and intense weather hazards, and growing uncertainties, notably as to international prices, which makes investment riskier and therefore more expensive.

The scientific community has been warning us for many years of the incredibly rapid degradation of natural resources, and especially soil's productive capacity. Yet, soil quality is the most important element in agriculture's and even humanity's "survival kit." Dwindling soil quality and fertility, dropping groundwater levels, deforestation, food and environmental pollution, proliferation of pesticide-resistant predacious insects, and growing greenhouse gas (GHG) emissions are as many negative externalities caused by intensive industrial agricultural production systems.

[1] This figure must, however, be nuanced in light of current annual food losses in the amount of 33% of world production (according to May 2011 FAO-commissioned study, "Roughly one third of the food produced in the world for human consumption every year—approximately 1.3 billion tonnes—gets lost or wasted.").

Poverty, hunger and malnutrition are rife, particularly in rural areas of developing countries; two-thirds of the poorest are small farmers. When these people cannot earn a living from farming and other rural activities, the rural exodus intensifies despite a shortage of jobs in cities in other sectors of activity.

One major challenge is therefore found in maintaining and developing rural jobs, in particular in the productive sector at all levels.

Faced with all of these challenges, there is only one conclusion: overall productivity must be increased to meet tomorrow's global food needs but to do so we must find an alternative to the intensive production system that has been in place for 50 years in industrialized countries, a system whose limits most actors now acknowledge. R1

C. A Consensus Now Exists: A New Paradigm Is Needed

We can now see a consensus in the international community (whether among researchers, policymakers or practitioners) on the need to steer agriculture toward new, more environmentally sustainable and socially fairer modes of production in order to ensure the planet's global food security. Yet, there are production systems able to intensify agriculture while limiting recourse to fossil energies and chemical inputs—these are production systems that comply with the principles of agroecology (AE). R4

The scientific community in the broad sense, civil society organizations, States, international organizations and donors are increasingly calling for an examination of AE as a promising approach and reflection on the technical, human and political means to set up to ensure a transition to and/or cohabitation at the very least with conventional agricultural systems. What is more, many studies emphasize the relevance of smallholder farming models to ensure agroecologic food production.

2. Agroecology: the New Paradigm?

A. Evolution of the Concept Over Time

The term "agroecology" appeared for the first time in scientific literature in the 1930s (Bersin, 1928, 1930). Until the 1960s, AE consisted of only one scientific discipline in conjunction with agricultural production and plant conservation. Then, different branches of AE emerged. Following on from the ecologist movements and hostile to the industrial agriculture that emerged in the 1960s, particularly in Latin America, AE fostered the birth of the first agroecology movements in the 1990s. AE as a set of agricultural practices emerged in the 1980s and rapidly found itself interlaced with emerging social movements. Thus, in recent decades, the concept has slowly come to encompass new environmental, social, economic and ethical dimensions in connection with development. R5

B. Agroecology: a Definition

Today, AE simultaneously designates a science, a set of practices and, for some, a social movement. According to scientists specializing in AE on the American continent (Altieri, Gliessman, Caporal), agroecology is the result of the fusion of two scientific disciplines, agronomy and ecology. It is both a science (AE is the application of ecologic science to the study, design and management of sustainable agro-ecosystems) and a set of practices (AE seeks, through diverse practices, to optimize agro-ecosystems [i.e. ecosystems transformed by humankind] by imitating natural processes, thereby fostering beneficial biological interactions and synergies between their components). It makes it possible to obtain more favorable conditions for plant growth, notably by managing organic matter, increasing soil biotic activity, and ensuring ecosystem renewal. In addition, for some others and in some geographic zones, AE has become a social movement. R6

C. A Multivocal Concept

Several sometimes highly different approaches can be placed under the heading of AE. One recurrent confusion is linked to the fact that it designates both an area of scientific research and a set of principles and doctrines defended by social movements. While they all share the goal of reconciling ecology and agricultural production, their practices vary depending on the amount of concessions made to the conventional intensification model.

Thus, AE can exist in practices and concepts ranging from "all organic" to "conservation farming" (see box) which requires the use of chemical inputs. The exact outlines of AE are moveable and depend on where one places the ecologic cursor according to the goals one pursues, the production means one has, and the socioeconomic and environmental context in which one operates. While the concept of AE has a precise definition, its application does not: it can be seen as encompassing approaches such as "agrofarming" (see box) and "evergreen farming," while inversely the notions of "conservation farming" and "ecological intensification" are inspired by some of the principles of AE. AE is also linked to "sustainable crop production intensification through an ecosystem approach"—an expression used by the FAO, the principles of which are very similar to the AE concept. R4 Ultimately, one should not compare this diversity of concepts but rather look at what unites them: a rejection of conventional agriculture and a move toward agriculture that tends to make intensive use of ecosystems' specific capacities according to the scientific laws of ecology. R6

Different Production Models R6

"Conventional" intensive agriculture, commonly called "industrial farming": The forms of agriculture in the broad sense (including stock farming) practiced primarily in industrial countries and emerging countries since the "Green Revolution." These agricultural systems are characterized by the use of high-yield varieties, intensive use of chemical inputs, and recourse to irrigation, equipment and generally credit. They are therefore capital-intensive.

Organic farming: Beyond the rejection of the use of synthetic chemical fertilizers, synthetic pesticides and GMOs for crops and, in stock farming, the rejection of animal flours, synthetic amino acids and force-feeding, organic farming is based on respect for natural biologic activity and natural biogeochemical cycles in particular.

Ecoagriculture: This is founded on the insertion of agricultural production techniques in natural ecosystems and the definition of agricultural techniques that respect ecosystems and biodiversity in particular.

The doubly green revolution: This term was destined to inspire research to invest in the definition of environmentally-friendly high-yield agricultural and stock farming techniques. The same concept took the name of "ecologically intensive agriculture" in 2007.

Evergreen agriculture: Invented in India, this consists of organic farming techniques compatible with limited fertilizer use and occasional use of phytosanitary products. The primary characteristic of these techniques is that they are part of a complex "production ecosystem": as many as 20 or 30 productive activities connected to each other.

Conservation agriculture: This generic term encompasses agricultural techniques that protect soil from erosion and all forms of degradation. Three principles arise from this: recourse to crop rotation and plant cover, reduction in soil operations going so far as to practice "direct sowing," and returning crop residues to the soil.

Ecologically-intensive agriculture: This is based on the idea that natural mechanisms—the ones described by ecology—can be amplified to the point of becoming nearly exclusive (or dominant) in terms of agricultural practices. The ecologically intensive aspect therefore refers to the intensive use of the ecologic properties of production ecosystems and not to production systems resulting from a conventional logic to which one has added a few ecologic aspects.

D. The Major Founding Principles of AE

Unlike conventional intensive agriculture which relies on the use of outside inputs of chemical origin, AE seeks to intensify production while preserving natural balances and favoring recycling.

Environmentally-friendly agriculture. AE is based on a number of principles that can apply to management of a plot or an entire territory. The key principles of AE as defined by Altieri (2002) are: (i) enhance recycling of biomass and optimize nutrient availability and balance nutrient flow; (ii) secure favorable soil conditions for plant growth, particularly by managing organic matter, ground cover, and enhancing soil biotic activity; (iii) minimize losses of solar energy, air and water by way of microclimate management, water harvesting and soil management through increased soil cover; (iv) promote species and genetic diversification of the agroecosystem in time and space; and (v) enhance beneficial biological interactions and synergisms among agrobiodiversity components, to promote key ecological processes and services. R3

More autonomous and more local agriculture. AE is based on a basic postulate: the ways in which the ecosystem is worked in traditional farming make up the most relevant source of knowledge to understand an agrosystem. In this way, AE attempts to reconcile above all the traditional practices that are well mastered by peasants but also scientific knowledge and locally available resources (human, material, economic). It aims to lower costs by reducing dependence on the outside, whether for inputs, energy or unmastered techniques. Finally, AE is an approach that, on the territorial scale, leads to the production and consumption of a greater variety of crops, on a somewhat local scale, notably by favoring mixed farming and short supply chains. R7

E. AE Worldwide: the Concept Can Vary with Geographic Zone

In countries where chemical input consumption is insignificant, notably in sub-Saharan Africa, farmers apply techniques similar to those of AE on their farms. One simple reason is that outside inputs are often too expensive (fertilizer, phytosanitary products, irrigation, mechanization) or not available. For instance, many farmers know and implement traditional techniques to preserve and restore soil fertility. R8

While it is not easy to quantify the amount of land cultivated with AE practices worldwide today, a few figures can shed light on the amplitude of its development. In West Africa, for example, more than 700,000 ha are cultivated using SWC (*See box on "key techniques.") in Burkina Faso, Mali and Niger. Nearly 5 million ha are cultivated using ANR* (Dogon plateau, Central Plateau of Burkina Faso, Maradi Zinder zone in Niger). Roughly one third of cotton growers in the Sudanian savanna combine agriculture and stock farming.

In Guinea-Bissau, Guinea-Conakry and Sierra Leone, traditional management of saltwater (use of silt and salt as herbicide) and freshwater (washing plots and irrigation) is practiced over more than 100,000 ha.

Some emerging countries such as Brazil practice large-scale AE. In Brazil, the growth of AE was based on traditional agricultural practices and carried by various social movements. Today, one can see in this country the juxtaposition of large industrial farms (notably with the strong growth of agrofuels) with strong growth in local-scale AE due to social movements and incentive policies and, between the two, large farms practicing "large-scale" AE, notably direct seeding mulch-based cropping systems* (DMCs), but whose environmental (high doses of chemical inputs, primarily herbicides) and social (drastic job cuts) characteristics make use of the name AE questionable for many practitioners.

In developed countries where agriculture that makes intensive use of chemical inputs dominates, certain AE practices have also been spreading for several decades. This is notably the case in France, Germany and the United States.

For several years, AE has had the wind in its sails and been the subject of growing interest from the international community in the broad sense. Meeting in Johannesburg in April 2008, an international community of 400 scientists, in a report (*International Assessment of Agricultural Knowledge, Science and Technology for Development*, 2009), called for us to support small farmers and step up research into AE. In December 2010, the United Nations Special Rapporteur for the right to food made AE his number one priority, and in June 2011, the FAO published an operational handbook on "how to produce more and better".

A Few Proven "key" AE Techniques

Crop/livestock integration: This consists of keeping animals on the farm. There are several advantages to doing so: production of organic animal manure and recycling of crop by-products as animal feed; introduction of fodder crops useful to livestock into the crop rotation.

Agroforestry: A technique that consists of introducing trees into cropping systems. This allows one to produce food resources (fruit or other), limit erosion and improve the soil, limit animal straying problems, provide cropping systems with nitrogen (notably acacia), protect crops from strong winds, house pollinating insects and pest predators.

Assisted natural regeneration (ANR): An agroforestry technique that, for farmers, consists of protecting and managing the spontaneous regrowth of trees and shrubs in their fields (In Niger, the growth of agroforestry systems has been spectacular: a comparison of satellite images from 1975 to 2005 shows 15 to 20 times more trees, with re-greening on the estimated scale of at least 5 million ha—"largest environmental transformation in the Sahel, if not in Africa.")

Nutrient management, in particular nitrogen management: The principle is to integrate legumes in crop rotations so as to fix nitrogen from the air for protein synthesis and soil fertilization (for example, nitrogen-fixing *Acacia albida* or mucuna).

Combining diverse species and rustic varieties in the same fields so as to better absorb available light energy.

"Repel-attract" strategy to deal with weeds and crop pests: The aim is to chase away insects by planting repulsive plants such as Desmodium between rows of the planted crop (effective notably with corn) while attracting insects to other plants that produce sticky matter in which they become trapped.

Direct seeding mulch-based cropping (DMC): Cropping techniques in which seeding is done without tilling the soil that is kept covered with the use of mulch and/or the association with plant cover. Crop rotations are necessary and the plant biomass produced can help drive soil fertility. Cover crops are often grasses or legumes that grow faster than weeds and provide the soil with more nutrients and organic carbon. They protect against soil erosion, and improve the physical structure and biologic fertility of the soil.

Soil and water conservation (SWC) actions: (See *La transformation silencieuse de l'environnement et des systèmes de production au Sahel*, CILSS, CIS, May 2009, pages 29-34) zaï holes, half moons, stone rows in Burkina Faso and Niger—SWC techniques make it possible to double or even triple yields in the same ecologic context.

3. Virtuous Model Struggling to Impose Itself

A. AE, a Many-Virtued Concept

Obvious environmental and public health virtues. The agroecologic systems implemented and/or adopted by small farmers have obvious environmental benefits by their very nature: in terms of resilience to climate hazards through higher resistance to extreme weather, which is becoming more and more frequent; in terms of strengthening biodiversity through farm diversification and the recovery of local seed varieties; and in terms of maintaining and restoring soil fertility and lowering the use of petrol-based chemical inputs that pollute the environment and destroy the soil. R9

In addition, AE is better for public health: its techniques provide a better environment for populations, fewer health risks caused by the application of chemical products on plots, a general improvement in living conditions, and healthier, more nutritious, more varied diets. R9

AE is better suited to smallholder farming models and contributes to better social equilibrium. AE provides agricultural and job development prospects for smallholder farmers, who are what is more threatened by intensive industrial agriculture. As a reminder, in Brazil, smallholder farmers generate three times more paid jobs than agribusiness. R3 In addition, several studies have shown that the AE experiments that have the most conclusive results in terms of increased production are most frequently implemented by smallholder farms (SFs) on the small scale. Less subject to the imperatives of cutting wage costs, they have various advantages: it is often the farmers at the head of family production units who have the greatest interest in diversifying and staggering their productive activities throughout the year so as to manage their own labor best, avoiding excessively busy periods and periods of under-work. R1

AE does not radically alter customs, but it strengthens exchanges. The results of AE have been taken up by many movements defending rural populations (farmers' organizations in particular). These results do not necessarily imply any radical changes in local farming practices. Instead, they optimize local resources and skills. AE also plays a driving social role because it requires community participation and

horizontal, farmer-to-farmer exchange of known methods. R9 For example, in Latin America, the key factor in the development of AE is the action of various organized rural and social movements: Via Campesina and the landless farmer movement in Brazil, and the National Association of Small Farmers (ANAP) in Cuba. They adopted AE in their technical approach as a banner to demand access to food sovereignty.

AE and economic efficiency—a controversial point. The main criticisms of AE in literature deal with its technico-economic effectiveness. This section attempts to shed light on these criticisms. R7

Criticism No. 1: "In AE approaches, yields are lower and therefore AE cannot reduce world hunger." Contrary to the idea that industrial production systems produce more, studies in recent years have shown that autonomous agroecologic production systems on small farms are more productive per surface unit. R3 In particular, a 2006 study (Julles Pretty, *et al.*) compared the results of 286 recent sustainable agriculture projects in 57 poor countries. The study showed that yields rose an average of 79% on the farms where AE practices were used (accounting for 3% of cultivated land). In addition, it should be noted that the average increase for these projects in Africa is higher than the world average, attaining 116%. R4 Furthermore, many documents often contain the following observation: before the development of industrial farming, which makes very heavy use of chemical inputs, the existing agricultural systems managed to feed the population. Finally, even though the Green Revolution sped up this intensification, hunger has not been eliminated, and has even tended to rise in recent years. Conventional intensification is therefore not the only solution to hunger.

Criticism No. 2: "Agroecologic methods require more work." This statement is perfectly true and acknowledged however it raises questions for many experts. How can one tackle the issue of rural jobs in unindustrialized countries, that is to say in countries where other economic sectors are little able to absorb surplus workers? Should we not attempt to keep people in the countrysides and offer them job prospects in rural areas?

The argument against AE here is that more "work" means higher labor costs and therefore lower economic profitability. Yet, with smallholder farming—which is well suited to AE—the use of outside labor is usually short-term and generally very rare. The additional labor therefore has only a slight impact on production costs. One should also note the existence of examples of improved labor productivity in AE systems that disprove this claim (manure transportation, draft animal use, etc.). Finally, agroecologic practices are a factor in minimizing economic risks for individual farmers or on the territorial scale: (i) savings on outside inputs, the price of which is constantly rising because of the high cost of fossil energy used to produce or transport them; (ii) the recycling principle in which everything benefits the ecosystem (natural nitrogen from legumes or acacias plantations) encourages crop development, as well as where combining crops and livestock makes it possible to move toward an integrated system (using manure to fertilize the land and feeding the livestock with harvest residues); (iii) crop diversification that limits the risk to farmers of betting everything on one crop, which can be a disaster in the case of a weather hazard or pest attack on the chosen crop; and (iv) optimizing local know-how limits the need for outside training.

AE strengthens the local economy. Beyond its suitability for the interests of smallholder farmers, AE has virtues in terms of food sovereignty: emphasizing farm autonomy by reducing recourse to external inputs, and promoting short supply chains, local food processing and extensive recycling, AE allows for a reduction in dependency on the outside for agricultural systems on the territorial scale. R6 Generally speaking, applying AE makes it possible to lessen farmers' and their organizations' vulnerability overall, and the choice of practices and dissemination methods should be guided by a constant concern to limit the risks taken by farming families (technical, economic and weather risks). R8

B. Many Challenges to Overcome

Given that AE has been proven to have so many environmental, social and economic benefits and advantages, why is this agricultural model not more fully developed and promoted at high institutional and political levels?

Many articles by scientists and practitioners mention a certain number of unavoidable challenges to which special attention must be paid if one wishes to promote and develop AE.

Let us specify that the challenges to overcome do not seem to be of the same nature in industrialized countries and developing countries where the Green Revolution did not happen, and on which we shall focus our analysis.

Rationalize and adapt agroecologic methods according to the specificities and realities in the field. As mentioned above, AE follows certain key principles, including minimizing use of chemical inputs. While many experts may pursue the "zero chemical inputs" goal, it is above all important to rationalize their use[2]. For instance, one can achieve spectacular increases in yields by combining a minimal dose of fertilizer (microdosage) and/or a concentrated dose of fertilizer (in zai or half moons) with AE techniques. This is probably one of the most promising paths that would lead to yield increases of more than 100% to 200%. What is more, we can also use fertilizer of natural origin in short supply chains (less transportation) such as Tahoua phosphates in Niger. These additions can correct frequent deficiencies (in phosphorus, for example) in sandy and lateritic soils.[3].

Furthermore, the selection of AE practices must be adapted to the local context: in Madagascar and elsewhere, for example, where rural populations are subject to sharp agricultural product price variations and strong weather variations, it seems appropriate to consolidate and disseminate complementary

[2]All the more as it seems difficult to justify the establishment of an AE development initiative to encourage West African farmers' organizations to adopt more sustainable practices when the doses of chemical inputs they use are extremely low (13 kg of fertilizing nutrients per ha) compared to the often exaggerated fertilizer use in wealthy countries (more than 200 kg per ha in Europe).

[3] See the report on the results of the CILSS ACDI climate change project.

agroecologic techniques that are safe, do not have any major risks for peasant families, and are robust in the long term to progressively improve the living conditions of small farmers. R8

Reflect on and analyze the potential for scaling up in agroecologic practices. While AE originally evolved from the concept of a plot-level approach, to that of farm-level agroecosystem, and then to cover the entire food system R5, the AE techniques that are currently proving themselves are conducted at the local scale, often at a very micro level. It is true that AE is increasingly not seen as merely a set of practices, but is included in a comprehensive process on territorial scale, which makes it possible to take a slightly broader approach.

It would be appropriate to take a much longer view and reflect on how to develop agroecologic practices, techniques and methods on the large scale. Despite the multitude of successful AE projects, it is more than necessary to deepen thought and research on the conditions necessary for these initiatives to be scaled up so as to convince policymakers to support AE more fully.

It is also probable that the adoption of more proactive policies to support these practices, notably through the use of regulatory instruments and policies on the national, regional or international scale (such as the National Plan of Action for Desertification Control (PAN/LCD), the United Nations Convention to Combat Desertification – UNCCD, and the Rio conventions[4]) would be a major step toward such a change of scale.

The need to invest in research and development. We saw above that agroecologic practices have considerable potential and remain largely unexplored. It is urgent that research and development take a stronger interest in AE in order to better understand how the ecosystems developed by farmers work in concrete terms and better understand the effects of the various techniques used on crop yields and herd performances. It is also more than ever necessary to increase research on AE's economic benefits because environmental benefits alone will not provide sufficient motivation to adopt these practices, in particular in developed countries but also in developing countries.

This research should place a central focus on innovations and practices as stated in the report of 400 researchers with IAASTD (IAASTD, 2009): "To be more sustainable, agricultural development needs above all research that is both more fundamental and more respectful of farmers' innovations." Some of the peasant innovations promoted in recent years by research can considerably improve the efficiency of production systems while helping restore soil fertility in degraded environments.

Thus, we should reflect on methods to research AE that place the main focus on participatory research techniques in which FOs are central. Small farmers' knowledge of the soil and climate conditions in their area and their know-how make them the primary practicing experts in these techniques.

Finally, the extension methods for these techniques should also be thought out to favor horizontal networked transmission of techniques as much as possible via farmer exchanges and the creation of innovation networks connecting school farms and FOs, school farm demonstrations, etc. R4

The need for strong public policies in support of smallholder farms applying agroecologic innovations. Beyond the various challenges listed above, implementation of agroecological practices, now largely carried out by smallholder farms, requires a more favorable environment as a whole for these farmers. Considerable efforts should therefore be made in terms of public policies so as to enable these practices to develop.

While one of the first requirements is more tenure security to ensure that the environmental efforts undertaken on the land are not in vain, the issue is broader because implementing AE on the large scale requires in reality deep-reaching agrarian reforms to foster the rise of this kind of sustainable smallholder farming.

In addition, AE practices need to focus policies on the provision of public goods (extension services, roads and storage facilities, access to local and regional markets, access to credit and weather insurance, research and development, etc.) rather than on private goods in the form of chemical input subsidies that are both extremely expensive for States and counter-productive in regard to the AE approach.

If we compare the content of agricultural policies in Brazil and Madagascar (See "Agro-écologie et politiques agricoles, deux exemples contrastés en pays tropicaux", Valentin Beauval, September 2011) in terms of AE development, the result is enlightening! In Brazil, the law of 2010 on extension and technical assistance for agriculture and land reform gives priority to AE extension activities in rural areas. Combined with other consequential reforms for farmers (welfare and retirement systems, harvest guarantees, land reform), such policies have enabled the rapid spread of best practices, including AE. R4

In Madagascar, on the contrary, where AE has been spreading for several years, the virtual absence of agricultural policies means that these AE techniques are not disseminated over the long term except for those that require little financial investment and help lower risks and increase households' technical and economic autonomy and food security.

It therefore seems that more sustainable forms of agriculture will only spread to smallholder farms on the large scale in a country if real agricultural policies support these forms of agriculture and provide an incentive to use agroecologic practices through suitable subsidies and credits.

Another avenue worth exploring addresses financing these AE practices. Suitable forms of carbon credits proposed by developing country policymakers (along the lines of the World Bank's Biocarbon Fund) deserve further study. These funds could be carried by regional agricultural policies that would encourage the adoption of AE practices and help with their scaling up.

Finally, there is the question of the interaction between the international economy and the growth of AE. The liberalization

[4] Adopted during the 1992 "Earth Summit," the Rio Convention aims to ensure the conservation of biological diversity, the sustainable use of its elements, and the fair sharing of the advantages arising from the exploitation of genetic resources.

of the agricultural product trade undertaken by the WTO has helped lower real agricultural prices and helped lower agricultural incomes and contributed to the pauperization of smallholder farms. Promoting the development of AE therefore also means implementing price stabilization policies and controlling market opening that brings identical agricultural systems into competition with each other. This should allow smallholder farms to be competitive and prevent the repeat of food riots such as the ones in 2009.

Conclusion

The AE concept is not new, and it has evolved considerably over the decades in function of the angles from which the various actors, scientists, and practitioners have approached it. While AE is currently front and center and appears in many studies, declarations and advocacy campaigns, the fact remains that AE deserves to be more clearly defined when the concept is used because the various iterations of the concept have undermined the general understanding and visibility of what the concept encompasses. Considering the multiple global food challenges for the 21st century, particularly with regard to agriculture's sustainability and resilience in the face of climate hazards, and on reading the projections (Agrimonde) of the demand and needs that tomorrow's agriculture will need to meet, the AE model progressively imposes itself. The abundant recent writings on the subject tend to sing the praises of AE and demonstrate its many virtues. Many challenges remain to be addressed if we wish to extend agroecology practices on a larger scale. In particular, further research on the subject is needed with, among other things, the aim of more fully analyzing the large-scale economic benefits of these practices. Because it would be counter-productive to set up idealistic systems that do not overcome the food security challenges waiting for us. Not to mention the fundamental element of accompanying AE with strong support policies not only for the development of these systems but also in securing production factors such as land tenure.

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R4 *Report: "Agroecology and the Right to Food"*, Olivier de Schutter, March 2011, 21 pgs.
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R5 *Agroecology as a science, a movement and a practice. A review*, Wezel, S. Bellon, T. Doré, C. Francis, D. Vallod, C. David, 2009, 13 pgs.
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In this special report, CARI not only defines and argues in favor of adopting agroecological practices, it also endeavors to transcribe the various testimony of people who have adopted AE practices in France and developing countries, describing a few key techniques.
http://www.cariassociation.org/IMG/pdf/special_agroecol_32p_coul.pdf

R8 *L'agro-écologie à Madagascar – Analyse des conditions d'adoption paysanne de diverses techniques agro-écologiques à partir des expériences de coopération d'AVSF*, Brice Dupin, May 2011, 74 pgs. (French version only)
This document provides an analysis of the results of AVSF's cooperation efforts in regard to AE in Madagascar. It proposes methodological recommendations on how to support farming families and their organizations with the aim of agroecological intensification through better consideration of farmers' current practices and strategies on their farms and territories.
http://www.ruralter.org/index.php?option=com_flexicontent&view=items&cid=17&id=340:lagroecologie-a-madagascar-analyse-des-conditions-dadoption-paysanne-de-differentes-techniques-a-partir-de-lexperience-davsf&Itemid=100002

R9 *Ecologically efficient agricultural systems for smallholder farmers: contributions to food security,* March 2011, 24 pgs.
As part of the preparations for the thematic sessions in the 3rd European Forum on Rural Development held in Palencia in March 2011, this working document presents the scope of study of the second working group titled "eco-efficient agricultural systems for smallholders: contributions to food security."
http://www.ruralforum.info/images/ficheros/bs2-en.pdf

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Inter-Réseaux Développement Rural (www.inter-reseaux.org) is an association that aims to promote networked discussions, exchanges and reflection on the subject of rural development in developing countries.
This brief was written by Fanny Grandval (fanny.grandval@inter-reseaux.org), project manager, Inter-Réseaux.
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