Agroecology: A Response to the Agricultural and Food Challenges of the 21st Century

Coordination SUD
Solidarité Urgence Développement

Coordination SUD

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Introduction

Faced with the negative impacts of and limits to agriculture based on the agricultural revolution of the 20th century – known by the term "Green Revolution" in the Southern countries and often qualified as 'productivist' agriculture – many approaches around the world are seeking to implement a type of agriculture that reconciles production objectives with ecological or even social objectives (such as job generation, standard of living and life quality, and food security). The **practices** claiming to draw inspiration from agroecology are diverse, as are the terms for describing them. The concept of agroecology makes it possible to associate a large number of these practices with several fundamental principles.

Agroecology is also a **scientific approach**: *'ecology applied to the plant population in cultivated fields'* or *'cultivated field ecology'*.[1] In other words, it is agronomics that rediscovers that agriculture is based on an ecosystem (an 'agrosystem'). Depending on the approach, the scale considered can be a cultivated plot of land, a farm, an entire region, or even the agri-food value chain.

Agroecology is often considered to be a **movement** that promotes more sustainable agriculture and forms of production/consumption.

Many studies have been carried out on agroecology and its impacts. The member organisations of the Agriculture and Food Commission (C2A) of Coordination Sud, (the platform of French international solidarity NGOs), are convinced of the importance of supporting family farming for the Southern countries. They are arguing for public policies favourable to their development. They are also often witness to the negative impacts of and limits to "productivist" agriculture as well as to the positive effects of agroecological approaches implemented for family farming.

Critics of agroecological approaches often say it is unrealistic to claim to "feed the world" or generate enough income with agroecology. Agroecological experiences at the local level also sometimes have trouble becoming more widespread. In a way, it is difficult for agroecology to 'change scale'. Olivier De Schutter, UN Special Rapporteur on the Right to Food, emphasises that *'the scaling up of these experiences is the main challenge today'*.[2]

This is why the C2A wishes to review the situation regarding the two main questions below:

- The **ability of agroecology to respond to the major challenges of humanity** in the 21st century: food security for a growing population whose modes of consumption are changing, economic and social development of the Southern countries and their populations, transition in modes of production and consumption faced with the current ecological crisis (deterioration of cultivated ecosystems, exhaustion of non-renewable resources, deterioration of biodiversity, environmental contaminations and global warming);
- The **conditions required** for the spread of agroecology: most suitable type of agriculture (family or capitalist) for implementing ecological practices, systems for supporting and working with farmers (technical and financial support for innovations and risks related to the transition, research, and information exchange), economic environment and agricultural policies, and international development cooperation.

1 Stéphane Henin, quoted by Christophe Naudin, at the C2A Agroecology Seminar held on 11 December 2012 (hereinafter 'Agroecology Seminar').

2 Olivier De Schutter, 2010.

This report covers these two issues based on a literature review carried out by Gret and the *Centro de Desarrollo e Investigacion Rural* (CEDIR)[3], with support from the *Agronomes et Vétérinaires Sans Frontières* (AVSF) association and the AGRECOL Andes foundation, and on the results of the seminar held on 11 December 2012 in Nogent-sur-Marne, France.

It should be noted that in this document we are concerned mainly with agroecology as a set of approaches and practices. Nevertheless, the 'social movement' dimension is never far away, as the social dynamics linked to agroecology are also sometimes a condition for the development of certain practices, especially through the networks for exchanges of experiences and for participative selection and exchanges of seeds, or for alternative marketing channels. ●

3 The study by Maria del Carmen Soliz, Daniel Vildozo, and Pierril Lacroix, 'Estudio bibliografico de agroécologia en América latina y el Caribe', CEDIR-AVSF-AGRECOL Andes, 2012, is available on the AVSF editorial site, at www.ruralter.org.

PART 1

How can agroecology meet the major future challenges for humanity

(food security, economic and social development, jobs, ecological crisis)?

Sustainability of agriculture: a long-standing question

Agriculture is made up of a set of activities that seek to obtain plant and animal products, essentially via transformations of the cultivated ecosystem. Agricultural activity is thus based on the latter.

Some transformations of the ecosystem are transitory and have short-term objectives:

- increasing the flow of mineral elements, organic matter and water, and directing them towards domesticated species and certain of their organs (grains, roots, muscles, etc.);
- protecting these species and organs against deterioration and destruction (from parasites, etc.).

Other transformations of the ecosystem are more long-term and seek to further future production cycles. The production capacity of the ecosystem – its 'fertility' in a way – greatly conditions the future results of the agricultural production: volumes and quality of production, as well as regularity over time.

Agriculture is therefore made up of activities that condition **both the short-term production and the more long-term evolution of the cultivated ecosystem** (including soil fertility, biodiversity, and micro-local climatic characteristics). Most agricultural activities have an influence on both simultaneously (for example, the type of tilling will influence both the production level of crop cycles and the more long-term evolution of soil fertility). Other activities aim specifically at improving the fertility of the ecosystem in the medium or long term (such as construction of terraces, tree planting, choice of breeding stock on a dairy farm, etc.).

Therefore, since its beginnings, agriculture has had a medium/long-term impact on the cultivated ecosystem. This impact has inevitably been taken into account by farmers. It is moreover partially thanks to improvements in the productive potential of cultivated ecosystems (often through increased integration of farming and livestock activities) that the various successive agricultural revolutions over the centuries have enabled an increase in production.

This is especially the case of the 'first agricultural revolution of modern times', which was really an agroecological revolution. In different regions of the world, it enabled an advanced degree of integration of farming and livestock activities, such as the introduction of weeded crops or leguminous fodder plants instead of letting land lie fallow. This enabled an increase in cultivated surface area each year and in the number of heads of livestock, as well as the production and increased use of manure, allowing for improvement of soil fertility and agricultural yields[4].

More generally speaking, as AVSF director Frédéric Apollin emphasises, '*agroecology is perhaps a scientific novelty, but not necessarily a novelty for family farmers. […] Agroecology sprang from family-farming societies, which have historically developed and used agroecological practices – and thus not from NGOs or research centres, even if the latter are currently contributing to their rehabilitation and their improvement in new socio-economic contexts – and especially from strong pressure on natural resources*'[5] » .

Many agrarian civilisations have acquired precious knowledge and know-how on the functioning, use and protection of cultivated ecosystems; risk management; conservation; and use of agricultural products.[6] In many regions of the world, smallholder farmers with very little surface area per worker implement labour-intensive production systems that incorporate various activities, which are relatively autonomous in external inputs and based on a stabilised mode of reproduction of fertility. These systems can often be qualified as agroecological.

Why speak of 'agroecology' today?

Under these circumstances, why must we currently bring up the question of 'sustainability' of agriculture and to talk about agroecology, as opposed to other forms of agriculture?

The response is linked to both the ecological crisis in agriculture in many regions of the world and to the negative impacts of and limits to the Green Revolution.

Ecological crisis in agriculture

First of all, in many regions of the world, agriculture is undergoing crisis – especially family farming. It is an economic and social crisis: there is sometimes not enough agricultural productivity to enable families to meet their fundamental social needs and to invest in improving their tools of production[7]. But there is also generally an ecological dimension to this crisis: the low productivity results not only from the small surface area cultivated per worker, but also from the weak yields per hectare, which themselves reveal a crisis in ecosystem fertility[8]. The ecological crisis tends to become more serious over time, because the family cannot create enough resources to invest in improving the ecosystem (animals and ways of making use of animal excrement, tree planting, irrigation systems, terraces, etc.).

4 'La première révolution agricole des temps modernes', Marcel Mazoyer and Laurence Roudart, 1997.

5 Agroecology Seminar, 2012.

6 Maria del Carmen Soliz et al., 2012.

7 *Annual physical productivity* can be defined as the quantity of annual agricultural production per agricultural worker, and *net annual economic productivity* as the annual added value per agricultural worker. Redistribution of added value that is disadvantageous to farmers (that which goes to other economic stakeholders) may also be a cause for low monetary income.

8 *Agricultural yield*, or production volume calculated per cultivated hectare (including production used for livestock), can be calculated for a production cycle or for an entire year when there are several production cycles or when there is production throughout the year (for dairy farms, for example). Here we are interested in the *annual yield* per hectare, taking into account all production present within the system of production.

We can often observe that the ecological crisis is caused by the disappearance of former systems of fertility management, due to demographic pressure (disappearance of long fallow in slash-and-burn systems or of short bush and herbaceous fallow) or to the fact that new systems do not make it possible to sustainably improve per-hectare yields. The ecological crisis is also intensified by migrations of impoverished farming populations in fragile ecosystems (sloped land in tropical climates, etc.) due to demographic pressure or processes of land concentration.

In these circumstances, the aim of agroecological practices is to provide a response to the cultivated ecosystem crisis.

The Green Revolution's negative impacts and limits

The second element to take into account is related to the negative impacts of and limits to the agricultural revolution of the 20th century, described by Marcel Mazoyer as the '*second agricultural revolution of modern times*'[9] and known by the term 'Green Revolution' in the countries of the South.

The type of agriculture based on the Green Revolution is often qualified as 'productivist', insofar as it essentially seeks to maximise yield and income per hectare or labour productivity, without taking into consideration the ecological and social impacts of the production – either in the short term or long term, or at the local or global levels.

The negative effects of systems based on the Green Revolution are varied in nature. They often tend to impoverish cultivated ecosystems and sometimes increase the producers' dependence on the techniques of the Green Revolution. There are many examples of these negative effects:

- Deterioration of the fertility of cultivated ecosystems. Intensive use of chemical fertilizers and of pesticides leads to the destruction of the biological and physical fertility of soils, which tend to become sterile and dependent on further supplies of chemical fertilizers (loss in particular of micro-organisms, which are the main transformers of organic matter into mineral elements assimilable by plants).

BOX 1

> The Green Revolution

The Green Revolution is based on:

- The development of new means of agricultural production based on the Industrial Revolution: motorisation, large-scale mechanisation (increasingly complex and efficient machines) and chemicalisation. Chemicalisation consists in using mineral fertilizers (nitrogen, phosphate and potassium) and synthetic products for the protection and treatment of plants and animals (pesticides and drugs, respectively). Motorisation has also allowed the spread of irrigation in some regions.
- The breeding of plant varieties and domestic animal breeds that have a high genetic potential and that are adapted to these new means of production.

The systems based on the Green Revolution have generally enabled a strong increase in per-hectare yields, thereby making it possible for humanity to meet its growing food needs. Today, the food and nutritional needs of a significant proportion of humanity are not being met properly, but this results more from unfair distribution of productive resources and income around the world than from an overall deficit in food[10].

9 Marcel Mazoyer and Laurence Roudart, 1997.

10 Laurent Levard, 2012.

- Loss of agricultural land: erosion, aridification and salinisation of irrigated land.
- Loss of biodiversity (increased loss along with the spread of GMOs), making the use of pesticides and herbicides necessary.
- Exhaustion of non-renewable resources (water, phosphate and potassium, fossil carbon).
- Contamination of the environment and of people.
- Deterioration and simplification of landscapes.
- Contribution to climate change.

While some of these effects are seen locally, others are of a more global nature and directly concern all of humanity.

In the long run, the worsening of these negative effects will lead humanity to an impasse. Furthermore, the Green-Revolution model seems to have reached certain limits, and this is not unrelated to some of its effects. For example, growth in yields per hectare has been running out of steam globally. While average rice yield per hectare increased an average of 2.2% per year between 1962 and 1989, its growth declined to half that (+1.1%) from 1989 to 2009. The decline in growth of wheat yields is even more notable: from +2.8% to +1.2% per year for the same periods.[11]

Finally, other than effects of an ecological nature, the Green Revolution can also lead to impacts in terms of:

- family farmer dependency on firms upstream (e.g. supply in equipment, seeds, fertilizers and other inputs) and downstream (e.g. vertical integration, with modes of production and market conditions imposed by food-processing firms);
- indebtedness and economic and financial crisis of the farm;
- pressure from large-scale farms that carry out land and resource grabbing;
- situations of discontent and depression in the family-farming environment (including even many suicides) linked to the accumulation of these difficulties.

As a general rule, the implementation of Green-Revolution techniques is often a success in places where agroclimatic conditions are brought under control well and are stable over time. However, this does not prevent the above-mentioned negative effects from frequently appearing in the more or less long term. The Green Revolution generally enables strong growth in yields when the environment enjoys enough initial fertility (especially the organic fertility of the soil, which conditions its capacity to retain mineral elements and water and to resist erosion) to make the investments and extra costs profitable and to deal with unforeseen occurrences in nature.

On the other hand, Green-Revolution techniques have often been a failure when agro-climatic conditions are not sufficiently under control and the environment is fragile. Implementing such techniques has often led family farmers to even deeper crisis or even bankruptcy. This is why they frequently tend to reject these techniques.

In the regions that had not provided satisfactory solutions beforehand to the sustainable management of soil fertility, the Green-Revolution techniques have turned out to be especially risky and dangerous for farmers. This is because such techniques tend to simplify and specialise the systems of production, thereby destroying the aspects of biodiversity, practices, systems for protection of soil, and sustainable management of fertility that could have lasted. At the same time, these techniques lead to an increase in production costs. In this case, the ecological crisis in the traditional systems and the perverse effects of Green-Revolution solutions join together to weaken family-farming economies.

Agroecological approaches therefore seek to provide an alternative to the type of agriculture based on the agricultural revolution of the 20th century.

11 Laurent Levard, 2012.

Breaking out of the impasse

The ecological impacts of agriculture on the environment result not only from just the agricultural techniques that are applied, but also from more general economic and social processes. For example, the crisis in family farming pushes many impoverished farmers into cutting down forest to gather firewood, the sale of which procures monetary income, and prospects for profit in cultivating new land for capitalist agriculture lead to deforestation. There are also many ecological consequences from the developed countries' production and consumption model as a whole (including the stages of marketing and processing of products).

The upcoming decades could lead to intensification of the ecological impasses of agriculture as it is practised throughout the world, especially along with increasing scarcity of non-renewable resources, further deterioration of some ecosystems, and global warming. Agroecology thus seeks to provide a response not only to the immediate challenges, but also those that future generations will have to face.

Definition and fundamental principles

The approaches of agroecology are varied

Many approaches claim to be inspired by an agriculture that is more sustainable: 'sustainable agriculture', 'doubly green revolution agriculture', conservation agriculture, ecologically-intensive agriculture, organic agriculture, etc.

We may add that some agroecology approaches also take into account three other dimensions: job creation in rural areas, the comprehensive nature of the mode of agricultural production and of food consumption, and the 'social movement' dimension.

The job dimension

Some aspects of the agricultural revolution of the 20th century (mechanisation, motorisation, use of herbicides) have enabled growth in labour productivity by increasing the surface area worked per worker[12]. The increase in labour productivity in many regions of the world moreover results more from the increase in surface area per worker than from the change in agricultural yields. However, the destruction of agricultural jobs due to the implementation of these techniques is very often not compensated by the creation of jobs in other sectors of activity. It thereby leads to an increase in unemployment and under-employment. Negative social impacts result from this, as the population excluded from work is deprived of income needed to respond to its fundamental social needs.[13]

The agroecological approaches that include the issue of jobs therefore seek to give priority to the use of labour-intensive work and agricultural systems, rather than replacing them by other means of production.

[12] The two other components of the farm worker's annual productivity are the yield (or added value depending on whether we reason in physical or economic terms) per hectare per production cycle and the number of annual production cycles on a single plot of land.

[13] Moreover, it is important to note that, from a strictly economic point of view, when 'freed' labour is unproductive, replacing the work by imported means of production (i.e., the manufacture of which generates no added value in the country) leads to an overall decrease in the added value for the country concerned.

Treating modes of agricultural production, exchange and food consumption as a whole

Some agroecology approaches are also concerned with the ecological and social impacts of modes of agricultural production and food consumption as a whole. These approaches therefore cover transport, the processing and marketing of products, the distribution of added value in these value chains, and the processing of products and modes of consumption[14].

Consequently, as is often the case in Brazil for example, an increasing number of agroecological experiences are structured around solidarity-economy principles and promote a reorganisation of the value chains for exchanges and economic development of these products (short channels, public procurement, participative certification, etc.) and the relocation of agriculture and local and regional exchanges each time these are possible. These therefore open up new possibilities for outlets and for fair remuneration for producers in short channels and in institutional markets (e.g. public procurement by local authorities or public services).[15]

A scientific discipline and a set of practices, as well as a social movement

Above and beyond being a scientific discipline and a set of practices, agroecology is also often considered to be a social movement.[16] As stated by Joaquim Diniz, Professor of Agroecology at the Federal Institute of Science and Technology Education of Rio Grande do Norte State in Brazil, many agroecological experiences have been enabling families and collectives (along with the eventual participation of other players such as NGOs, consumers and public authorities) to form networks that deal with concerns linked to food security, the preservation of natural resources and food sovereignty.[17] In this way, agroecology helps people become aware of the issues and contributes to collective actions leading to alternatives to the dominant modes of production and consumption.

Defining agroecology

Asking the question of whether agroecology is capable of responding to some of the main challenges of humanity requires clarification of what we mean by the term 'agroecology', especially given the diversity of approaches aiming for more 'sustainable' agriculture.

Generally speaking, we must be careful of certain biased or 'minimalist' approaches that focus on particular crops without taking into account the agricultural production system as a whole, or that allow progress on some aspect (for example, a simple more sustainable use of inputs) but without responding to all the challenges mentioned above as a whole. This is likewise the case for certain concepts that are still too vague, such as the very recent 'climate-smart agriculture'.

On the other hand, it is important to avoid an overly exclusive and dogmatic approach, and to recognise the plurality of approaches that enable a transition towards ecological agriculture or agroecology.

We will therefore define agroecology as a type of agriculture that:

i. makes it possible to reproduce, or even improve, the productive potentialities of the cultivated ecosystem;

ii. is mostly independent of non-renewable resources;

iii. produces diversified and good-quality food;

14 Denise Van Dam et al, 2012, Chapter 1.
15 Joaquim Diniz, Agroecology Seminar, 2012.
16 Denise Van Dam et al, 2012, Chapter 1.
17 Agroecology Seminar, 2012.

iv. does not contaminate the environment or people;

v. contributes to the fight against climatic warming.

In the end, it is a matter of maximising the positive externalities of agriculture (i. to iii.) and of minimising the negative externalities (iv. and v.), keeping in mind that, for these last two points, the externalities can also be positive in the cases of recycling contaminating elements or of positive carbon footprint.

Four essential operating principles

In order to do so, agroecology is based on four essential operating principles:

1) It seeks to **take advantage as much as possible of cultivated ecosystems' potential for sequestering external natural resources**, rather than require the supply of external resources (energy and inputs).

- Some of these resources are unlimited and directly accessible:
  - solar energy and atmospheric carbon for the synthesis of organic matter;
  - atmospheric nitrogen for protein synthesis, via legumes that have the ability to fix atmospheric nitrogen thanks to association with micro-organisms in their roots.
- Other resources – even though they are practically unlimited – are more inaccessible, especially mineral elements located deep in bedrock. Whatever the case may be, maximum use of these resources is involved (e.g. maximum soil cover through associated crops and the succession of various production cycles on the same plot of land throughout the year, use of legumes, trees with deep roots, etc.).
- Finally, some of these resources are not unlimited: rainwater, river water and underground water). In this case, agroecology seeks not only to sequester it (including via water-retention systems), but also to make optimum use of it by reducing losses that occur in the form of evaporation, evapotranspiration and run-off (agroforestry, hedges and specific infrastructures such as terraces, etc.).

  Reducing losses also concerns mineral elements and biomass.

BOX 2

> Living with the semi-arid climate in the Nordeste region of Brazil

Brazil's Nordeste region has a semi-arid climate and suffers from cyclical droughts. The agroecological approach there coexists with very expensive irrigation projects. It consists, among other things, of 'living with a semi-arid climate' through simple and inexpensive techniques for collecting, conserving and using the available water.

For example, 350,000 family water tanks with a capacity of 16,000 litres have been built along with participation by families[18].

2) Agroecology is based on the use of **interrelations and internal flows** within cultivated ecosystems. It is firstly a question of making recycling of biomass possible via:
   - integration between plant and livestock production (producing animal feed and using animal excrement as fertilizers);

[18] According to Joaquim Diniz, Agroecology Seminar, 2012.

– integration between plant production activities (soil fertility thanks to legumes, hedges and trees that protect crops from wind and excessive heat, etc.);
– integration between animal activities (use of animal by-products for feed for other types of livestock).

Developing these interrelations also provides a way to manage the farm's microclimate.

These methods also develop the metabolic function of soil micro-organisms as well as the various functions of living organisms present in the ecosystem (biological control, etc.).

Overall, the above principles 1) and 2) make it possible to both limit the use of external inputs and to increase production volume per hectare. Ecological agriculture thus puts the cultivated ecosystem at the heart of its approach and seeks to make use of its complexity. In contrast, in Green-Revolution agriculture the ecosystem tends to be a simple physical tool that is to be 'simplified' as much as possible by eliminating, for example, all the animal and plant species other than that which is cultivated.[19]

3) Agroecology attaches **as much importance to the reproduction of the productive potential of the cultivated ecosystem** – and especially biodiversity and the organic and mineral fertility of soils – **as to immediate agricultural production**.

4) Agroecology **avoids the possible negative effects in terms of contamination** of the environment and people.

Consequences

Adopting this definition and these principles calls for six remarks:

- Agroecological practices can respond to different types of problems: wind or rain erosion; loss of organic fertility and/or soil minerals; poor water management; reduction of biodiversity; parasite attacks; frequent unforeseen weather occurrences and climate change; lack of farm autonomy (related to chemical inputs, animal feed, energy, etc.); mediocre food quality; contaminations of the environment, products and people; and price fluctuation, etc. The practices given priority thus depend directly on the major problems encountered.[20]
- Frédéric Apollin states that '*agricultural practices have sometimes been lost because they were no longer adapted to the new conditions or because they were wiped out by the Green Revolution. And they're coming back into fashion, after having been denounced as inefficient, as Marie-Monique Robin has shown with the milpa system*[21] *in Central America. […] Agroecology is thus a way of enhancing the value of the historic profession of family farming with regard to nourishing agriculture that does not do violence to nature*'.[22]
- Many organisations promote practices that can be qualified as 'agroecological' (crop rotations, use of legumes, agriculture-livestock integration, etc.), but they **do not necessarily use this term**. This is the case, for example, of the NGO ENDA in Senegal and of the Songhai Centre in Benin.[23]
- **Organic agriculture** can be considered part of agroecology, even if it is not directly concerned with certain issues such as energy expenditures, either during production or

19 Laurent Levard, 2012.
20 Valentin Beauval, Agroecology Seminar, 2012.
21 Traditional system of associated crops based on maize and legumes by Central American family farmers.
22 Agroecology Seminar, 2012.
23 Examples given by Valentin Beauval, Agroecology Seminar, 2012.

downstream from it (i.e. transport). This is because the labelling of products as 'organic' is based essentially on the non-use of chemical inputs in the agricultural production process. Likewise, the issue of jobs is not directly taken into account by organic agriculture. Some agroecology approaches are based more on a regional scale, whereas organic agriculture more directly concerns practices at the farm or even farm-plot level.

Finally, many agroecological approaches concentrate on the process of the ecological transition of agriculture, without the highly defining effect of organic labelling (one is 'in' or 'out'). As a result, they do not necessarily mean that the use of all chemical inputs will stop immediately (as opposed to organic agriculture). They may even sometimes recommend a combination of chemical and organic fertilizer initially until soil fertility is entirely recovered.

- Not all agroecological practices necessarily seek to create jobs, even if in practice we can observe that agroecological systems generally tend to use more labour.
- In this document, we are focussing on the sphere of **agricultural production**, even if – as previously stated – some of these approaches:

– are concerned with the mode of production as a whole (including the marketing, processing and distribution of products) and with modes of consumption;

– fully incorporate the 'social movement' aspect, with dimensions that are strongly cultural (re-appropriating traditional techniques, etc.) and political (defending rights and the role of family farmers, food sovereignty, etc.).

These aspects provide high added value compared to exclusively technical and agricultural approaches.

Agroecology and food security

The impact of agroecology practices with regard to food security brings up first of all the question of their consequences on the average level of agricultural yields and their regularity.

Agricultural yields

It is important first of all to make clear that measuring yields per hectare must take total final production into consideration. This includes both plant (including trees) and animal production, as well as production in terms of food calories, for the farm's entire farming system over the course of one year. Applying evaluation methods that take into account only the results of one crop on one plot of land and over a single production cycle has often led to understating the importance of agroecology. Indeed, agroecology is characterised by a diversity of activities and by maximum surface occupation over the course of the year[24].

Many studies have shown that when agroecology provides mainly **responses to the fertility crisis** of ecosystems and is implemented under **agroclimatic conditions that are adverse to agriculture** (water stress, sloping land and superficial soils), the result is a large or even considerable increase in agricultural yields because of improvement of fertility, protection of soils, and better use of external resources and the ecosystem.[25]

24 Maria del Carmen Soliz et al., 2012.
25 Maria del Carmen Soliz et al., 2012.

BOX 3

> Difficulties of evaluating yields of associated crops and successions of crops over the year

The existence of different types of production makes it complicated to evaluate the overall yield of the farming system and to compare the different systems. We can see this by measuring, for example, yield in terms of food calories; however, this is simplistic because agriculture does not produce only calories. This is why evaluation and comparison in economic terms (i.e., added value – see below) is often necessary.

For example, planting gliricidia leguminous trees in maize farm plots in **Malawi** not only increases per-plot maize yields, but also fodder supply for animals (gliricidia leaves) as well as firewood.[26]

Variation in production due to this agroecological practice must be evaluated for the farming system as a whole and take into account not only increase in maize production but also increase in animal production and firewood production, and even possibly increases in production in other farm plots that have been made possible by increased use of animal excrement as fertilizer.

In 2003, Jules Pretty and his team carried out a systematic evaluation of the impact of 286 actions to promote agroecology in 57 poor countries, covering 37 million hectares. Their findings indicated an average increase of 79% in agricultural yields.[27]

Ulrich Hoffmann, one of the writers of the UNCTAD report *Organic Agriculture and Food Security in Africa*[28], published in 2008, reports that organic agriculture practices enable increases in yields of 120–130% within three to ten years, and that increase is faster when the organic techniques are applied on systems using little chemical input.[29] This is especially the case of agriculture and livestock integration practices, which see the use of fodder and by-products from crops (straw, etc.) or livestock raising (e.g. whey from cheese production used in pig raising) for animal feed, and the fertilization of fields with animal excrement. This is also the case of associated crops practices and the use of nitrogen-fixing trees (legumes) such as *gliricidia sepium*, a tree native to South America, or *acacia albida* in Sahelian Africa: its deep roots make it possible to bring up minerals and water from the subsoil.

Another study carried out at the request of the British government and that covered 40 projects to promote agroecology in 40 African countries, representing 10.4 million farmers and 12.8 million hectares, came to similar conclusions: an increase of 113% in agricultural yield over a period of three to six years.[30]

Looking at change in agricultural yields when **Green-Revolution-based agricultural systems are transformed** into agroecological systems, the situations vary more, especially according to how intensely the farming system had initially used external inputs and to the level of sensitivity of vegetable and animal productions to the main factors affecting the yields (e.g. sensitiveness to pests and deficiencies in mineral elements). In some cases, there is little effect on the yields, while in others there may be significant decreases[31]. In a study produced in 2008 on organic agriculture, findings showed an average decrease of 8% in yields in the case of systems based on the Green Revolution in the countries of the North.[32]

26 Marie-Monique Robin, 2012.

27 Jules Pretty et al., 2006.

28 UNEP-UNCTAD Capacity Building Task Force on Trade, Environment and Development (CBTF), 2008.

29 Marie-Monique Robin, 2012.

30 Jules Pretty, 2011.

31 Maria del Carmen Soliz et al., 2012.

32 Catherine Badgley et al., 2007, quoted by Christian Aid, 2011.

BOX 4

> Examples of agroecology impact on agricultural yields

In **Malawi**, the planting of the leguminous tree gliricidia in maize fields made it possible to at least double maize yields, reaching an average of 3.7 tonnes per hectare even with degraded soil. Marie-Monique Robin has provided comments by one family farmer: 'Here are our gliricidias [...], big trees more than five metres high. They are native to South America but adapt very well in Africa because they don't need much water. We use their leaves as fertilizer. As it's not a tree that grows very fast, we've planted some alternately with our maize seedlings. As soon as they've reached 50 cm, we cut the leaves and bury them at the foot of the maize'. Dr. Sileshi Gudeta, Director of the Malawi branch of the World Agroforestry Centre explains that 'studies generally show that agroforestry makes it possible not only to increase the fertility of soils, but also to considerably reduce the presence of harmful insects, weeds or pathogenic fungi'.[33]

'One hectare planted with the milpa system [an agroecological production system very common in **Mexico**, in which many associated crops are used on plots, with little or no chemical inputs] produces as many food calories as 1.7 hectares of maize monocropping. If we measure only maize yield, it is definitely higher on a larger farm, but smaller farms also produce beans, pumpkins, tomatoes and turkeys'.[34]

BOX 5

> A small decrease in yields following the transition from conventional agriculture to agroecology in the Philippines

In the **Philippines**, following the conversion from the Green-Revolution model of growing rice to agroecological methods, as part of actions promoted by the NGO MASIPAG (Farmer-Scientist Partnership for Agricultural Development) with 35,000 farmers, and according to a study carried out among 840 families, the average yield decreased only slightly: 3.3 tonnes/ha instead of 3.5 tonnes/ha.[35]

There are nevertheless examples of increase in yield levels, especially when the implementation of ecological practices makes it possible to improve the levels of fertility of the ecosystem, significantly increase the sequestration of external resources (carbon dioxide and atmospheric nitrogen; rain, surface or underground water) and develop the internal flows of the production system's sub-activities.

Ulrich Hoffman reports that *'over time, the systems that followed the methods of the Green Revolution wind up obtaining yields [in organic agriculture] similar to those obtained by intensive farming methods as soon as the ecosystem becomes balanced again and the soils recover their fertility'*.[36]

33 Marie-Monique Robin, 2012.

34 Miguel Altieri, quoted by Marie-Monique Robin, 2012.

35 Lorenz Bachmann et al., 2009, quoted by Christian Aid, 2011.

36 Marie-Monique Robin, 2012.

BOX 6

> Increasing yields while decreasing chemical fertilizer supply

In **Nicaragua**, the Campesino a Campesino movement has promoted the use of legumes in order to recover degraded land, but also with a view of reducing the doses of chemical fertilizers. These latter decreased from 1.7 to 1.4 quintals/ha, whereas yields grew from 0.7 to 2 tonnes/ha.[37]

In **Ethiopia**, a study was carried out in the Tigray region and covered nearly 1000 family-farming plots in 19 communities. Its findings made it possible to compare average cereal yields over the 2000-06 period according to the type of fertilization: absence of external fertilization, compost or chemical fertilization. The yield obtained with compost (2.5 tonnes/ha) was not only higher than that of non-fertilized plots (1.2 tonnes/ha), but also higher than that of plots fertilized with chemical fertilizers (1.8 tonne/ha).[38]

Reduction in variability of production and in risks

Agroecological practices generally correspond to great diversification of farming systems, in contrast to systems specialised in one or several activities.

The **combination of different activities** (on one farm and on a single plot of land, over time and in space) contributes to reducing the uncertainties and the year-to-year variability of the farm's overall level of production:

- by reducing parasite attacks (The increase in biodiversity enables better control of parasites, especially those that specifically attack a particular crop);
- by making it possible to protect soil and crops from certain climatic phenomena (high temperatures, strong rains);
- by allowing results obtained through other activities to make up for occasional poor harvests (following a climatic accident or a parasite attack, etc.);
- by making it possible to make up for cyclical decreases in the price of a particular product via the sale of other products.

Risk reduction is heightened via the use of crop varieties and animal breeds that have less potential but are **more resistant** to agroclimatic accidents.

The existence of a high level of **biodiversity within the species and breeds used** improves adaptation to different types of situations and ultimately enables a reduction in risks.

BOX 7

> Mix of rice varieties in China

'In Yunan Province in **China**, after rice varieties vulnerable to diseases were mixed with resistant varieties, yields increased 89%, rice blast decreased 94%, and farmers were able to stop using fungicide sprays'.[39]

37 Maria del Carmen Soliz et al., 2012.
38 Sue Edwards et al., quoted by Christian Aid, 2011.
39 Y.Y. Zhu et al., 2000, quoted by Olivier De Schutter, 2010.

Many agroecological practices, especially agroforestry, help increase the **organic fertility of soils** and thus their capacity for water retention. This decreases the risks of drops in yields in the event of climatic accidents.

Finally, **making farming systems independent of external inputs** makes it possible to lower the risks due to socio-economic environment variations, such as the price of agricultural products (and thus available income for input purchase), price and availability of inputs, access to credit, and input grant policies. Here we find a fundamental difference from the Green Revolution practices that make farmers very dependent on this socio-economic environment, including for the purchase of seeds in the case of hybrid or GMO seeds that have to be bought each year. In her most recent film, *Les Moissons du Futur* ('Crops of the Future'), journalist and film-maker Marie-Monique Robin explains how the family farmers of Malawi, who had benefited from agricultural input (seeds and fertilizers) subsidies set up in the 2000s, became very vulnerable when the government had to suspend this policy because of budget constraints.[40]

The availability and nutritive quality of foods

Growth in yields and decrease in their variability lead to overall improvement in food security for farming families.

BOX 8

> Improvement of food security in the Philippines

In 2007 and 2008, a study was carried out among families who implemented organic agricultural practices in the **Philippines** with support from the NGO MASIPAG (see above). Its findings indicate that 88% of families concerned consider that their food security was 'better' or 'much better' than in 2000. This proportion was only 44% for farmers who did not implement such practices. Nearly 20% of the latter declared that their food security had deteriorated.[41]

With regard to the nutritive quality of food, Olivier De Schutter has stated that the shift from diversified crop systems to simplified ones based on cereals has contributed to a deficiency in micronutrients in many Southern countries[42]. The diversification of activities linked to agroecology often makes it possible to provide more diversified and better balanced food to farming families and local communities. Olivier De Schutter makes clear that *'the diversity of food, made possible through the growth in diversity in the fields, is especially important for women and children'*.

BOX 9

> Improvement of food and greater food autonomy

In the **Philippines**, the study carried out for the NGO MASIPAG (see above) reveals an increase in the consumption of vegetables, fruits and grains with high protein value, as well as of meat, by the families who have adopted organic farming. These latter grow an average of 15 more plant varieties than do other farmers.[43] *[to be cont.]*

40 Marie-Monique Robin, 2012.
41 Lorenz Bachmann et al., 2009.
42 Olivier De Schutter, 2010.
43 Lorenz Bachmann et al., 2009.

A study of households concerned by the implementation of agroecological practices in **Ecuador** highlights the qualitative improvement in the diet of the families concerned, and especially a strong increase in the consumption of fruits and vegetables. At the same time, the families' food self-sufficiency increases, along with a decrease in purchase of canned food.[44]

Access to food

The diversification of food enables improvement in the farming families' direct accessibility to more balanced food. Part of their production is also sold, thereby improving accessibility to diversified products by the rural and urban regions concerned.

The issue of accessibility to healthy and balanced food is also connected to that of labour productivity, be it in physical terms (volumes produced per worker) or in economic terms (farming income, increase in which enables access to food not produced on the farm).

Agroecology and generating wealth and income

Added value for the farm

Agroecology's ability to generate **wealth (added value)**, and thus income at a local level depends on its impact:

- on the one hand on the **levels of yield and production**,
- and on the other on the **production costs** linked to the use of production methods from outside the farm (inputs and equipment).

As we have seen, when agroecology **is used to meet a fertility crisis in the ecosystem**, yields generally increase significantly. As for production costs, they are generally low initially. Even though costs do increase in the agroecological systems, they remain relatively limited, and their growth is generally less than the growth in production levels, enabling appreciable improvement in added value per hectare.

Here we must note that agroecological systems largely take advantage of inputs and animal labour force that are part of the system. These represent 'intermediary consumptions' (such as use of fodder for feed, animal traction, or animal excrement for fertilization). From an economic point of view, these internal flows (which are thus both production of a sub-activity of the farming system and means of production of another sub-activity) cancel each other out and therefore do not represent a cost for the farm as a whole. It is moreover the use of these internal flows that enables agroecological systems to be largely autonomous from external means of production and to create significant added value.

When agroecology **replaces systems based on the Green Revolution**, the situation is more uneven: Everything depends on the evolutions of both the yield and of the costs of means of agricultural production from outside the system. The evolution of the yield varies according to the circumstances (see above). The costs of means of production tend to decrease greatly due to the fact that expensive production methods are replaced by 'internal solutions'.

44 Maria del Carmen Soliz et al., 2012.

For example, Marciano T. Virola, Knowledge Management Officer at Asian Farmers Association for Sustainable Rural Development, has made the following observation based on different Asian examples of small farms shifting from agricultural using chemical fertilizer towards agriculture based on agroecology: *'In the transition period, we can see a decline in rice production compensated by fewer production costs'*[45]. Generally speaking, added value tends to grow – and often strongly – even when yield levels decline.

Agricultural income

Income levels per agricultural worker depend on the productivity of the agricultural work. While agroecological systems do enable growth in overall added value, they are also often more labour-intensive, due to:

- increase in work linked to the increase in the number of crops;
- work to organise the sequestration of external resources and transfers between activities (fodder, manure, etc);
- monitoring and preventive-care work for crops and animals, in order to detect possible anomalies and take action sufficiently beforehand to avoid the propagation of diseases and parasites, etc.;
- replacing capital by labour (manual weeding instead of herbicides, biological-control practices instead of phytosanitary products, etc.);
- construction and maintenance of infrastructures (soil protection, irrigation, drainage systems, etc.) and plantations;
- the difficulty of mechanisation and modernisation for associated crops and crops that are heterogeneous from a genetic point of view;
- major involvement by farming families in developing products above and beyond production, such as frequent processing procedures and direct or short-channel sales for the products.

When the extra work enables farmworkers to use their labour force more fully and regularly over the year, annual labour productivity grows. For example, based on various agroecology experiences in Asia, Marciano T. Virola explains that *'by alternating crops over time and with long and short crops [sowing of cash crops while the rice grows], labour can be used more efficiently'*[46].

BOX 10

> Increase of income in India

A study co-ordinated by the Indian organisation Development Research Communication and Services Center (DRCSC) among 300 farms that implemented agroecological practices reveals growth in income in 64% of cases, with an increase at least twofold in 44% of cases. The drop in income in 36% of farms can be explained by investment costs (e.g. infrastructures for soil protection, animals)[47].

This illustrates the sometimes critical nature of the transition phase (See below).

When the additional work leads to use of greater labour, the annual productivity of the agricultural workers may wind up decreasing. At the very least, the increase in the annual labour productivity is less than the increase in added value.

45 Marciano T. Virola, Agroecology Seminar, 2012.
46 Marciano T. Virola, Agroecology Seminar, 2012.
47 Ben Hobbs and Sophie Powell, 2011.

However, when this use of extra labour makes it possible to lower the rate of under-employment and unemployment at the local level, the social productivity of the worker (i.e. the added value related to all people of working age regardless of whether or not they actually work) winds up increasing.

Furthermore, from the farmer's point of view, labour productivity also depends on **prices**. For example, drop in labour productivity at constant prices may be compensated by improved value of the production, especially thanks to short channels, which make it possible to modify the distribution of added value in the value chains. The short channels are also often an integral part of the development proposals of agroecology.[48]

In specialised production systems in which only one or several products are sold, marketing is frequently carried out by the (male) farmer. Diversification of activities in agroecological systems very often creates **new income activities for women** (e.g. marketing of fruits and vegetables, etc.) and thereby furthers their greater empowerment and improves social and economic conditions within the farming family and the rural community.[49]

Added value and income at the local level

At the local level, and above and beyond the agricultural production itself, other elements must be taken into consideration:

- Agroecology may lead to a change in demand in means of production coming from the local economy and thus have an impact on the region's productive activities. There may on the one hand be a decrease in means of production characteristic of the Green Revolution (even though these generally do not stem from the local economy), and on the other there may be growth in demand for certain resources used in the agroecological systems, such as fodder, manure, plants (e.g. demand from other farms), as well as light equipment (e.g. for animal traction) that may come from the crafts or small-scale industry sector.
- On the other hand, change in types and volumes of agricultural production may have an impact on processing, storage, transport and marketing activities. There are many examples in which diversification of production in agroecological systems has enabled the development of new activities and agrifood value chains, along with the generation of new income downstream from production. This is especially the case when the development of agroecology is part of a more overall economic and social process at a local level.
- Finally, the wealth distributed in the form of local incomes also depends on economic relationships and the ensuing prices (e.g. prices of agricultural products and prices of means of production). Agroecology can allow producers to avoid unfavourable economic relationships (e.g. paying too much for inputs, including patented seeds; being paid low prices for agricultural products in the case of monocropping, in which the farmer is in a position of dependency towards intermediaries). In addition to this, the development of agroecology is sometimes just one aspect of a more overall economic and social process at the regional level that makes it possible to obtain better distribution of added value among the value chains, through such things as producer organisations for marketing products and defending the interests of farm families of the region, local short channels, and fair trade.

Furthermore, we have seen that, from an economic point of view, agricultural activity basically has two results: **immediate production** and **variation** (positive or negative) **of the farm's production potential**. Economic calculation methods include part of this variation in the farm's added value. This can be seen in the case of change in the number of heads of livestock and sometimes in the change of the value of tree plantations (e.g. growth in value in the develop-

48 Valentin Beauval, Agroecology Seminar, 2012.

49 Maria del Carmen Soliz et al., 2012.

ment phase of the young plantation and depreciation in the production phase) and of certain infrastructures such as those for drainage and irrigation (value of the infrastructures, then the depreciation). Many other parameters that contribute to the production potential of the ecosystem (its 'fertility') are generally not taken into account in the calculation of the farm's added value, such as evaluation of soil fertility, biodiversity, existence of wind-cutting trees and anti-erosion systems, evolution in the genetic potential of animals and their physiological state, etc.

Agroecological practices aim precisely at improving the productive potential of the ecosystem, by working on several of these parameters. At the same time, Green-Revolution-based agriculture often leads, on the contrary, to deterioration of some of these parameters. Conventional economic calculation thus tends to underestimate the added value of agroecological systems compared to systems based on the Green Revolution.

Agroecology and jobs

We have seen (page 21) that agroecology practices are as a general rule **labour-intensive**, regardless of whether they are compared to traditional systems undergoing a crisis or to systems based on the Green Revolution. Greater labour intensity generally makes it possible to better use the available family labour force, which tends to be underused part of the year. It can also involve using more workers in agriculture. This is why agroecological systems facilitate the maintaining or even creation of agricultural jobs, especially in the transition phases that require specific investments (construction of a protection system for soils, planting trees, etc.). Nevertheless, some sustainable-agricultural practices also seek to limit or eliminate tilling; this can lead to a decrease in work time at certain periods of the year. For example, cover crops can make it possible to fight effectively against weeds (and to improve the organic and mineral fertility of the soil) without having to resort to tilling.[50]

We have also mentioned that certain agroecology approaches fully include the objective of job creation, especially by replacing fossil energy (motorisation) with animal or human energy, or by alternative techniques that call on more labour.

The diversification of activities that agroecology enables can also lead to job growth **upstream from production** (e.g. tree nurseries for agroforestry, small-scale equipment) as well as downstream (e.g. processing and marketing of agricultural products).

Agroecology and health

Decrease in the use of chemical inputs often contributes to a decrease in health risks for agricultural workers, the surrounding population and consumers (via reduction of pesticide residues on products). Indirectly, these practices as well as the recycling of certain wastes of a particular activity on the farm (especially thanks to integration between farming and livestock raising) contribute to the decrease in discharge of components harmful to human health (e.g. pesticide residues, antibiotics, nitrates, etc.) into the environment.

However, not enough studies have been carried out up to now, especially in developing countries, on the relations between modes of agricultural production and health, in order to highlight the negative externalities of conventional agriculture (in terms of costs for the community in treatment of diseases due to overexposure to chemical products and food and in terms of decrease in well-being of the population) and the positive externalities of agroecology for public health.

50 Maria del Carmen Soliz et al., 2012.

Agroecology and management of non-renewable resources

Agroecology gives priority to **rational use of water for agricultural use**, so as to limit losses through run-off, infiltration or evaporation. In situations where surface or underground water represents a rare resource, agroecology can contribute to balanced management of the resource, preventing its exhaustion in the long run.

One of the major bases of agroecology is also **autonomy in terms of energy expenditures** that involve the use of fossil carbon, be it directly at the farm level (via motorisation) or indirectly via the inputs used (e.g. manufacture of nitrogen fertilizer).

BOX 11

> Gradual reduction of chemical fertilizers in Asia

'One of the most popular models [in Asia] is the integrated and organic farm on small plots. This model enables farmers to reduce chemical fertilizers little by little, and they do so by using organic fertilizers and livestock excrement. This enables reduction in the use of chemical fertilizers. There is a transition period of one to two years'.[51]

With regard to **chemical fertilizers** from sources outside the farm, the nitrogen situation must be distinguished from that of other mineral elements, mainly phosphorus and potassium.

The production of **nitrogen fertilizers** requires significant energy expenditures and the use of fossil carbon (natural gas). Their transport from production areas to the places where they are used also entails significant fossil energy expenditure. Nitrogen represents a main component of animal or vegetable proteins. Agroecology gives priority to the sequestration of atmospheric nitrogen, which is available for free and in unlimited quantities in the atmosphere, via legumes. These latter are capable of protein synthesis using atmospheric nitrogen. The proteins that are generated this way can in turn contribute to human food (such as peas or beans) or animal feed (fodder and fodder grains from legumes). Some of the nitrogen that is fixed this way can be given back to the soil directly (residue from leguminous crops remaining in the soil or leaves and fruits of leguminous trees that have fallen to the ground) or indirectly (animal excrement rich in nitrogen).

With regard to **phosphorus** and **potassium**, whose mining resources are limited at the global level,[52] agroecology gives priority on the one hand to their sequestration in the subsoil and to their coming up to the surface thanks to trees with deep roots and, on the other, to recycling within the system (via incorporation of organic plant matter into the soil, fodder, or use of animal excrement for fertilization, etc.).

It is nevertheless important at this stage to make clear that agroecology is not always synonymous with decrease or elimination of the use of chemical fertilizers. While this is undeniably the case in systems based on the Green Revolution that are converting to agroecology, it is different in systems in which agroecology provides mainly a response to the crisis of fertility management in an environment where these mineral elements are not very present or available in the soil and in immediate bedrock.

51 Marciano T. Virola, Asian Farmers Association for Sustainable Rural Development, Agroecology Seminar.
52 Robert Levesque, 2011.

In these systems undergoing a crisis, farmers often do not use fertilizers because of lack of availability, too high a cost or risks involved (especially in the case of borrowing). The effectiveness of fertilizers is moreover often diminished by the limited capacity for retention of mineral elements in soil, due to the low proportion of organic matter and its rapid decomposition. The mineral elements then tend to be lost through leaching (infiltration in the soil) or run-off, or by deterioration and diffusion into the atmosphere in the specific case of nitrogen. They are thus largely undervalued. In this context, the agroecological practices that seek to regenerate the organic fertility of soils, improve their structure and biology, or decrease the phenomena of erosion, can enable improvement of crops' ability to take advantage of chemical fertilizers, especially nitrogenous ones.

Furthermore, the reconstitution of organic and mineral fertility of some soils can itself be obtained by associating organic elements and external chemical elements (phosphorus and potassium in particular). Complementarity is thus possible between agroecological practices and external mineral supply, all the while remaining at chemical input levels largely inferior to those practised in many systems based on the Green Revolution.

BOX 12

> Dealing with deficiencies in mineral elements in North and West Africa

'Most soil in the **Maghreb** and in **West Africa** is deficient in phosphorus. One response in the case of organic agriculture is to use natural phosphates. But these are not always assimilable and bring up the question of how quickly soils respond to them. Without restitution, some land remains very deficient in potassium for three centuries. Transfers of fertility must be carried out by going to look for biomass elsewhere. But with a population of 300 people per square kilometre, biomass alone is not enough. This is when we must sometimes go beyond the precise definition of organic [and use chemical fertilizers]'.

Valentin Beauval, retired farmer and agronomist[53]

'Faced with situations of deficiencies in phosphorus, potassium and magnesium, I see two strategies:

- A transition stage, which is difficult to manage when we start from an agricultural model very close to that of mining, towards a long-term model to gain back fertility. In the short term, mineral fertilizers in as natural forms as possible might have to be used on a local and occasional basis – that's to say non-dissolvable fertilizer because in tropical environments three-fourths wind up in the river after intense rains!
- Then, in the long term, the process of soil formation must be recreated and established. Soils are extremely living environments capable of solubilising bedrock and making crystallised minerals bioavailable. Very different soil and climatic conditions exist, and thus very different agronomic strategies too. But, overall, several simple rules can be applied practically everywhere: shaded (tree) cover, minimum tilling, permanent covering of soil by living and dead organic matter, etc. Then, if available, ramial chipped wood can be used to enrich it with carbon. Eventually, if the recycling processes work correctly, each cycle progressively enriches the soil in humus and minerals that have been solubilised and/or transferred by livestock.

There would of course be many other things to add, such as the role of cattle as a collection agent on unclean or undevelopable surfaces, or as a source of organic and mineral elements on cultivated services via manure and excrement; or the need to preserve and recycle one's mineral stock in a less leachable and less erodable organic form'.

Lionel Vilain, technical adviser to France Nature Environnement[54]

53 Agroecology Seminar, 2012.
54 Agroecology Seminar, 2012.

BOX 13

> **An example of complementarities between organic and mineral elements for soil reconstitution and improvement of yields**

In **Central America**, the use of soil preservation techniques and of organic manure of plant and animal origin combined with the use of chemical fertilizers in degraded areas enabled growth in maize yields from 0.4/0.5 tonnes/ha to 2.5 tonnes/ha in seven to eight years[55].

Agroecology and land recovery

We have pointed out the role of agroecology in improving the organic and mineral fertility of soils and their water retention ability. In some cases, the implementation of suitable practices enables real recovery, for farming and livestock-raising, of land that had previously become practically unproductive.

BOX 14

> **An example of agricultural recovery in Tanzania**

In western **Tanzania**, and at the initiative of HASHI (Shinyanga Soil Conservation Programme), agroforestry enabled the rehabilitation of nearly 500,000 hectares of degraded land in an area that had been called the 'desert of Tanzania' by former president Julius Nyerere.[56]

Agroecology and biodiversity

Preserving and taking advantage of biodiversity represents one of the bases of agroecology:

- diversity of cultivated species so as to increase overall yield of the cultivated ecosystem and decrease risks;
- genetic diversity within each plant and animal species, in order to better take into account local variations of the ecosystem and decrease risks. Agroecology often makes it possible to preserve the biodiversity of cultivated species and give new life to them when the biodiversity is weakened and threatened by Green-Revolution-based agriculture, which tends to adopt only species and varieties adapted to its techniques and means of production. Authors such as Miguel Altieri and Clara Nicholls consider that one of the most important results of agroecology in Latin America has been the preservation of traditional varieties thanks to seed banks and exchanges[57];
- biodiversity of species that are not cultivated but that fulfil important agronomic roles, either at the soil level (soil microbiology) or the plant level (plants, insects).

It is important to observe that maintaining ecosystems rich in species in turn furthers attraction of other species.

55 Maria del Carmen Soliz et al., 2012.
56 Charlie Pye-Smith, 2010.
57 Maria del Carmen Solis et al., 2012.

BOX 15

> Biodiversity in Peru and Nicaragua

In **Peru**, the development of agroecology contributes to preserving and promoting traditional biodiversity, especially by furthering many exchanges among family farmers. For example, a study carried out during a seed fair organised by Universidad Nacional de Cajamarca (UNC) in 1992, in which 38 farmers participated, showed that the farmer with the least diversity in seeds had five different species and 24 different varieties. The farmer with the greatest diversity had 38 species and 81 varieties of seeds.

Some varieties of maize, beans and potatoes marketed locally in the Cajamarca region incorporate external genetic contributions thanks to crossing with varieties from plant breeding at research centres, thereby increasing the biodiversity.

In **Nicaragua**, the seed banks and exchanges for traditional varieties involving 35,000 families have enabled the recovery of 129 local varieties of maize and 144 of beans[58].

Agroecology and resistance to extreme climatic phenomena

We have mentioned how systems practising agroecology have greater resilience to year-to-year climatic variations and more generally to climate change. We should mention the importance of this resilience in the event of extreme climatic phenomena, such as strong rains, flooding, droughts and high temperatures. Indeed, these will become more frequent and more serious in the coming years. Having tree growth, infrastructures and constructions that limit erosion, and regular soil cover over the year allows for greater resistance to these phenomena. Furthermore, as Olivier De Schutter mentions, *'…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'*.[59]

Moreover, whether it be in Asia, Africa or Latin America, agroecology (this time as a movement as well) has also often contributed to the development of participative systems of breeding and seed exchange and thus to making varieties that are more resistant to climate change available to farmers[60].

BOX 16

> Examples of farming systems resilient to extreme climatic phenomena

'Following Hurricane Mitch in 1998, a large-scale study of 180 communities of smallholder farmers of various regions of **Nicaragua** showed that the plots cultivated using simple agroecological methods (including stone dykes or levees, green manure, crop rotation and incorporation of agricultural residue, trenches, terraces, fences, mulch, legumes, trees, tilling perpendicular to the slope, no burning, hedges, and no-till planting, among others) make it possible to obtain an average 40% increase in arable topsoil, to increase the degree of ground humidity, to decrease erosion and to *[to be cont.]*

58 Maria del Carmen Solis et al., 2012.
59 Olivier De Schutter, 2010.
60 Marciano Virola, contribution at the Agroecology Seminar, 2012.

reduce economic losses in comparison with control plots from conventional farms. On agroecological farm plots, the loss of topsoil due to landslides was on average 18% less than that observed on conventional plots and gully erosion 69% less'.[61]

'A study carried out in southern **Brazil** shows that yield losses during the drought of 2008-09 were around 20% in agroecological systems (a yield of 4.2 tonnes/ha), compared to a decrease of 50% in systems based on the Green Revolution (4.5 tonne/ha)'.[62]

Agroecology and fight against climate change

According to climate-change specialists, one third of climate change is more or less directly linked to agriculture itself.[63]

Agricultural activities themselves are responsible for 13% of climate change: emissions of carbon dioxide (from production of nitrogenous fertilizer, fuel combustion), of methane gas (from digestion by ruminants, flooded rice fields) and of nitrous oxide (from emissions from soil and deterioration of nitrogen fertilizers, and from solid and liquid manure spread on cultivated land). To this should be added the approximately 4% of emissions linked to transport of agricultural products and inputs and 18% of change in use of land (mainly from deforestation, but also from cultivating prairies). Deforestation leads to release of CO_2 due to combustion of organic tree matter and a decrease in the proportion of organic matter in soil. The conversion of prairies into cultivated systems characteristic of the productivist system (monocropping, absence of organic fertilization and of tree growth) also leads to a decrease in organic matter in soils.

According to some estimations, if we take into account emissions linked to the processing and packaging of agricultural products and to the decomposition of organic residue of food, nearly 50% of global warming is due to the agricultural and food model as a whole.[64]

Agroecology helps fight climate change in three ways.

- First, agroecology **reduces use of fossil energies**, especially when it replaces Green-Revolution systems. Among other things, this makes it possible to improve the energy efficiency of agriculture, i.e. the relationship between the energy contained in agricultural products and the energy from outside sources (photosynthesis excepted) used for making them.[65]
- Second, it allows for a significant **carbon fixation** in the form of organic matter in soil (organic matter of soil, roots) and on the surface (perennial vegetation such as bushes or trees). This type of effect can be observed as much in cases in which agroecology provides a response to the crisis of fertility management in certain ecosystems, as in the cases in which it replaces systems based on the Green Revolution. In each case, the pre-existing systems are often characterised by a low proportion of organic matter in soils and by absence of tree and bush cover.
- Finally, by enabling farmers to create jobs thanks to increased income, it often provides a **response to the crisis in family farming**, thereby limiting the clearing of land covered by forest or savannah, be it on a local basis or following population migration to the agricultural frontier. ●

61 Eric Holt-Gimenez, 2002, quoted by Olivier De Schutter, 2010.
62 Maria del Carmen Soliz et al., 2012.
63 Source: Intergovernmental Panel on Climate Change (IPCC).
64 Laurent Levard, 2012.
65 Maria del Carmen Solis et al., 2012.

PART 2

The conditions required for developing agroecology

Family agriculture or capitalist agriculture?

Agroecology represents a **gradual and often substantial investment in the cultivated ecosystem** in order to increase its production potential.

The first question that must be asked regarding how to develop agroecology is, 'What is the most appropriate type of agriculture to be implemented?'. The agroecological transition should undoubtedly consider and concern **all agricultural systems** for the benefit of producers, consumers and the planet.

However, the efforts to promote agroecology, which include such aspects as basic research, research-action, training, agricultural extension, farmer-to-farmer exchange and investment support, should as a priority focus on **family farming**. This is justified by the latter's role in world agriculture and by factors such as food security as well as economic, social, ecological and regional equilibriums. The vast majority of farmers are smallholder or 'peasant' farmers, and family farming is responsible for 60 to 70% of global agricultural production. The issues of food security, food quality, jobs and life in rural areas largely depend on the dynamics of family farming.

It is also important to emphasise that agroecology is fundamentally based on **accumulated local knowledge** that has been amassed over centuries by family farming. In many regions, smallholder farmers have developed complex farming systems adapted to local characteristics. This has enabled them to face adverse conditions and meet their basic needs.[66]

Frédéric Apollin states that smallholder farmers are the 'historical agroecologists'.[67] Recovering their already existent knowledge and know-how and helping to improve it and diffuse it more broadly is not just common sense, but also something obvious for political decision-makers and agricultural development cooperation organisations to pursue, in terms of the cost-benefit of the actions to undertake.

In addition, family farming, which is essentially based on the use of family labour and in which production decisions are mostly made by the family itself, appears to be the most appropriate form for implementing such a transition. This is because farming families have a fundamental **interest in improving the cultivated ecosystem**, insofar as the social reproduction of the peasant family directly depends – in the short and long term – on this improvement. Each time it is able to do so, the farming family invests in improving the cultivated ecosystem in

66 Maria del Carmen Soliz et al., 2012.
67 Agroecology Seminar, 2012.

terms of time and financial resources, all the more so because this type of investment (e.g. planting trees, building terraces, transporting manure, etc) often requires much work. Indeed, family labour does not represent a production cost for the farming family: whether it works or not, it must satisfy its basic needs. Each time that the farming family has its own labour force available and no other opportunities for income, it is in its best interest to make substantial use of it, even if the surplus production made possible by this extra work (the 'marginal yield') is at a low level.

Here we can find **two differences with capitalist agriculture**, which is based on the use of salaried labour. The criterion for capitalist management is maximisation of the annual profitability of invested capital. If the profit rate does not reach a certain objective (the average profit rate overall), the owner of capital can transfer the latter to another region or sector of activity. Given this mobility of capital and the big investments (especially in labour) implied by practices to preserve and improve ecosystem fertility and by deferred profitability, capitalist agriculture is not always interested in the reproduction of the ecosystem.

For some, capitalist agriculture practices can even sometimes be qualified as 'extractive agriculture': ecosystems are gradually destroyed, and then capital is withdrawn once the level of profitability no longer justifies its presence. It is precisely in areas where capitalist agriculture is practised that deterioration of the cultivated ecosystem tends to be significant. Furthermore, as salaried labour represents a production cost for the capitalist entrepreneurs, they will use it only if the marginal profit rate justifies doing so, and they will not hesitate to replace it by machines if this enables improvement of the profit rate.[68]

In some cases, converting certain capitalist agriculture systems into agroecological systems seems all the more unrealistic because the soil has already often become sterile and will only produce yields after significant expenditures in fertilizer and pesticides. Conversion to ecological agriculture would imply massive and prolonged incorporation of organic matter that is not very compatible with the current orientation of capitalist agricultural systems (specialisation, absence of animals, etc.).[69]

When it has **significant surface area** available, capitalist agriculture can nonetheless implement very extensive systems with a very low level of artificialisation of the ecosystem and with reproduction of fertility. This is especially the case of range-type animal production in prairie or savannah ecosystems, where fertility is stabilised (on the contrary, this is often not the case of range-type animal production in tropical regions and on fragile soil previously covered by forests). Furthermore, there are also examples of capitalist agricultural undertakings having converted to agroecology, as in the case of several flower, banana or other fruit plantations in Latin or Central America; however, these are still few in number and involve radical changes in modes of production.[70] But in some cases these systems are accompanied by shifts of local and farming populations into limited and fragile areas, where production systems are undergoing a situation of ecological crisis.[71].

Overall agricultural policies favourable to family farming

This does not mean that it is necessarily in the interest of family farming to implement agroecological practices, or that it is always able to.

68 Laurent Levard, 2012.

69 Maria del Carmen Soliz et al., 2012.

70 On this topic, see the work done in particular by the Colombian expert Jairo Restrepo (*http://www.mashumus.com*).

71 Example of Namibia given by Valentin Beauval, Agroecology Seminar, 2012.

Several elements must be taken into consideration in order to better determine what kind of socio-economic environment, what systems for promotion and support, what agricultural policies and what kind of support from the international development cooperation world can contribute to the development of agroecology.

Whether it be for choices related to the sphere of production or that of consumption, the farming family constantly decides between short-term vs medium- or long-term objectives. The former include level of production and immediate or year-long income, as well as satisfaction of immediate social needs such as food, heating and health care, whereas the latter include reproduction of the ecosystem, productive investments and long-term improvement of social conditions of everyday life: preventive health care, education, sustainable improvement of habitat, etc.

In situations of **relative economic prosperity**, the farming family can easily reconcile these various objectives. On the other hand, during **economic and social crises**, the farming family will always tend to give priority to the short term – and especially immediate agricultural production – rather than to long-term reproduction of the cultivated ecosystem. This is often a simple question of survival. If the clearing of land allows them to sell firewood in the neighbouring town and thereby obtain extra monetary income, or if planting hillsides enables them to increase the agricultural production of the year, then farmers who must absolutely feed their family will decide to do so. They will do so even if such practices will lead irremediably to deterioration of soil and its fertility – and thus to production and income levels of the following years. And hence they will do so even if these very practices will, in the long term, only exacerbate the economic and social crisis of the family.

With regard to use of income, meeting immediate social needs will also take priority over agricultural investment and improvement of the ecosystem (and even over the year's production objectives). When there is no system of free public health care or of social security, the need to deal with urgent health-care expenses for a family member very often acts as a main factor behind the reduction of capital (via selling livestock, etc.) among farming families.

Generally speaking, when family farming undergoes severe crisis, the transition towards agroecology seems very difficult or even impossible, even if in the medium or long term these new practices could help to resolve this crisis. Yet, it is when this type of situation occurs that agroecology is most urgently needed in order to get out of the crisis! Transition is nonetheless possible, on the condition that it is strongly subsidised and that these subsidies actually make it possible to mitigate the scale of the crisis.

Furthermore, transition towards an agroecological system implies a certain risk for the farmer, as it means the implementation of practices (including those resulting from individual experimentations) whose consequences he/she cannot be sure to control. However, in crisis situations, families tend to reduce risks as much as possible and to put priority on meeting their immediate social needs (or their survival). Some projects aimed at promoting agroecology hence encounter little response from rural families experiencing crisis situations.[72]

This is why **all the agricultural policies enabling a degree of prosperity and stability in family farming are a prerequisite for agroecological practices to become effectively more widespread**. In its report *Quelles politiques publiques pour les agricultures familiales du Sud* ('What Public Policies for Family Farming in the South?')[73], Coordination Sud's Agriculture and Food Commission mentions the conditions that such public policies must guarantee:

[72] The implementation of agroecological practices enabling medium-term improvement of the potential of ecosystems is made much easier when these same practices either:

– (1) respond simultaneously to short-term objectives (e.g. developing a livestock activity or planting plants to protect against erosion all the while providing dietary supplements) and to objectives to improve the potential of ecosystems;

– or (2) are subsidised. But other interventions and practices are at the same time necessary for helping farmers to get out of their situation of crisis and insecurity. Otherwise, there is a strong risk that farmers will give up practices for improving the ecosystem as soon as the grants end.

[73] Louis Pautrizel, 2011.

- lucrative and stable prices;
- fair access to natural resources;
- public investments that support the dynamics of family farming;
- initiatives enabling the emergence of concerted, ambitious and effective policies.

BOX 17

> Development of family farming and protection in Guinea

'When we launched the Fouta Djalon Producers Federation (FPFD), the IMF and the World Bank told us that our potatoes could no longer be state-protected. Our Head of State replied: "I don't care about the IMF or the World Bank. Farmers, produce to feed the people of Guinea!", and he set up protectionist measures. The result is that, whilst Guinea imported 1,000 tonnes of potatoes in 1992, today it produces 20,000 tonnes, which is exported to the sub-region. So when policy exists, it works'.

Mamadou Kourahoye Diallo, FPFD manager of projects for improving food security for Northern Guinea[74]

Encouraging the transition towards agroecology

In regions with relatively favourable agro-climatic conditions that are brought under control, Green-Revolution-based agriculture often enables farmers to **generate sufficient income**. Transition towards ecological agriculture can put into question the usefulness of several things: equipment already purchased (such as motorised tilling equipment bought for monocropping); integration into existing production value chains (and the economic and social relationships they imply); significant evolution of the farming system, implying new costs (diversification of activities, purchase of animals, tree plantations, etc.); and additional work, the labour for which is not necessarily available within the family.

The available surface area per family worker does not necessarily justify the evolution towards a more complex system that is more labour-intensive and that calls less on motorisation of certain tasks. Results in terms of income are, for example, not guaranteed – all the more so because yields may decrease, at least initially. At the same time, farmers do not have to pay for many negative externalities of the Green Revolution. In other words, why change a system that works and that they are more or less able to control, for a new system with uncertain outcomes and that is difficult to control?

Furthermore, the current context of high agricultural prices may encourage farmers to take advantage of the short-term situation, by increasing the use of chemical inputs and by neglecting agroecological practices.[75]

Farmers' interest and outlook can nevertheless change, especially if the system is not stable in terms of fertility and if it tends to become more fragile over time, which is often the case. For instance, there may be decreased fertility and increased parasite attacks that lead to stagnation and irregularity in yields and that require extra doses of inputs, or dependence on a single or very small number of products whose prices tend to drop or be very volatile, etc. An increase in the number of family members may also lead to less availability of land per worker, thereby making intensive labour practices have greater interest.

74 Agroecology Seminar, 2012.

75 Eric Malézieux, René Dumont symposium, 15 November 2012.

In traditional production systems undergoing crisis, the challenge is to encourage **direct transition to agroecological systems**. In his most recent book *Famine au Sud, Malbouffe au Nord, Comment le bio peut nous sauver* ('Famine in the South, Junk Food in the North: How Organic Agriculture Can Save Us'), this is how Marc Dufumier, emeritus professor in comparative agriculture and agricultural development at AgroParistech, describes the successful transition of slash-and-burden systems to agroforestry systems in Africa, Latin America and South Asia.[76]

In any event, support for agroecology brings up the question of **socio-economic environment**. This concept includes: availability of the different types of agroecology means of production, along with relative prices compared to prices of other means of production (especially of chemical inputs, which are often subsidised); possibilities for marketing (and if need be processing) the variety of products stemming from the diversified systems of agroecology, along with relative prices compared to the price of 'traditional' products; and access to skills and knowledge unique to agroecology, as well as an environment favourable to development of the latter.

As CEDIR director Maria del Carmen Solis states, agroecology has often developed not thanks to public policies, but to promotion by farmer movements, civil society and development-cooperation NGOs.[77] Nevertheless, public policies can influence these parameters in different ways and create the conditions for real expansion of ecological practices. Yet, we cannot help but note that agricultural policies generally seek to promote the model stemming from the Green Revolution rather than agroecology, thereby giving a relative advantage to the former over the latter. This is especially the case of policies that provide subsidies for inputs (such as seeds, chemical fertilizers and pesticides). It is thus important to **inverse priorities** and to redirect current support from the Green-Revolution model to transition towards agroecological systems, including via subsidies.

State investments in **public property** (such as transport and storage infrastructures, electricity, information and communication technology, education, credit, agricultural extension services, research) seem especially important in order to support the development of family farming in general and agroecology in particular. In his report on agroecology, Olivier De Schutter considers that such investments must be given priority over support for the purchase of private property by farmers.[78] Finally, public policy promotion of short channels, certification of agroecological products, public purchases of such products, as well as the setting up of campaigns to promote them among consumers, are all ways to encourage the development of family-farmer agroecology. These public policies would further fair remuneration for the effort made by producers for agroecological transition, which is always demanding.

Enabling secured access to land

Implementing agroecological practices implies that family farmers have **access to land**. But in many regions of the world, land is sometimes in the hands of big landowners and capitalist enterprises that have no basic interest in putting such practices into action. Therefore, implementation of agrarian reforms to enable the development of prosperous family farming may very often be a first condition for expanding agroecological practices.

Furthermore, agroecology involves long-term investment in the ecosystem (improvement of fertility, planting trees, work and infrastructures for irrigation and soil protection). These investments require **long-term security** for the family's access to land. Without this, it will not be in the family's interest to carry out such investments, or it will not want to take the risk to do so.

76 Marc Dufumier, 2012.
77 Agroecology Seminar, 2012.
78 Olivier De Schutter, 2010.

This is why, as Marc Dufumier explains, joint ownership of agricultural and pastoral land in sub-Saharan Africa poses a problem: *'These very sparsely populated regions, where slash-and-burn agriculture is still often practised, are cultivated part of the time, during the rainy season. The land is then used for common grazing [herds left to themselves] during the dry season. Access to land there often remains free for all the herdsmen during the dry season, once the cereals and other annual plants are harvested. As a result, it's not in the interest of any farmer to plant trees or to make long-term investments, out of fear of seeing one's efforts ruined later by the passage of animals. This practice above all benefits the people with the largest herds, and, very often, the maintenance of soil fertility or plant cover is neglected due to overgrazing of jointly owned land. This is what is called the "tragedy of the commons"'.*[79]

But securing access to land does not necessarily require its privatisation, especially when it clashes with the existence of customary rights (see box below). As Marc Dufumier writes: *'Must we therefore, as the World Bank has long recommended to several sub-Saharan Africa governments, share and distribute this jointly owned land, along with deeds to it? While this may seem logical, the several experiments carried out in the name of the "the land belongs to he who works it" principle have resulted in greater land insecurity because they misunderstood customary rights.*

'Many farmers feel that that which has become legal (definitive ownership) is illegitimate. And that which seemed legitimate to them (periodic redistributions under the authority of elders) has suddenly become illegal. In short, state law has been superimposed on local customary rights, without the latter having really disappeared. And this has only added confusion to situations which are already quite complicated. Even worse, the new uncertainties regarding the rights and obligations of each person have been the source of unprecedented destructive behaviour. The richest families, which are capable of exploiting the largest surface areas, have launched into a frantic race for definitive ownership of arable land, by striving to farm it as much and as fast as possible, even if it means clearing the forest or the savannah [...].

'Periodic redistribution of the arable land of different areas according to the evolution of the number of mouths to feed can turn out to be more effective in the end, because this makes it possible to allocate the village workforce more flexibly and fairly, and to avoid the landless farmers appearing. In order to secure land rights on farmland and pastoral land, it is thus not mandatory to privatise land [...].[80]

Key steps for the development of agroecological practices thus seem to be land policies that not only enable redistribution of land currently concentrated in the hands of capitalist agriculture, but also protect family farming against land grabbing as well as strengthen security of access to land.

Furthering investments in agroecology

The global cost of means of production outside the farm is as a general rule lower in agroecological systems than in systems based on the Green Revolution. However, the transition does involve significant investments in means of production and in work. These include: animals; equipment for tilling and for the processing and storage of a new range of products; the planting of trees; and work and infrastructures for irrigation and soil protection, etc. Ibrahima Coulibaly, vice president of the Network of Farmers' and Agricultural Producers' Organisations of West Africa (ROPPA) states that more than half of African farmers lack draught animals, making it impossible to put organic matter into the soil.[81] The transition to-

[79] Marc Dufumier, 2012.

[80] Marc Dufumier, 2012.

[81] Colloque René Dumont du 15 novembre 2012.

wards agroecology requires this type of investment. Furthermore, the use of salaried labour in addition to the family's labour may be necessary.

The **transition period** is often a critical one, during which any investments require extra costs but do not yet have an impact on production. This is especially the case of tree plantations: during the growth period, there is no production or significant positive impact on the ecosystem for several years. Stopping the use of chemical fertilizers suddenly can even lead to a drop in yields. This phenomenon is frequent in the transition to organic farming. In this case, the situation is even more difficult for farmers, who cannot yet benefit from better prices because they have not yet obtained 'organic farming' or equivalent certification. There is a real risk of a vicious circle, as the drop in income prevents farmers from making the required investments.[82] This is why systems to subsidise the transition towards ecological agriculture may often be appropriate during the transition period.

It is especially important for support for development of agroecology to include measures that make special means of production available as well as specific financing for investment work. Many farmers currently have no access to credit, especially for the purchase of animals, equipment, tree planting and the building of infrastructures to protect and improve the ecosystem. The interest rates (10, 20, 30% per year or even more) are generally too expensive, especially given the deferred profitability of these investments and the uncertainty regarding their effective profitability. Public policies often encourage and subsidise chemical input supplies without providing for support systems for investments specific to agroecology. A switch in priorities and public investment to help farmers invest in capital are thus necessities.

BOX 18

> **In Peru, legislation to support organic production**

Peruvian law has a provision in which regional and local governments must include support for projects that promote organic production in their annual budgets. The state bank in charge of the agricultural sector (Banco Agropecuario) is obliged to grant loans to producer organisations for conversion to organic farming[83].

There is also strong development of agroecology in urban areas and outlying suburbs because of the possibilities of using compost. Support and specific investments for these areas are worth implementing.

Helping to generate and diffuse knowledge and know-how

Aspects to take into account

Agroecology requires specific knowledge and know-how. As Olivier De Schutter states, it is 'highly knowledge-intensive'.[84] While situations vary locally, several aspects must be taken into account, as shown below.

82 Maria del Carmen Solis et al., 2012.

83 Maria del Carmen Soliz et al., 2012.

84 Olivier De Schutter, 2010.

- Agroecology is largely based on **traditional knowledge and know-how** that especially exist in many farming civilisations and communities having practising agriculture for centuries via sustainable methods of managing the ecosystem and its fertility (which often stem from various agricultural revolutions).[85] This is true even if these systems have been destabilised and are undergoing crisis due among other things to demographic pressure and 'overexploitation' of the ecosystem and to damage brought on by productivist agriculture.

BOX 19

> Putting traditional techniques back on the agenda in Guinea

'The advantage of bananas where we live was mulching. We had bottomlands with slopes, and when the rain came we cut the straw and put 50 cm of it in the banana groves. [...] In 1968, we destroyed everything and started using tractors [...]. Our job was to re-establish this agriculture that worked based on that technique. You mustn't frighten people with new techniques; they already have enough problems feeding their children'.

Mamadou Kourahoye Diallo[86]

- Yet, for historical reasons some regions have been **bypassed by the 'agroecological' agricultural revolutions**. These regions have missed out on the development of animal traction or in-depth integration between farming and livestock activities, among other things. These situations may have been caused by ongoing crisis over generations, which prevented transition towards new forms of agriculture, or by domination by systems of simplified agriculture stemming from the Green Revolution. As a result, the knowledge and know-how unique to agroecology have been lost, and it is impossible to acquire them anew.
- As mentioned by Eric Malézieux, a researcher at the International Centre for Agricultural Research for Development (CIRAD), agricultural research has **worked very little on perfecting agroecological technical solutions** to the concrete problems encountered by family farming. It has instead given priority to Green-Revolution-based solutions. Research has tended to work specifically on several crops, without taking into account the agricultural production system as a whole.[87] Marc Dufumier states that *'agricultural research has focussed on genetic improvement for too long and has forgotten that the work of farmers is not just limited to taking care of crops or herds, but consists in developing and enhancing complex agroecosystems in order to extract useful matter periodically and over the long term'*.[88]
- Likewise, agricultural extension has, in many countries, been essentially in charge of the '**diffusion' of 'technological packages**' specific to each crop stemming from the Green Revolution.[89] We must take into account the frequent failure of 'pilot farms' that have been managed under the close control of technicians and that have benefited from advantageous conditions compared to those of family farmers as a whole. Eric Malézieux states that there are currently no public support systems for implementing agroecological innovations.[90]

85 Cf. Sylvie Guillerme's article *L'agroforesterie en Inde : de défi de la diversité*, in Denise Van Dam, 2012 (Chapter 9).

86 Agroecology Seminar, 2012.

87 René Dumont symposium, 15 November 2012.

88 Marc Dufumier, 2012.

89 Under these circumstances, and as Miguel Altieri observes, the technical and economic results of agroecology are remarkable compared to Green-Revolution-based agriculture, given that the latter has received continued state support for more than 50 years, especially in agronomic research and technical advice matters (in Maria del Carmen Soliz et al., 2012).

90 René Dumont symposium, 15 November 2012.

- In many countries, agricultural research and public agricultural extension have been **sacrificed** as part of structural adjustment policies. The private sector (e.g. Bill & Melinda Gates Foundation, multinationals, phytosanitary companies) is now investing in agricultural research, with powerful interests in the background that are too often connected to the technological model of the Green Revolution.
- **Agricultural training** (for young farmers, technicians or agronomists) often remains **dominated by the same frame of mind** and – more fundamentally – by an 'anti-farmer' ideology, as family farmers are often considered more as a curb to development than as actors of development. Agroecology itself is often ignored or looked down upon, even sometimes by farmers. This is all the more an impediment, as Patrice Burger from the NGO CARI emphasises, in that agroecology *'requires a personal approach' because its 'impact is not only in terms of production'*.[91] In university studies in agronomy, agroecology is often taught only in the form of a specialisation, after a degree course that remains focused on the Green-Revolution model.

BOX 20

> Socio-cultural constraints of the transition to agroecology

'A family farmer I know takes care of the community seed bank, and I asked him what problems he has. He didn't metnion the workload or the technology he must learn, but rather the fact that he is made fun of by his neighbours who practise conventional agriculture, who tell him, 'Why do you make your life so difficult? You have to do everything on your farm – weed, make your own pesticides – it's stupid!'. The family farmers themselves appear to have forgotten traditional knowledge, which seems to have become totally foreign to them. Sometimes the people whom agroecology would benefit the most view it with enormous scepticism. So how can we change this mindset? How can we raise the awareness of family farmers and encourage this new agroecological approach that their ancestors also practised previously'?

Marciano T. Virola[92]

- Farmers – both male and female – are very often **experimenters** and **innovators**. This also lets them adapt practices to the reality of their farm. They are also often more sensitive to the transmission of knowledge and know-how that **comes from other farmers**, whom they often trust more than technical extension agents or researchers. In their efforts to promote agroecology, some research or development-cooperation actors have often met with failure, reflecting the failures characteristic of the models of agricultural extension based on the 'diffusion' of 'technological packages' of the Green Revolution. This is especially the case when they have claimed to provide farmers with 'good agroecological solutions' intended for implementation as is, without taking into account the system, production or preexistent knowledge and know-how as a whole, or without considering that farmers need to experiment new practices and adapt them to their own situation.
- It is possible that many impediments (especially those specific to agroecological systems) that have not been resolved by some farmers or communities may **have been resolved** by other farmers – often in other communities, regions or countries.

91 Agroecology Seminar, 2012.

92 Agroecology Seminar, 2012.

BOX 21

> Limits and potentialities for the development of agroecology in the Philippines

'There is a lack of research on agroecological techniques. They are starting to teach them at school, but this isn't enough. I've spoken to a young Filipino farmer, who is a member of an organisation of young farmers. They were all agricultural students, and they realised that most of the university graduates wound up on the sales staff of agrochemical companies, selling inputs to family farmers. But, having discovered agroecology during field trips, they decided to join together and practice agroecology on their farms and to encourage young farmers to emulate them. This requires a lot of time and motivation, and perhaps an ideological belief that it's what they need. In short, there's much need for technical support, and they must discuss not only technology, but also the conditions needed for farmers to adopt it, suitability to their needs, and innovations to provide. We think that family farmers can always adapt technologies to local conditions and that knowledge can always be generated. Experimentation and adoption must continue until we reach a critical mass and we transform the food system as a whole.'

Marciano T. Virola[93]

The pivotal role of experiments by family farms, and the need for new agricultural extension guidelines

It is important for priority to be given to **experiments by family farms** and **exchanges of experience** (e.g. field visits and discussions). Agricultural extension must play a role of facilitating these exchanges as well as of explaining and systematising results (e.g. establishing technical/economic references), all the while providing complementary advice linked to research. As Olivier De Schutter recommends, it also involves creating the conditions for active participation by farmers and for *'co-construction of knowledge [in order to]*:

- *... benefit from the experience and insights of the farmers [...]*;
- *... ensure that policies and programmes are truly responsive to the needs of vulnerable groups, who will question projects that fail to improve their situation [...]*;
- *[empower] the poor – a vital step towards poverty alleviation [...]*;
- *[guarantee] a high degree of legitimacy and thus favour better planning of investment and production and better up-take by other farmers'*.[94]

Marciano T. Virola states that it is important to *'identify family farmers who are able to adopt and innovate, so that other farmers can emulate them and have the courage to carry out the transition towards agroecological systems'*.[95] Their farms can then become true farmer field schools – meeting places for exchange of experiences and training for farmers. Valentin Beauval underlines the fundamental nature of the *'creative dimention of farmers **in a group**, so as not to feel isolated from neighbours'*.[96] Support for these approaches must be sufficiently long-term, because the emergence and consolidation of innovative family farmers and technicians capable of training other farmers takes time.

Olivier De Schutter emphasises that *'state support can build on those efforts'*.[97] This is the case of Brazil, where priority has been given to agroecology through the 2010 Act on extension and technical assistance for family farming and agrarian reform, as well as through the 2012 national policy on agroecology and organic production.

93 Agroecology Seminar, 2012.
94 Olivier De Schutter, 2010.
95 Agroecology Seminar, 2012.
96 Agroecology Seminar, 2012.
97 Olivier De Schutter, 2010.

BOX 22

> The "Campesino a Campesino" experience in Central America and the "promotores campesinos" in Cuba

As Henri Hocdé, a researcher at CIRAD, explains, 'The "Campesino a Campesino" ("CaC") or "Peasant-to-peasant" programme was created in **Nicaragua** in 1987, within the National Association of Farmers and Livestock Breeders (UNAG). It all began with reciprocal visits among family farmers from Nicaragua and Mexico to promote and diffuse appropriate technologies among smallholder family farmers without resources.

'The "CaC" was created in reaction to the "top-down" model of technology transfer (of new varieties, irrigation systems, or agricultural inputs and equipment), which had strongly marked the agricultural policy of Nicaragua in the 1980s. The "CaC" sought rather to increase fertility and soil productivity as well as to improve the lifestyles of family farmers, all the while reducing production costs and outside dependency.

'This model was established in much of **Central America**. It is applied by many NGOs and also by several research or development projects that are convinced of family farmers' ability to develop their own sustainable agriculture. More than 10,000 family farmers have joined the "CaC", and several thousand others have been influenced by this programme'.[98]

In her most recent book, Marie-Monique Robin reports that, in **Cuba**, 'in the middle of the 1990s, the ANAP – the National Association of Smallholder Farmers – called on "promotores campesinos" (family-farmer leaders) affiliated with Campesino a Campesino. Spread out all over the country, these leaders facilitated workshops directly on farms in order to spread agroecological techniques and especially those of permaculture. Fifteen years later, as highlighted by Miguel Altieri, professor of agroecology at the University of Berkeley, 100,000 farm families produce 65% of the country's food on only 25% of its land'.[99]

As Olivier De Schutter points out, *'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'*.[100]

Knowledge exchange networks

Public policies must be able to support the many initiatives that come from civil society (such as farmer movements and NGOs) by helping them to come together more in networks. Work to document, publish and diffuse data on successful initiatives must be carried out. As Mamadou Kourahoye Diallo points out, in reference to a model of exchanges among producers that brought the number of compost bins in use up to 30,000 from 300, 'When people see it works, it spreads like wildfire'.

During the seminar on agroecology organised by the C2A on 11 December 2012, a suggestion was made to design and set up a **global platform of exchange of practices and experiences peculiar to agroecology**.

Christophe Naudin, a former farmer and agronomy professor/researcher at Groupe ESA in Angers, France, suggests considering systems of remuneration for the risk undergone by family-farmer experimenters, which could help fund such a platform.[101]

98 Henri Hocdé et al., 2000.
99 Marie-Monique Robin, 2012.
100 Olivier De Schutter, 2010.
101 Agroecology Seminar, 2012.

BOX 23

> The need to generate and diffuse data

'Many NGO projects and programmes remain anecdotal or unreported. We always ask ourselves, "Where are the studies? Where are the data?". If we compare this with conventional agriculture, the latter benefits from big research budgets and can show much data on high-yield varieties and GMOs, etc. Yet, the work by family farmers and the support from NGOs are not reported on; there is a lack of budget.

'A family farmer in Afghanistan might need a special technique, but where can it be found? In China perhaps? How can the knowledge be found and be brought to the farmer? Better exchange of knowledge is needed. Can we have a Facebook for family farmers? How is it that with the NICT we have today, it's still so difficult to diffuse knowledge? Why is all this knowledge and experience kept? Why aren't we seeing more agroecological revolutions in Latin America? Why don't research and public institutions take up this issue?'

Marciano T. Virola[102]

Agricultural research: its objectives and methods

Agricultural research centres must work much more than they do currently on agroecological solutions to problems encountered by farmers. As Marc Dufumier writes:

'Instead of giving priority to looking for varieties with high genetic potential for photosynthetic yield, shouldn't we be looking for ways to associate plant species so that available luminous energy is intercepted optimally by cultivated plants?

'Instead of breeding only varieties according to their yield in field stations, shouldn't we give priority to hardy varieties that are in theory less efficient but in reality more profitable and less risky because they're tolerant to predators and pathogens?

'Instead of looking for chemical solutions to the issue of soil fertility, shouldn't we be seeking to make better use of bacteria and soil fungi?

'Instead of seeking to eradicate predators, shouldn't we aim at neutralising them by controlling as best as possible the biology of insects that are useful for crops, in order to help them in their relations with harmful pests, which would avoid having to eradicate them?'[103]

It is also important that agricultural researchers work in close cooperation with family-farm experimentations (e.g. within the framework of farmer field schools) and that they have farmer organisations and agricultural extension bodies become involved from the stage at which priorities and research programmes are determined. It should be noted that many researchers are aware that they should work with family farmers and their organisations, but they basically seek to work with them for field experiments and not in the stage upstream from research. Such participation by producer organisations in determining research objectives brings up the question of their representativeness and their resources.

State investment in this type of research is fundamental. This is especially true because the private sector is for the most part not involved in this type of research, probably because, as pointed out by Olivier De Schutter, agroecology practices cannot be patented.[104]

The importance of **agro-socio-economic research** must also be emphasised, in order to better take into account the overall dynamics within farming systems, farms, regions and value chains.

102 Agroecology Seminar, 2012.
103 Marc Dufumier, 2012.
104 Olivier De Schutter, 2010.

BOX 24

> Relations between farmer-researchers and academic researchers

'The issue of relations between farmer-researchers and academic researchers is crucial and can develop only if we are aware of the expectations and differences between the two parties. The family farmer often goes forward using empirical knowledge, whereas the academic researcher goes looking rather for knowledge of a different nature, which can be applied on a more widespread basis. At first glance, these types of knowledge are at variance and in opposition with one another. But the knowledge is more fruitful when we manage to make direct comparisons and exchange it between both parties. It's very difficult from an epistemological point of view'. *Christophe Naudin*[105]

'In both the South and the North, we must increase the number of field farm schools, by making scientists a partner in them. Scientists must leave their ivory towers and laboratories and go back to the fields. They must learn to work with family farmers so that together they find solutions adapted to different types of land and needs. If we want sustainable agriculture, the "one size fits all" principle of unique and universal solution is out of date'.

Ulrich Hoffmann, co-author of the UNCTAD report 'Organic Agriculture and Food Security in Africa'[106]

'Instead of constantly working out alleged genetic "improvements" at field stations, researchers should – all things being equal – start by acknowledging the obvious: farmers are still the main innovators on their own land. What's expected from agricultural research is that it makes the systems established by family farmers more intelligible, explains the effects of new techniques, or works out prediction models. These will have to be the main objectives of scientific work in agroecology. Agricultural development needs research that is both more basic and more respectful of the conditions and know-how of family farmers'. *Marc Dufumier*[107]

Agricultural training

Agricultural training (training of young farmers, technicians and agronomists) must teach future professionals much more than it does now about understanding how ecosystems and family-farm economic processes work, as well as how to acknowledge and develop family farming and its knowledge and know-how.

University education (the training of agronomists) must not be neglected, because this is a key level in the more overall reproduction of the knowledge and vision of agriculture and family farming. It must often be reconsidered in depth, as agroecology cannot be conceived as just a simple specialisation in a degree course focused on the Green-Revolution-based agricultural model.

Enhancing the value of products derived from agroecology

Agroecology often leads to **diversification** of agricultural activities. It is important that this diversification be accompanied by **lucrative and stable outlets** for the new products. Agroecology therefore often requires the creation of **new value chains and markets** in order to facilitate the exchange and promotion of products.

105 Agroecology Seminar, 2012.
106 Marie-Monique Robin, 2012.
107 Marc Dufumier, 2012.

In more general terms, decent and stable remuneration is a precondition for producers both to find it worthwhile and to have the resources to carry out certain investments. They also sometimes need it to make up for possible temporary declines in yield. The development of agroecology can thus partly depend on **reorganising value chains and markets**, as well as on the conditions for marketing of products.

Agricultural policies can contribute to the development of new value chains and to the existence of lucrative and stable markets, including by supporting new processing and packaging activities for agricultural products.

A way to provide better remuneration for producers is to give enhanced value to agroecological approaches through **public signs of recognition** or through **legally or socially recognised participative guarantee systems**. These may be directly related to practices (e.g. 'organic farming' label or 'quality' label, etc.) or they may be related to them indirectly or partially (e.g. 'fair trade' labels). This enhanced value, as well as the economic and social dynamics related to these approaches (producer organisations, etc.) can represent strong encouragement for the development of agroecological practices at the local level.

Some countries have indeed implemented policies to officially recognise agroecological production, with labels making it possible to differentiate products stemming from it. Official recognition also aids in identification and in enhanced value on the national and export markets, and it protects the sector from misleading or untruthful labels.

Regulations in force in various Latin American countries regarding organic farming are generally aligned with the requirements of the major importer countries (mainly the United States and the European Union). These policies can thus have a positive impact in furthering the development of agroecology. However, there may be inconsistency between adhering to the standards of countries that are export outlets and the need to take into account local realities and dynamics. It is important for standardisation systems to work closely with producer organisations and for participative certification systems to be recognised.[108]

BOX 25

> Ecuador: differences between public standards and standards established by producers

In **Ecuador**, a 2004 decree governs organic production. This decree applies to production intended for export. At the same time, many producer organisations involved in local and national markets have specific rules that are not recognised by public regulation. The transition stage is not defined by a given period (e.g. 12 to 36 months), but by concrete progress in the use of organic manure and organic inputs and by soil and water management. Some producer groups have determined extra requirements involving the preservation of water and other natural resources on communal land, above and beyond practices on one's own farm. Certain groups authorise the use of chemical pesticides with low-level toxicity in exceptional situations[109].

BOX 26

> Participative certification systems in the Andean countries

'In **Ecuador**, **Peru** and **Bolivia**, participative certification is based not on certification by a third party but by direct and participative social control carried out by collectives in which the stake-

108 Maria del Carmen Soliz et al., 2012.
109 Maria del Carmen Soliz et al., 2012.

holders are producer organisations, consumers, actors of civil society, and local and national public authorities.

'This first level requires the training of family-farmer leaders to act as intermediaries between the organisations and the farms. A second level exists at the municipal or local level, where a multi-stakeholder committee operates. It conducts annual verifications of farm production to make sure farms respect the standards that have been created together. A third level is made up of regional platforms at which the various producers and the various local committees are represented. They carry out the certification and present a sort of handbook to the producer.

'This system is spread over several regions. It is enjoyed by several thousand families of producers and consumers and around 10 municipalities which themselves have started to make resources available to support participative guarantee systems and the marketing of agroecological products in specific areas'.

Maria del Carmen Solis[110]

Public purchases can act as encouragement for developing agroecology. In Bolivia for example, there is a law providing for towns and cities to give priority to the purchase of ecological products, and it is effectively applied in big cities in particular. La Paz, El Alto and Santa Cruz, for example, purchase over USD 1 million of organic bananas from the producer organisation Unabeni each year.[111] In Brazil, a minimum quota (30%) for family-farming products in orders by schools has been set (see below).[112]

BOX 27

> In Brazil, programmes for public purchase of family-farming products

'The Brazilian public purchase programmes do not specifically concern products derived from agroecology, but those from family farming. Nevertheless, they indirectly contribute to agroecological practices.

These programmes are:

- the national school food programme (PNAE). Initiated in 2009, this programme provides that at least 30% of products served in school dining halls come from family farming, rural family businesses or one of their organisations;
- the food purchase programme (PAA). Initiated in 2003, this federal government programme aims to help fight hunger and poverty, all the while reinforcing family farming. It enables direct purchase of products from family farmers or their organisations, in order to create strategic food stocks for food distribution to the most vulnerable segments of the population'.

Joaquim Diniz[113]

The development of short channels (e.g. farmers' markets) with support from the state or local authorities also contributes to the development of family-farming agroecology, by providing more direct links between consumers and producers and for fair remuneration of the latter's work.

110 Agroecology Seminar, 2012. Regarding participative certification, the following article can also be consulted: *Certification participative pour une ruralité plus durable: le réseau Ecovida au Brésil*, by Katya R. Isaguirre and Pierre M. Stassart, in Denise van Dam, 2012 (Chapter 3).

111 Maria del Carmen Soliz et al., 2012.

112 Joaquim Diniz, Agroecology Seminar, 2012.

113 Agroecology Seminar, 2012.

BOX 28

> Farmers' markets to better remunerate agroecological producers

'In **Ecuador**, in the regions of Cuenca in the south or of Ibarra in the north of the Andes, AVSF and its partners, CEDIR[114] and FICI[115], help support an innovative approach unprecedented in the country: direct sales by family farmers of organic products at urban municipal markets. The organic products are sold to consumers at the same price as conventional ones, but, above all, the prices are stable throughout the year and prevent the consumer from suffering from periodic price increases.

Such direct sales also very significantly improve the prices to producers (which are on average 30% higher than the sales price to resellers) and thus their incomes. This system is growing in momentum. In Cuenca, nearly 600 farming families and several thousand consumers currently benefit from it. Sales doubled in three years, reaching about USD 1.2 million in 2011. In the North, in 2010 more than 500 producers sold around EUR 600,000 of fruits and vegetables, meats, eggs, dairy products and cereals at various farmers' markets, at points of sale, or as part of public purchasing.

AVSF, CEDIR and FICI provide technical assistance to producers in the transition towards organic production; support the setting up of a participative guarantee system; and provide facilitation, advice and training for capacity building of the organisations so that they can manage their marketing and look for new markets. Finally, capacity-building support in negotiation is given to the producer organisations, for their relations with the public authorities'.

Christophe Chauveau, AVSF - 2012

More generally speaking, the existence of urban demand for good-quality products contributes to the development of agroecology. According to Frédéric Apollin, a challenge for producer organisations is therefore to create new alliances with consumers and with towns and cities, and to encourage reflection on the type of agriculture that is in the best interests of society.[116] However, the public authorities can also contribute to building such alliances, whether at a local or more overall level.

Promotion of cultivated biodiversity and protection against GMOs

Agroecology is based on enhancing the value of broad genetic diversity (diversity of species, plant varieties and animal breeds), which makes it possible to take advantage of complementarities, to control parasites and to minimise risks (e.g. in case of climatic accident). In the longer term, enhancing genetic diversity also guarantees the preservation of biodiversity. In contrast, the breeding of a limited number of species, varieties and animal breeds is a way of reasoning characteristic of the Green Revolution, of which GMOs are fully a part, and it is very much in contradiction with the preservation and development of biodiversity.

It is important for national legislation on seeds to fully recognise the right of farmers to **preserve, re-use, exchange and sell their seeds**, including those sold by seed companies.

Furthermore, genetic contamination of traditional species by GMOs is currently a threat. This is why it is important for states to protect agroecological crops from this type of contamina-

114 Rural Development and Research Centre.
115 Federation of North Andes Quechua Indians.
116 Agroecology Seminar, 2012.

tion in particular, by banning GMO use within their borders. This means not only strong political will, but also the setting up of effective control mechanisms.[117]

ENCADRÉ 29

> GMO moratorium in Peru and Ecuador

Peru and **Ecuador** have established moratoriums and other legal mechanisms in order to prevent the development of GMOs within their borders.[118] Peru has a 10-year moratorium on GMO-based crops throughout the country, in force from 2012. In Ecuador, the new constitution adopted in 2008 does not allow GMO crops in the country. But even though legal mechanisms ban GMOs in these two cases, agro-industrial groups, with their very strong lobbying capacities, might render these protection systems invalid in the short or medium term.

The need for consistent agricultural policies

Agroecology will be able to truly spread only if family farms enjoy a socio-economic environment favourable to their development. Projects aiming to promote agroecology without more overall prospects enabling family farming to reach a certain level of prosperity are generally doomed to failure.

Furthermore, we have seen that the development of agroecology requires support for its various components:

a) **technical component:** promotion of agroecological practices and support for setting them up;

b) **economic component:** creation of a socio-economic environment specifically favourable to their development (includes land, access to credit, reorganisation and production of exchange channels and enhancing the value of products, market access, development of short channels, etc.);

c) **political component:** support to producer organisations and innovation networks.

Real political choices must therefore be made in agricultural policy matters, so as to give priority to agroecology practices rather than practices stemming from the Green Revolution. Agricultural policies very often include agroecological components, but these latter remain relatively marginal when we consider the resources allocated to them compared to other components, especially chemical input subsidy programmes. The dominant ideas within state machinery and certain agricultural circles often hinder a more determined approach favourable to the ecological transition of agriculture.

We must also not ignore the economic interests behind the propagation of agriculture inspired by the Green Revolution, which have great capacity for influence over political decision-makers, international institutions, and certain NGOs, as Ibrahima Coulibaly pointed out recently.[119]

Many projects supported by international development cooperation or even public policies seek to promote agroecology, even though the overall socio-economic environment and other policies in fact continue to favour Green-Revolution-based agriculture. They frequently fail in more or less the long term. For example, it happens that farmers implement a certain number of practices with the support of subsidies and then give them up once the project is finished.

117 Maria del Carmen Solis et al., 2012.
118 Maria del Carmen Soliz et al., 2012.
119 René Dumont Symposium, 15 November 2012.

Resources for support are sometimes insufficient. Joaquim Diniz explains, for example, that in northeastern Brazil the credit lines intended specifically for agroecology have been hardly used because technicians who can help prepare the projects and funding requests have not been working enough with farmers.[120]

Furthermore, as Mamadou Kourahoye Diallo explains, the fact that there are multiple institutions and ministries concerned, depending on the themes (agriculture, water, forests, environment, land, etc.), does not help in facilitating the establishment and implementation of policies favourable to agroecology. Corruption (of forest wardens, etc.) is also an impediment. The legal and institutional environment is thus crucial. *'Without laws that are solid and firmly fixed, it's difficult for anything to gain a foothold'*.[121]

Joaquim Diniz emphasises that it is thus important for the various policies to be better integrated and for them to be checked by the social stakeholders locally. It is important for the various stakeholders involved to participate in working out and monitoring the implementation of the policies concerned. Clear definition is required regarding the roles and functions of the various stakeholders (central government, local governments, producer organisations, civil society and international development cooperation organisations).[122] In Brazil, a law now provides for integrated action by the different ministries so that policies and programmes are agroecology-oriented (see below).[123]

BOX 30

> Brazilian policy to promote agroecology and organic production

'National policy on agroecology and organic production was established in **Brazil** via a presidential decree in August 2012. Its objective is to "integrate, structure and adapt policies, programmes and actions that seek to support the ecological transition of agriculture, organic farming and agroecology-based farming". National policy seeks to direct the already existing agriculture support instruments – credit, insurances, agricultural prices, public purchases, research and technical assistance – towards the development of agroecology. This policy is steered by a national commission in which the federal government and civil society have equal representation, as well as by a body made up of representatives from different ministries'.[124]

This must make it so that the conditions peculiar to each region, local area and type of farmer are taken into account better. Indeed, the main problems and impediments are not always the same. They must thus be well analysed in each case, and this especially requires a more overall approach that takes into account socio-economic factors.

The integration between different agricultural policies and other policies impacting agriculture must allow for greater consistency and synergies at the various geographical levels considered. States must not limit themselves to policies to make standards, but must truly promote agroecology in an active way, including by the use of national legislation that is not limited to regulations regarding organic products for export.

120 Joaquim Diniz, Agroecology Seminar, 2012.
121 Mamadou Kourahoye Diallo, Agroecology Seminar, 2012.
122 Maria del Carmen Soliz et al., 2012.
123 Joaquim Diniz, Agroecology Seminar, 2012.
124 Joaquim Diniz, Agroecology Seminar, 2012.

The role of international development cooperation

It is important for international development cooperation to support the efforts of states and economic stakeholders to give priority to agroecology. International development cooperation has a role to play in several areas:

a) **At the country level, for support of this type of action, policy and investment.** Development cooperation must especially contribute to funding participative research networks. Just as in the case of public policies promoting agroecology, development cooperation must be maintained over time, because the agroecological transition processes are long and thereby require prolonged support. *'We have a real problem of sustainability for funding of support-extension actions, as we do for support to producer organisations'*, states Claude Torre from the AFD.[125]

BOX 31

> The French Development Agency (AFD) and agroecology

'Intensification of agroecology will be an important aspect of AFD strategy to support sub-Saharan Africa food security [presented in January 2013]. For 15 years, along with support from CIRAD, AFD has provided nearly EUR 30 million for several national and crosscutting projects (northern Cameroon, Mali, Madagascar, Laos, Cambodia, Tunisia, etc.), especially for promoting systems of direct seeding on plant cover [...] This research work has enabled CIRAD to capitalise on the subject… But in terms of diffusion the results are mixed due to the following points in particular:

- the project approach (weak sustainability),
- the context of very deteriorated soil (much time is needed to restore soil fertility),
- promotion of a "technological package" in a context in which there are few services available (financing, input supply, agricultural equipment suppliers, extension).

'These experiences are going to be evaluated in 2013, and we want to take advantage of this in order to reflect more broadly on agroecology practices, especially by including, along with other donors, the issues of agroforestry and the integration between farming and livestock breeding, for example. In the longer term, we will need to increase our knowledge so that we do not focus on a single practice – even if it has been successful – all the while including non-agroecological elements in southern Brazil. We want to include the water issue.

'Our approach will be put into context, in the sense that we want to support existing dynamics. There are no miracle solutions. We must start with what exists and understand the cultural dynamics that are being established and how we can support them. Why not with a hybridisation of practices mixing conventional and innovative techniques, keeping in mind that it is the farmers themselves who adapt their practices?

'In Madagascar, a direct-seeding approach has allowed farmers to intensify livestock breeding via permanent prairies. This had not initially been expected. We are reflecting on public incentives to develop these practices, such as payment for environmental services and local approaches.

'We want to have a more crosscutting approach in operations, by "greening" our practices and working with other donors (Germany and Northern European countries) that have significant experience in agroecology.

'There is a need for grants for R&D and training, because the countries are reluctant to fund such subjects with loans.

'With regard to NGOs, AFD has experience in conservation agriculture thanks to the FISONG (Sectoral Innovation Facility for NGOs). NGOs have already carried out experiments in this field, and the next one will be oriented on the adaptation of agricultural practices to climate change'.

Claude Torre[126]

125 Agroecology Seminar, 2012.

126 Excerpt from the contribution by Claude Torre, French Development Agency (AFD), Agroecology Seminar, 2012.

b) **At the international level, especially for giving direction to programmes on research and exchange of experience between countries.** Supporting the design and setting up of a global platform for the exchange of practices and experiences peculiar to agroecology seems especially relevant[127].

c) **At various levels, in order to help spread the concept of agroecology**, in the background of which powerful private interests uphold a different conception of agriculture. Opportunities for promoting agroecology should be increased. It is important that civil society not be alone in taking action on this issue.

BOX 32

> The difficulties in promoting agroecology at the international level

'The C2A has been following the international negotiations on food security and agricultural issues for several years. The question of which agricultural model to uphold is emerging in the international negotiations, especially in climate negotiations, and the concept of agroecology comes up in this discussion.

'We have seen how public policies to promote agroecology are necessary in order to change scale. But we must take into account the weight of international dynamics on the content of public policies. We can currently see strong promotion of private investments, especially along with the G8 and the "New Alliance" of 25 multinationals that want to develop agriculture in six African countries.

'Alongside this, the concept of agroecology must be taken into account when it comes to global governance of food and rural development. The theme of "agriculture and climate change" was one of the topics of discussion of the FAO's Committee on World Food Security (CFS). The latter was reformed two years ago, with an innovative form of governance: states, international organisations, private sector and a civil society mechanism (CSM) representing international civil society. The CFS is endowed with a "High Level Panel of Experts" (HLPE), which, based on theoretical and empirical research, publishes reports on the state of discussions on various themes, making it possible to frame and launch discussions. One of the 2012 reports clearly mentions agroecology as a possible response to the challenges of food security – this is a first in an international organisation report.

'However, states have not really incorporated the HLPE's reflections, and agroecology is not mentioned in the final declaration of the CFS. This is because the private sector insisted that it be included only if other concepts such as "climate-smart agriculture", which is close to green economy, are as well. We were in competition: should we, civil society, have insisted for it to be included at the risk of having a private-sector concept? The risk was too great, and we backed down. Agroecology has turned out to seem like a concept of civil society, which is not good'.

Maureen Jorand, project officer at CCFD–Terre Solidaire[128]

The question of policy consistency is also one affecting international development cooperation. There is de facto competition between capitalist agriculture vs family farming, 'productivist' agriculture vs agroecology, food production vs agrifuel production, need to guarantee lucrative prices thanks to suitable commercial policies vs liberalisation of markets, etc. Likewise, there is a contradiction between supporting biodiversity and putting pressure on Southern countries to adopt intellectual property legislation and regulations that hinder local exchanges of seeds and plant material. When this is not the case today, the states that are drivers and donors of international development cooperation must often show more consistency and cease simultaneous support of models that in actuality oppose one another. ●

127 Suggestion discussed during the Agroecology Seminar.
128 Agroecology Seminar, 2012.

By way of conclusion:

Real agroecological transition requires shared objectives

The world is currently facing many challenges.

- How to limit the negative impacts and externalities of 'productivist' agriculture?
- How to increase per-hectare yields for world food security?
- How to ensure the food sovereignty of countries and rural regions so that they are more autonomous, and how to limit their vulnerability to price fluctuations in global food commodity markets?
- How to maintain and create jobs in rural areas?
- How to preserve ecosystems and landscapes?
- How to deal with loss of plant and animal biodiversity in a world where such biodiversity still exists on many family farms?
- How to respond to the increasingly pressing need for good-quality products among consumers worried about recent health or food crises?

All these 'how tos' are challenges that can be met best by agroecological family farming based on knowledge and know-how that in some cases already exists.

As we have seen, promoting this family-farming agroecology implies **giving support to its various aspects**:

- **Technical:** furthering the *experimentation, improvement and diffusion of numerous agroecological systems, practices and techniques*. This can be done through suitable systems of exchanges between smallholder farmers and their organisations, new types of technical support, and research to assist family-farming agriculture.
- **Economical:** helping to *reorganise value-chains for exchange, promotion and marketing of these products* (e.g. processing on the farm, short channels, public purchases, and participative certification, etc.) as well as to *relocalising of agriculture and of local and regional exchanges* whenever possible. Doing so will enhance the value of the products, thereby improving remuneration for producers, and in any event it will lessen the economic risks taken by family farmers.
- **Social and political:** strengthening in particular the *role of farmer organisations and networks working to promote agroecology* (e.g. networks for innovation and exchange, or a platform for reflection on agroecological agriculture), as well as *having stakeholders from civil society monitor policies*. This will aid in several aspects: the recognition of products produced through family-farm agroecology; the defence of rights of access to land, credit and specific and lucrative markets; and, finally, the establishment of new services, such as technical support, advocacy and participative certification.

When it comes to changing scale and transforming farming systems, a major challenge for all the stakeholders concerned will be determined support for family-farming agroecology, and this will require changes in attitude and practices.

It is above all a challenge for technicians and practitioners of farming and stockbreeding. It involves nothing less than a renewal in agricultural extension and management:

- better taking into account the existing practises and techniques;
- adopting more horizontal extension and support systems and being concerned with regional management rather than just individual farms;
- constantly assessing and evaluating the performance and methods of using mineral fertilization and pesticide or antibiotic treatments compared to possible alternative agroecological practices;
- and, finally, assessing and documenting the performances (technical – productivity – economic – environmental) and making them known.

All this is a challenge…

… **for agricultural research centres**, which must continue their efforts to ask themselves new scientific questions. Indeed, research currently takes too little account of agroecology practices and its effects, and it does not draw enough inspiration from local know-how and the questions that family farmers ask themselves. For both practitioners and researchers, a more systematic and less analytical approach to animal-production systems should be adopted, especially with regards to animal health.

… **for training institutions** of an intermediate or higher level. Will agroecology remain the niche subject or specialisation it is usually limited to, compared to the common-core syllabuses that still draw too much inspiration from conventional agriculture and Green-Revolution-based models?

… **for farmer, trade union and economic organisations.** Are these organisations fully ready to begin bold reflection on their practices as well as on the type of agriculture that they want to defend in the future in terms of products and quality – an agriculture that will provide encouraging prospects for their children as well as protect this planet on which we all depend? These organisations must also be able to:

- take care of certain services for promoting agroecology (e.g. networks and groups of innovation and exchanges, and participative certification);
- carry out advocacy among public authorities, local authorities and the private sector;
- monitor the policies that are enacted;
- and, finally, create new alliances, especially with consumers.

It is also a major challenge for those working in institutions and in local and national politics. Will they undertake to promote family-farmer agroecology? Their action is decisive. They must:

- secure access to land;
- protect the domestic and regional markets;
- adopt suitable and bold legislation (e.g. conservation and exchanges of family-farming seeds) in the face of certain lobbies;
- finance suitable technical assistance systems for innovation in agroecology;
- reorganise the training systems for young farmers;
- invest massively in family farming (e.g. draught animals in Africa, irrigation, processing, etc.);
- finally, help further lucrative prices (including by support for value chains and certifications that enhance the value of these products on national markets) and public purchase policies.

Finally, this is a challenge for public and private international development cooperation agencies (including NGOs). They must not just 'green' their cooperation, but also:

- truly empower and support rural stakeholders and family farmers in the transition towards agroecological systems that are relevant for the future;
- work along with existing dynamics;
- support the funding of networks of exchange, manager training, research/action on agroecology in the countries of the South, and greater innovation by farmer organisations and NGOs.

We must also keep in mind that agroecology is neither a dogmatic nor a simplistic approach. We must chase away the fears and hesitations that this word still stirs up. No, agroecology is not limited to organic agriculture, even if the latter is indeed a preferable objective in the medium term. What is important, for many types of agriculture around the world, is to promote an agroecological transition that takes into account all the possible leeway for progress in gradually replacing the techniques of conventional agriculture with agroecological practices. Agroecology does not mean 'returning to self-sufficiency' either. Rather, it involves promoting more autonomous agricultural systems and exchanges, which will initially reduce risks for producers – and eventually those for consumers and all of society.

Also, we do not want to reproduce the errors of the past by diffusing turnkey models for agroecological techniques. **A realistic and pragmatic approach to agroecological transition** thus requires different responses suitable to rural areas through:

1. prioritisation and clear identification, along with family-farmer organisations and communities, of local problems;
2. joint identification of existing, historic or lost local knowledge about the sustainable use of this diversity of environments;
3. identification of the different paths for economic development of agroecological products;
4. building alliances among farmer organisations, towns and cities (e.g. technical assistance, short channels and public purchases), the state (e.g. public policy and funding), the private trade sector (e.g. distribution), research, and NGOs and development cooperation bodies;
5. finally, the adaptation, reinforcement or building of the most suitable forms of producer organisations in order to encourage and support the agroecological transition on a local basis.

For all this, agroecology faces a great danger: that of being taken over and trivialised by less demanding concepts such as 'agriculture raisonnée' or 'climate-smart agriculture' to name just two. **The agroecological transition that we want and stand up for needs to be a shared objective**, so that we can simply go back – with a minimum of common sense – to the basics of agriculture. This will allow us to gain back diversity in terms of production and environments, as well as to build a greater number of local systems of agriculture and exchanges that are more autonomous and less risky for all of society.

It is this **family-farm agroecology** that will finally make it possible to re-enhance the profession, the knowledge and the know-how of family farmers as well as to recreate social ties, respect and trust between society and 'a nourishing agriculture that does not do violence to nature'. ●

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Agroecology: A Response to the Agricultural and Food Challenges of the 21st Century

Agroecology can be part of the response to the frequent crisis in agriculture (one of the components of this crisis being the crisis in reproduction of cultivated ecosystems). It can also respond to the negative impacts of and limits to the "productivist" model stemming from the Green Revolution.

The first part of this report analyses the extent to which agroecology can meet the current and future challenges faced by humanity, as well as the conditions under which it can do so. These challenges include food security, wealth and income generation, jobs, health, management of non-renewable resources, land recovery, biodiversity, resistance to extreme climatic phenomena, and the fight against climate change.

The second part analyses the conditions required by agroecology to develop. These include policies favourable to family agriculture overall (because this seems to be the type of agriculture best suited to implementing agroecological practices), encouragement in the transition towards agroecology, secured access to land, support for investments in agroecology, generation and diffusion of specific knowledge and know-how, promotion and enhancement of the products stemming from agroecology, promotion of cultivated biodiversity and protection against GMOs, and a globally consistent agricultural policy with these objectives. The role of international development cooperation with regard to these objectives is also covered.

Finally, the report emphasises the need to provide simultaneous support for the different aspects of family-farming agroecology, as part of a realistic and pragmatic approach toward the agroecological transition. This makes for challenges to many stakeholders and therefore requires shared objectives.

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