

Short memorandum

The agro-ecology project: TOWARDS DOUBLY EFFICIENT AGRICULTURE that reconciles competitiveness with respect for the environment

In the context of the agro-ecology project for French agriculture, Stéphane Le Foll asked Marion Guillou to identify practices and systems that should be promoted and the measures necessary to enable their development.

Four principles guided her work:

- To resolve the dilemma concerning the increase of agricultural production on the one hand and environmental constraints on the other, by designing production systems that are both competitive and sustainable,
- To capitalise on the achievements of pioneers in France and other countries, learn lessons from them concerning collective methods for innovation by farmer groups, and mobilise the scientific and technical knowledge generated by research and development,
- To encourage rather than force, because to favour innovative approaches and practices it is necessary to avoid excessive regulation that allows no margins for manoeuvre,
- To permit a diversity of systems adapted to local conditions, the environment and the organisation of actors, so that farmer groups, their projects and their agronomic practices can be replaced at the heart of any project.

Using a novel methodological approach, the considerable mobilisation of INRA, its sectoral groups and Ministerial departments enabled the conduct of an open and ambitious analysis, achieved through consultations with numerous partners.

A “universal” movement

The demographic revolution is under way: our planet was home to 3 billion people in 1960, 6 billion in 2000, 7 billion today and will contain more than 9 billion in 2050. Demands for food will continue to grow, and agricultural biomass will be increasingly called upon to be used for non-food, energy and chemical purposes.

Future agricultural demand will depend on world economic growth, changes to dietary habits, the fight against wastes and also on public policies with respect to agriculture, trade, energy and the environment.

But all hypotheses point to the need for an increase in global agricultural production (by 30% to 80% according to the Agrimonde foresight study carried out by INRA and CIRAD, 70% according to the FAO), and to achieve that care over the management of natural resources and reductions in greenhouse gas emissions will be more than ever essential.

Particularly because in the context of a growing scarcity of land, only improvements to yields, and hence an intensification in production per hectare, will enable an increase in agricultural output. On all continents, and depending on constraints specific to each country, account is already being taken in new or renewed practices not only of objectives concerning competitiveness but also the need to attenuate climate change and protect soils, water and/or other rare resources; these practices have sought to place greater value on the services offered by natural environments in the agricultural production function. For example, conservation agriculture based on simplified soil tillage and a maximum restitution of organic matter to the soil, responds to the need to diminish soil erosion; the reintroduction of perennial crops into China, India or Australia targets the same goal.

It is sometimes the renewed organisational methods adopted by different actors which enable progress; for example, in Spain, regarding collective water management, or in South America where crops are being adapted (species, varieties, practices) to tropical environments. Public policies frequently support these efforts because the market is very rarely efficient in giving value to these resources, despite their scarcity; for example, Low-Carbon Farming in Brazil or the Green Morocco Plan. In all cases, actors in research, development and training are involved – in concert with farmers – in the design and deployment of innovations.

A balance needs to be found in France

After the Second World War, French farming was able to adapt very efficiently to the needs of society, demands which were clear when the CAP was first launched, and met thanks to profound changes, developed and managed with and by the farming community. So French farming first produced to feed, then to sell and finally to respond to demands for a diversified diet. Thanks to public support, both direct (CAP, national agricultural policies) and indirect (research, training and development), the global productivity of production factors in the agriculture and agri-food industries increased, while at the same time these two sectors and the territories where they were based were able to maintain a certain diversity. To achieve this, dense networks grew up within these sectors and territories involving farmers, suppliers, the agri-food industry and para-agricultural organisations.

But these successes should not conceal some less favourable changes; firstly the strong dependency of most farming systems on pesticides, veterinary products and fossil fuels (particularly through synthetic nitrate fertilisers and livestock feeds), and secondly the damage caused to the four dimensions of the environment: soil, water, air and biodiversity. Some progress has certainly already been achieved in this area, but it remains insufficient. Furthermore, current signals from the market, where cereal and oilseed prices remain very high, are encouraging the trend towards a simplification of crop sequences, a shortening of rotations, the specialisation and increased size of farms and the abandonment of livestock production to the benefit of arable crops when natural conditions so permit. European, national and regional public policy tools are no longer sufficient to compensate for the differences in income and living conditions between these different farming modes.

Nevertheless, these weaknesses should not mask the advantages. The prospects are favourable because the French agriculture and agri-food industries are active in a context of growing global demand (including for animal products) and trends towards higher prices in the medium and longer terms, even though it is probable that they may also fluctuate more markedly, particularly because of the financialisation of economies, uncertainties affecting international commercial and agricultural policies and climate change.

So how is it possible to develop and support farming systems that are both productive, competitive, economical in resource terms (water, energy, fertilising materials, etc.) and respectful of the environment?

There are many pioneers who – usually working in a group – have tested and implemented innovations that target these multiple objectives. They have chosen a variety of paths to reach their goals.

Bernard Hubert and Michel Griffon – among many other researchers – have tried to compile an inventory of these innovative approaches; during the course of our investigations, we discussed these methods with some twenty networks that have adopted them. What were the motivations for these pioneers? What were the keys to their success? How far can these experiences be applied beyond often specific pedological, climatic, economic and social contexts? And how will it be possible to convince the great majority of farmers who, according to a recent study carried out on behalf of the Terrena, Triskalia and Agrial, with the Higher Education and Research in Agriculture, Food Science and Markets Group (ESA) and the Pays de la Loire Region, might be ready to commit themselves to such a change if they receive appropriate support?

An approach involving numerous consultations and expert appraisals

We met with several networks working in the field; those which have tried and implemented innovative practices and systems which target such dual economic and environmental performance, and those which cover all farming models but are also vectors for progress. We asked the opinions of actors in a variety of sectors (agricultural suppliers and processing companies, distributors, etc.) and territories (Regional Councils, etc.). We also questioned the network of agricultural affairs advisers working for the French Ministry for Agriculture, Food and Forestry (MAAF), and Agreenium correspondents throughout the world.

These wide-ranging consultations allowed us to identify and qualify the trends under way wherever they are occurring, which is in a broad range of fields: from organic farming to precision agriculture, and including conservation agriculture, ecologically-intensive agriculture, integrated protection, agroforestry, sustainable farming or high environmental value agriculture. They also led us to determine whether, in other countries, some practices or policies might provide inspiration.

In parallel with these consultative and synthetic efforts, we took up the ambitious challenge to identify and characterise the performances targeted, the effects of farming practices on them, in order to clarify opportunities for progress. These major efforts were ensured by teams from INRA, but also involved some “sectoral” groups open to professionals in order to identify priority levers for each productive target.

Finally, we sought to analyse how it would be possible to facilitate transitions in a maximum number of French farms, by means of incentives rather than constraints. For this purpose, we identified the obstacles to change, the levers to be used and drivers to be introduced – usually at a collective level – from the approaches adopted by farmer groups, and by sectors both upstream and downstream or those covering a territory; in fact, those which could constitute projects for Economic and Environmental Interest Groups (GIEE) that will be created in the next French Law on the Future of Agriculture.

Our proposals will require changes to information systems on farming practices, to different systems and sectors in the agri-food industry, to research and development orientations, to the initial and continuing

training of actors in the farming and rural worlds, and to the services which provide support for farmers (agricultural consultants). They will also necessitate the use of tools under the future Common Agricultural Policy (CAP) and/or the French Loi d'Avenir (Law on the Future of Agriculture) in order to enhance the value of producing public goods such as reductions in pesticide use and greenhouse gas emissions, or the supply of other ecological services.

There is no “off the peg” solution

Despite the sometimes prescriptive nature of certain methods designed to achieve dual efficiency, improving production usually involves the need for a different type of production, through an adaptation of practices and systems to the pedoclimatic and agro-ecological environment, and to the local economic and social context. This is a first demanding reality that must be taken into account.

In addition, some of the ecological services rendered by agriculture need to be considered at territorial and temporal scales which exceed the context of a single farm and an annual management scheme. For example, in order to ensure good water quality in a river or in groundwater, practices must be coordinated at the scale of watersheds. Similarly, to prevent the spread of diseases and encourage pollinators, the development of mosaic landscapes is a benefit. Furthermore, it may be some time before the impacts of environmentally-friendly practices can be measured. This is a second demanding reality that must be taken into account.

Finally, the economic, health and climatic contexts of farming are now subject to major random events; for example, a return to (even more) marked price volatility, uncertainties linked to climate change or the increased circulation of goods and people which also carry parasites and infectious agents, will create conditions that are more unpredictable than before. In any proposal concerning changes to agricultural systems, awareness of these hazards must be taken into account.

Analysis of the sectors also demonstrated the importance of encouraging innovations throughout the value chain. Downstream sectoral innovation should indeed offer opportunities to enhance the value of products resulting from diversification and thus provide new possibilities to reconcile economic and environmental performance.

START FROM WHAT IS POSSIBLE, EXPLORE THE BOUNDARIES AND ENCOURAGE CHANGE

The major transformation and modernisation of French agriculture that occurred between 1960 and 1980 led to a model built around production based on technical control of the environment, perceived as being a substrate (soil) and/or a constraint (climatic events or attacks by pests), and to a great extent focused on supplying standardised goods for a mass market. And even though some environmental and social limitations to this system were highlighted as from the 1980s, the integration of ecological objectives in public policies since the 1990s only developed alongside this model, and resulted in constraints that needed to be taken into account “*a posteriori*”. Today, we need to encourage transitions towards systems that target dual performance, based on the evidence supplied through the efforts of pioneers and on the data generated by research and development.

Thousands of farmers in France, and millions of farmers throughout the world, who target doubly efficient farming, have shown that this is possible. The exploration of innovative practices, and their combinations, has highlighted numerous, diverse options that can be adapted to most local conditions.

The analytical work carried out during this mission showed that some twelve main levers could be operated to enable a better combination of economic and environmental efficiency.

These levers concern several essential points:

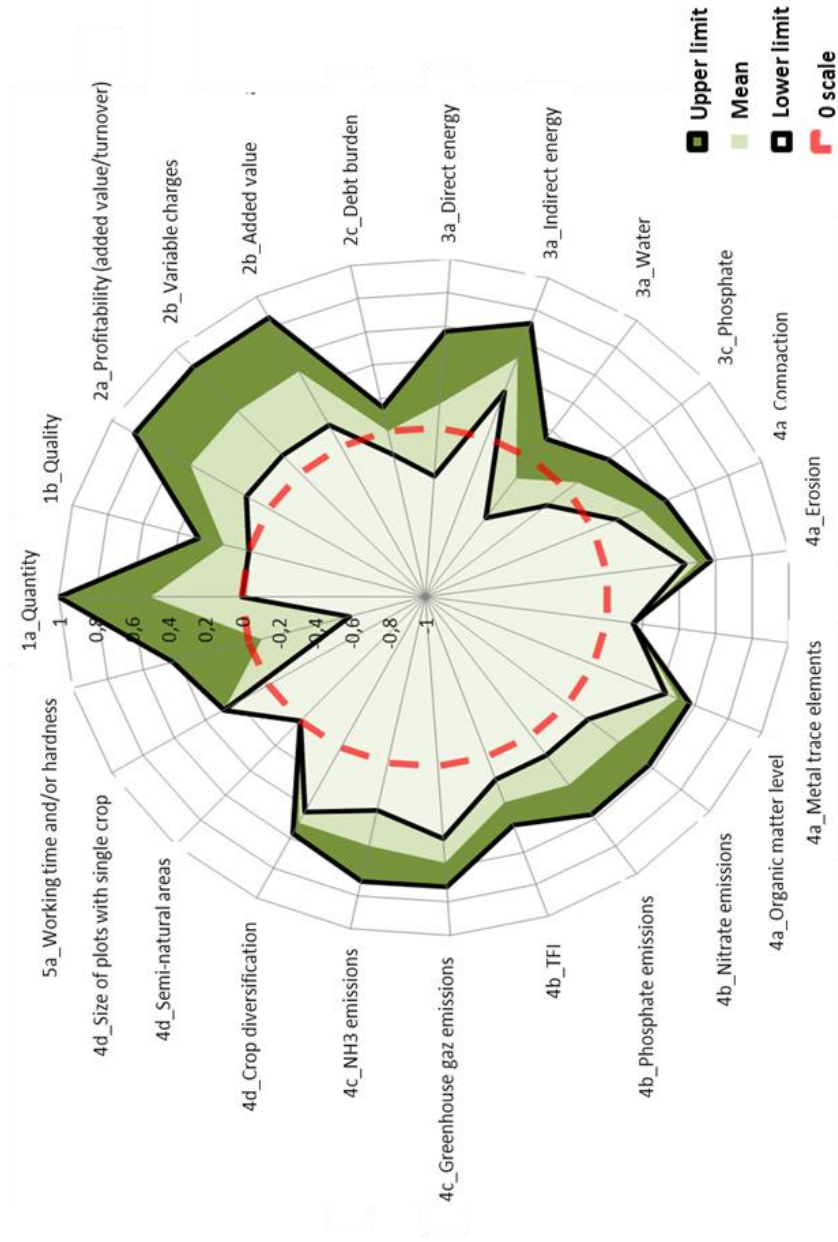
- The management of water, soil and air resources (including, in this case, greenhouse gases),
- The diversification of crops in schemes and rotations; for example, by introducing legumes and companion plants,
- The feed autonomy of livestock farms and optimised waste management,
- The management of agricultural solidarity in different territories; for example, between crops and livestock farming or through the the sharing of labour or tools.

As an illustration, doubly efficient arable systems (as shown below) have highlighted margins for manoeuvre which comply with the related constraints of product quality and competitiveness. The objective of the farm considered here, which specialises in annual arable crops in a region where this specialisation is widespread, is to markedly diminish its environmental impacts by reducing the use of synthetic nitrate fertilisers and plant health products, while maintaining, or even increasing, productive and economic performance. This farm operates independently, in the sense that it does not make use of any exchanges with other, neighbouring farms. Situated in a region specialised in annual arable crops, there is no possibility of recourse to organic waste from livestock farms. When seeking for short-term effects, this farm is not envisaging an increase in its agro-ecological infrastructures which would have beneficial environmental effects over the longer term.

The elementary practices implemented consist in: (i) soil cover through the planting of intercrops with agro-ecological functions; (ii) the preservation of water resources by adapting the cropping sequence to nitrate uptake; (iii) improvements to the management of fertilisation by using decision-making tools to adjust fertilising inputs and by cultivating legumes in combination; (iv) the diversification of sequences and rotations by increasing the number of species included, and (v) based on genetic techniques, using improved varieties in terms of yield and pest resistance.

Farm specialised in annual arable crops (without irrigation) [in a region also specialised in annual arable crops]

Radar of performances associated with combining selected practices



- **Management of water and its quality**
 - *Adapt crop sequences to the uptake of nitrogen*
- **Management of mineral elements**
 - *Use decision-making tools to manage inputs (N, P, K and other fertilisers)*
 - *Grow legumes in combination with annual crops*
- **Diversification of sequences and rotations**
 - *Plant intercrops with agro-ecological functions*
 - *Increase the number of species grown in a rotation*
- **Choice of varieties and seeds**
 - *Choose varieties with improved yields*
 - *Choose varieties with improved pest resistance*

The system thus defined has a favourable impact on: (i) productive performance, notably in terms of yields (up); (ii) economic performance (not including the debt burden), either in terms of variable costs (down) , profitability and added value (up); (iii) the direct and indirect consumption of fossil energies (down), and (iv) several types of environmental performance, notably regarding the protection of soils against erosion, the organic matter content in soils, the use and/or emission of nitrogen, phosphorus, plant health products, greenhouse gases and ammonia (NH₃).

Performance relative to the use of irrigation water and phosphates, and the preservation of biodiversity, is little impacted (and thus little improved) – with the notable exception of the “crop diversification” indicator, which is markedly enhanced. Working times may suffer a negative impact; the same applies to debt. An increased diversification of plant crops also requires an increase in technical know-how.

Overall, it appears that the system defined here can combine economic efficiency (debt burden not included) and environmental performance, but at the possible cost of a deterioration in workload, its complexity and technicality, and in debt because of the need for more investment; the preservation of biodiversity is certainly improved (through various practices, and particularly soil cover), but only modestly because of the lack of inclusion in the system of agro-ecological infrastructures, the beneficial effects of which would be deferred.

A similar approach was adopted with respect to different production orientations: arable production in regions with a majority of mixed livestock farming, arboriculture, viticulture, dairy production, or the rearing of cattle, pigs or poultry.

Based on feedback from the field, in both France and other countries, and on an analysis of scientific production supplemented by expert opinions, we were indeed able to identify coherent sets of practices to target dual economic and environmental performance, and to determine the obstacles and levers attached to their deployment and/or generalisation depending on the specific conditions. The constant changes made by farmers in the past in reaction to new contexts have shown us that they know how to adapt and innovate. This transition towards dual performance should therefore be encouraged through the mobilisation of numerous actors and signals.

At this stage, in order to encourage a majority of farmers to commit to this path, we feel it is necessary to act simultaneously on support for farmers and on their economic, technical and social environment.

PROPOSALS

The transition towards agriculture that is efficient at both the economic and environmental levels requires a series of strong technical guidelines that can be acted upon and are accessible via an appropriate information system. These technical guidelines will constitute valuable resources for the adaptation of initial and continuing training materials for farmers, and for the training of agricultural consultants in the principles of agro-ecology, so that they can be disseminated more widely among farmer groups who are ready to commit to this path.

Although improvements to guidelines and training are two prerequisites to ensuring agro-ecological

transition, they alone are not sufficient. The economic context (the high prices of several agricultural raw materials) which drives the simplification and specialisation of crops, coupled with agro-ecological systems that are more demanding in terms of workload, more complex and more susceptible to random events, are all factors that can hamper change. These obstacles can only effectively be overcome by the introduction of powerful incentive mechanisms.

Finally, in order to ensure a long-term change dynamic, it is necessary to encourage groups of farmers acting within GIEE, and actors working downstream and upstream of farms and in different territories.

Our proposals could act simultaneously on all these levers. They are linked to the principal factors relative to data and guidelines, to training and advice, and finally to incentives.

Better characterise and identify potential doubly-efficient systems

- Adapt public sector statistical tools to serve the study of dual efficiency;
- Make the CASDAR (the special appropriation for agricultural and rural development) a lever to exploit and share data and technical references;
- Orient CASDAR calls for projects towards the design of doubly-efficient farming systems;
- Set up a shared information system by interconnecting the databases run by different actors in agro-ecology;
- Encourage actors in research and development to produce new knowledge on agro-ecology;
- Drive the emergence and existence of networks for data exchange in addition to structured information systems.

Promote initial and continuing training adapted to taking up this challenge

- Adapt the system and guidelines for initial and continuing training, and mobilise all actors involved in training;
- Assist farmers in managing transitions through professional training, mobilising if necessary the lever of the European Agricultural Fund for Rural Development (EAFRD);
- Mobilise agricultural and veterinary higher education institutions in support of these changes.

Support transition by farmer groups through a renovated agricultural consulting system

- Organise consulting services and ensure their quality by certification at two levels, that of the provision of advice and that of their structure;
- Use the CASDAR a lever in support of this approach;
- Mobilise the GIS Relance Agronomique (Scientific Interest Group for the Revival of Agronomy) to develop training guidelines for agricultural consultants;
- Create a clear separation between consulting and sales activities;
- Give new impetus and direction to demands for advice on agro-ecology by creating consultancy grants allocated to GIEE.

Introduce incentives to overcome obstacles at the individual, collective or sectoral levels

- Support risk-taking linked to changes in practices and systems (agri-environmental measures, experimentation of regional funds for risk sharing);
- Design innovative systems to encourage reductions in the use of inputs purchased from outside the farm (study and experimentation of input savings certificates);
- Make use of synergies with river basin agencies in catchment areas;
- Improve the quantitative management of water; study plans for hillside reservoirs on a case-by-case basis and, if relevant, envisage a rise in the price of irrigation water;
- Orient work on plant and animal genetics in order to ensure that farmers benefit from a choice of plant varieties and animal breeds that are suited to agro-ecology;
- Mobilise technological research, training, development and industry to design equipment that is adapted to agro-ecology;
- At a territorial level, encourage new types of “agricultural solidarity”, notably relative to the links between cropping and livestock systems and the optimisation of areas of ecological interest;
- Make use of the margins for manoeuvre provided under the future CAP for 2014-2020;
- Remove certain prescriptive constraints which hamper innovation or collective practices;
- Authorise a “right to experimentation” within an appropriate framework, to enable exploration in the context of GIEE of alternatives that are more efficient than current norms;
- Develop systems for the technical and financial management of farms according to a multi-annual time step and improve tax arrangements so as to allow progress in this respect;
- Encourage and validate innovations resulting from field experiments by making use of the European Innovation Partnership (EIP) on Agricultural and Productivity and Sustainability;
- Mobilise those upstream and downstream of farms to support innovation;
- Develop the dual efficiency of agriculture at a regional scale, working in consort with local government bodies.

Recommendations that could mainly be implemented in the context of GIEE

The mission demonstrated the clear value of collective approaches as a lever to ensure dual efficiency. Although it was not the role of this mission to issue proposals concerning the status of future Economic and Environmental Interest Groups (GIEE), we felt that as a minimum, these bodies should be structured around a collective project targeting dual performance led by a group of farmers and associating, if appropriate, operators in different sectors (for example, regarding the introduction and valorisation of new crops) and/or territories (for example, watersheds).

In view of the importance of this collective dimension and the pertinence of making the GIEE essential links in the agro-ecology transition chain, it is crucial that incentives for transition should preferably target collective approaches recognised in the the context of these GIEE.

This could be the case for the “consultancy grant” and “mutual fund” arrangements referred to above, and also for the systems specified in the context of the European Agricultural Fund for Rural Development (EAFRD) – particularly AEM.

Furthermore, it is important that the GIEE label, defined by the State, should be exploited within a managed framework. Protection of the GIEE brand name, and of the term “Economic and Environmental Interest

Group” would mean that any benefits resulting from this image (e.g. local partnerships with local distributors) could be restricted to members of groups recognised by the authorities.

Ensuring the sustainable commitment of French agriculture to the agro-ecology dynamic

Whether they concern the development of standards, training or changes in support for farmers, these measures should be deployed over a period of some ten years. It is therefore important to start planning now these more structured systems, the tools for collective monitoring and the adjustment of actions that will ensure that the long-term maintenance of this dynamic.

We feel that the three key factors described below could guarantee a long-term future for this approach.

Ensure that the GIS Relance Agronomique (Scientific Interest Group for the Revival of Agronomy) is a central actor in the agro-ecology transition process

The *GIS Relance Agronomique* is currently the only large-scale collective initiative which gathers different actors in agricultural research, development and training within the same body. In our previous recommendations, we proposed entrusting this GIS with new and structuring missions that would principally concern information systems, the exploitation of data and standards, guidelines for the training of consultants or the scientific management of any arrangements differing from the provisions of common law that might affect GIEE.

For this reason, the *GIS Relance Agronomique* should be pivotal to future arrangements at the service of dual performance. As a minimum, this would require a change to its name – to perhaps the Scientific Interest Group for the Revival of Agro-Ecology – and possibly improvements to its organisation.

More open governance of the farming industry and a new way to build progress indicators

Governance of the farming industry is currently based on institutions and organisational methods inherited from a time when it was an isolated activity dedicated to a single function, that of production.

Today, this industry is closely linked with the expectations of society (notably regarding the issues of the environment or product quality) and the realities of how rural spaces are managed, which is increasingly apportioned, concerted and complex. This is particularly justified insofar as the public subsidies granted will only be available on a long-term basis if they are attached to producing public goods. Agro-ecological revival thus requires a greater openness of the regional and national authorities that will initiate and then follow this massive transition towards doubly-efficient systems.

The challenge is to foster and organise discussions, debates on ideas, exchanges and coordination between the different actors involved at both the national and regional levels. In this respect, and while adhering to the rules of representativeness when it comes to decision-making, the different forums and bodies which provide an opportunity for debate on agro-ecology (national, regional or local) must whenever possible ensure the presence and contribution of all stakeholders who are not strictly of an agricultural nature (non-governmental organisations, consumer associations, industrial players, nature parks, etc.).

Furthermore, we feel it is important to ensure the full commitment of all actors to approving the plans for agro-ecological development, and notably regarding the always crucial issue of defining indicators (targets, outcomes, impacts, etc.). In particular, the construction of a road-map for agro-ecological approaches should be seen upstream as an opportunity for the joint development of guidelines that are shared by all the actors concerned (for example, within the GIEE), and not just as a series of indicators predetermined by experts.

Thinking today about the CAP after 2020

Margins for manoeuvre exist to ensure that the CAP 2014-2020 can be driven to serve the agro-ecology project, but they remain limited by a context where the CAP still remains too dependent on past orientations, some of which are now revealing their limitations (lack of adaptation to high price volatility, and to the new challenges of competitiveness, innovation and sustainability, notably regarding reductions in greenhouse gas emissions, etc.).

Because the agro-ecology project is a long-term structural plan, we need to reflect today on a CAP that will be more efficient in supporting dual efficiency in a context of climate change. At an environmental level, this will require revision of the regulations on joint financing, so as to take account of the geographical scale of this challenge (differing markedly whether it concerns diffuse pollution or the fight against global warming). The CAP should also take more systematic account of the realities and of all the costs and benefits, both private and public, of different practices.

Several options can be envisaged to provide support for European farming in a more volatile and uncertain world: support for private risk management systems, counter-cyclical subsidies, etc.

Imagination and consistency are both necessary in this area: the agro-ecology project needs a strong and sustainable CAP that will differ markedly from what it is today and what it will be during the period 2014-2020.