

RECOMMENDATIONS

This report summarizes the main lessons learned from our discussions concerning world food supplies in 2050, in the context of demographic growth and climate change, as well as the first conclusions drawn from these discussions. In the following, we present a few recommendations. They were chosen for their importance and the urgency of their implementation. The problems of feeding the world are complex and have many facets including political, technical, social, economic and cultural ones. They can only be solved by long-term policies, implemented within a framework based on sustainable development affecting many activities in society, both in developed and developing countries, from individual behaviour to international trade agreements, agricultural practices and environmental conservation. Three areas are highlighted where action is needed without delay: firstly, nutrition and dietary habits, which for us, are the most important issues; secondly, demographics and finally, global trade. The report continues by treating agricultural production and environmental issues and ends with prevention, forecasting and management of crisis situations which are, unfortunately, inevitable.

The following recommendations concern policies to be implemented at the national, European or world level. In the following, we will not distinguish between them. The table at the end of this chapter specifies the different levels. The recommendations concern successively nutrition (A), demographics (D), economy (E), production (P) and crisis management (C).

1 | Nutrition and dietary habits

In the developed countries, public policies in matters of nutrition must be reoriented towards higher efficiency and harmonized with those pertaining to agriculture, health and environment. Two common objectives should be targeted. The first is to restrict high-calorie foods and optimize diets in order to combat obesity, thus improving overall health by lowering the incidence of obesity-related diseases. The second objective is to reduce consumption, food loss and waste in order to prevent rich countries from claiming too much of the world's food resources, which are about to become scarce or exceed the availability of so-called sustainable resources. Individual calorie intake (in developed countries) should be reduced from 4 000 kcal/day to about 3 000 kcal/day,

and the contribution of animal products should be only 500 kcal instead of the current 1000 kcal/day. This should be a long-term objective, but action is needed today in order to reach this goal. This general policy should be implemented by incentives and regulatory measures that will affect consumers and by a new orientation of agricultural policy. The proposed measures are detailed in Chapter 3 and include in particular:

A1 – A strong incentive to lower individual consumption of meat and animal-derived products¹, in particular red meat produced from cereal-fed animals² must be put in place. To reach the objective, education of the general public (including children) is needed as well as training and involvement of health professionals and social workers. Public authorities must also set an example, for instance regarding public-school cafeterias³;

A2 – Incentives as well as regulation in the food and agriculture industries and in institutional catering must be increased in order to significantly lower the proportion of sugar and saturated fat in prepared foods; actions are also required to restrict promotional food messages;

A3 – Incentives and regulations should be devised to fight food waste, in particular by wholesale markets, supermarkets, caterers as well as by individuals. In particular, the great diversity of food choices, due to pressure by producers and consumers alike, contributes to waste through expiry of "sell-by" dates.

Regarding emerging countries and low-income developing countries, where chronic undernutrition and dietary deficiency coexist alongside an increase in obesity, we recommend that France's policies be to:

A4 – Support direct actions in favour of the prevention of undernutrition, keeping in mind dietary issues when defining sector-based programs (agriculture, education, social benefits). French policies must also favour income growth for poor populations to enable them to access a more varied diet, especially the vulnerable groups, which should have access to a higher proportion of animal products in order to decrease dietary deficiencies. **In these countries, consumption of saturated fats, sugar and in some cases animal products by the fraction**

¹In 2005, FAO estimated that globally half the calorie intake from animal products was from meat and half from eggs and dairy products.

²Livestock fed on grass in pastures that are improper to other agricultural uses are not in direct competition with global food production.

³The English "green day", day in the week where collective catering (for example, in companies, schools, hospitals, nursing homes, holiday centers) serve organic meals, could be shifted to promoting a decreased consumption of meat.

of the population already consuming these foodstuffs in excess should be discouraged. The trend in these countries to adopt the unbalanced diets prevalent in developed countries should be stopped.

A5 – Research on human nutrition must be strengthened, covering dietary imbalances due to deficiencies or excesses, diets with favourable impacts on health and the environment in various settings (rural areas, urban areas, geographical and genetic differences); sustainable diets, obesity, epigenetics without forgetting the cultural and even religious aspects of diets.

2 | Demography

It is highly desirable and possible to reach a lower population level, of the order of 8.6 billions in 2050 instead of the 9.2 billions projected by the United Nations. This would already significantly reduce the pressure on food production. The current population growth rate in some countries (2% and above) makes any hope of local sustainable development impossible, not to mention of overcoming nutrition problems. This generates a desire to emigrate towards more developed countries who, in turn, try to protect themselves from immigrants by erecting barriers. Such a situation is not sustainable and generates conflicts and humanitarian tragedies. Hence, it will be necessary that:

D6 – Governments of countries where population growth rates are still high be encouraged to engage in **population awareness programs to help couples reduce the number of children (in particular, to decrease the number of unwanted births). Increased population awareness of the need to reduce birth rates can only come about in a context where the **education, health and status of women are improved**⁴.**

Governments of some countries will be confronted with a new type of migration, induced by climate change, which could start before 2050 and will become truly worrisome during the second half of this century. It is necessary to:

D7 – Study the possibilities of **giving "climate refugees" an acceptable international status, encourage and support policies favouring local adaptation of countries to these changes, which will be progressive: habitat modification or nearby relocation (when possible), changes in agricultural production systems, physical protection (for instance, dams), management of the biggest rivers.**

⁴On this topic, see the annex for comments of the Critical Reading Group, in particular those of Mrs. Tesson-Millet (Association Équilibres et Populations), Mrs. Almeras (Fondation Ensemble) and Mr. Charmes (IRD).

Where adaptation is not possible, it is necessary to prepare populations for migration (towards a specific destination).

3 | Economy and global trade

It will be possible to feed the planet in 2050 but only with massive food transfers between continents. It is inevitable that in the near future, due to population growth and climate change, whole regions and even continents such as Asia (more than half of humanity) and Africa will no longer be food self-sufficient, as is already the case for example in the Middle East and North Africa. Some countries will depend by more than 60% on imports to feed themselves. Such a constraint requires planning ahead and regulating of global agriculture markets to avoid crises, such as the precursory crisis in 2007-08 but only much worse. *In a few words, attempts must be made to limit the "volatility" of global agricultural commodity prices.* Economic studies have established, from past examples, that the negative effects of arbitrary market regulation through stocks, quotas and subsidies can be stronger than the expected benefits.

The goal of reducing price volatility can only be reached through a joint effort of nations to organize international trade in a multilateral approach supported by the WTO.

The following recommendations were the focus of many comments by the Critical Reading Group. They can be found in the annex. These comments were examined closely and most of them were taken into account. The reader is also invited to review additional remarks (" À propos des commentaires sur les aspects économiques du rapport ") written by the authors of Chapter 6 and placed in the annex after the comments.

We recommend that particular attention be given to the following points:

E8 – Global trade liberalization should be maintained for all activity sectors, both agricultural and non-agricultural, providing that the following conditions are fulfilled. Trade liberalization allows food-deficit countries to obtain the monetary resources needed to pay for imports and food-surplus countries to sell food on the world market. A point seldom discussed until now, which deserves to be debated in this context or in a regional one, is that of preventing from unilateral measures restricting exports, which had a disastrous impact in 2007-8 on the equilibrium of the world food market. One should keep in mind that market liberalization implies that subsidies are decreased in rich countries because their impact works against the development of poor countries.

E9 – A number of regional or local agricultural markets should be strongly supported for the necessary length of time, in particular in developing countries where populations are or should be self-sufficient and produce a small surplus (see also **E11**). Support can be given in various forms, from subsidies to producers to temporary protection measures. Support is required to make sure that competition from international markets does not completely discourage the efforts by these countries to increase production, which is necessary in the long term for their food security, to slow rural exodus and to maintain the global equilibrium of international markets.

E10 – The effects of speculation on agricultural markets should be restricted, through better regulation of agricultural futures markets (especially concerning processed products) without hampering their functioning. They play an essential economic role for producers and consumers alike. This requires incentives from public authorities to strengthen self-regulation of commodity stock exchanges and to protect them against the intervention of purely financial speculators.

Although regulation of markets is unavoidable, it is even more important to develop local production capacities because the survival of billions of people depends *above all* on agriculture in their own neighborhood:

E11 – Ambitious programs for agricultural and rural development of the poorest countries, in particular sub-Saharan Africa, must be implemented, especially those benefiting small farms (see section 4 below) where women often play a major role. Marketing infrastructures must be developed to process and commercialize the local food production (roads, packaging and storage facilities, markets); these public works might be integrated into a regional framework. Local or regional markets for agricultural inputs (fertilizers, water, seeds...) must be better organized. It is also desirable that in poor countries, small farmers receive help to increase production, in particular through loans to obtain more inputs and to *lower their vulnerability to risks, especially to climate risks*, through improved plant varieties that are more resistant, higher-yielding and requiring less water *and through the creation of insurance mechanisms*. Such programs should also have a regional cooperative facet. Finally, these programs must be strongly supported financially through the major development agencies. Plans to support small farmers have already been implemented in the past by international institutions but have not always had the expected impact because investments in agriculture have declined globally.

It is critical **that small farmers be helped to intensify their farming practices**, to improve their standard of living and to feed the urban populations that depend on them. This would also slow rural exodus that leads to extreme poverty in countries where industrial activity is not yet sufficiently developed and not yet capable of absorbing the influx of new city dwellers. Increased production must

be achieved, at least at the current stage, **while maintaining labour-intensive production** and not by implementing labour-saving mechanized agriculture. The social problems encountered by Brazil, which has both types of practices side by side are well known. The introduction of animal traction or micro-tractors, as done progressively in China, can serve as an example. Finally, agricultural research can provide innovative solutions, but the main initial contribution must be financial support. Decreasing the losses at the production and harvest stages must be the major objectives for research and farmer education.

E12 – An observatory to monitor and forecast trends in the global food situation and markets must be created. The main danger would be that of a race between the growing needs of an increasing global population and higher production capacities with a propensity for losses and waste. Such competition poses a risk of scarcities and high prices volatility. To avoid such situations, it is important to be able to anticipate developments. A possible defence against these risks is to create a forecasting body for food commodities and their markets. The goal will be to monitor the trends and subtle signals, to interpret these trends especially those concerning the basic parameters of the global food system, to put forward hypotheses and scenarios, and to anticipate dangers and suggest solutions.

This independent monitoring body would support the High Level Panel of Experts on Food Security and Nutrition recently created by FAO and the UN High Level Task Force in charge of coordinating agricultural policies, as well as other agencies at the regional and national levels. The International Council for Science (ICSU), an independent science organization, would be ideally placed to undertake such an initiative which would bring together internationally recognized scientists. It could closely monitor key variables such as:

- trends in agricultural, dietary and environmental policies;
- the evolution of the relationships between population growth, consumption, food production and imports in fragile countries;
- evolution of production and stocks in areas of climate risks and situations of simultaneous crises in several geographical areas;
- trends in animal product consumption in different countries;
- price trends in agricultural markets, in order to make projections;

The monitoring body would build and update models of agricultural production based on detailed maps (50 × 50 km) showing all the parameters that affect agriculture. Such a tool would improve the efficacy of projections and help measure the impact of any local or regional crisis.

Additionally, the **prospective work** undertaken jointly by INRA and CIRAD ("**Agrimonde**" project) to study the possible evolution of the world food balance should be pursued and expanded. The first report was published in 2009.

Finally, the goal should be to reach a strong global agricultural and food policy.

4 | Agricultural production and the environment

The decreased consumption of animal products and smaller food intake in developed countries, if they are implemented, will significantly lower agricultural needs and in turn the pressure on the environment. Nonetheless, world agricultural production must double by 2050, significantly less if the healthy diets recommended in section 1 become widely accepted and significantly more if they are not. The continuous increase in yields over the last 50 years that has outpaced population growth has recently slowed. The increased costs of energy, the progressive depletion of fertilizer deposits (for example, phosphates, potassium chloride) and the deterioration of certain farming soils, in particular in tropical regions, prompt us to state that *the world food problems cannot be solved by a "normal" evolution of the production.*

Consequently, **agricultural issues must be at the forefront of political and economic concerns of all nations.** In particular:

P13 – The considerable production capacities of European farming must be maintained and redirected towards the production of healthy foods that are nutritionally and ecologically sound and have a low impact on natural environments, biodiversity and carbon footprints. **This policy should be the basis for reformulating the Common Agricultural Policy.** Europe must use its high agricultural production capacities to satisfy its own needs and to contribute its share to providing food to countries that have structural production deficits, in particular countries in the Mediterranean region with which it has strong ties. It is a question of global solidarity, ethics and economic cooperation. In this respect, protecting farm land from urban, industrial and transportation development must become a priority in Europe, where each year the amount of lost arable land is equivalent to the surface area of a French department⁵ (administrative region)!

P14 – More generally, in countries that have already reached high agricultural yields, a change in agricultural practices towards "ecologically intensive"

⁵In other terms, compared to France's surface area, one department every ten years!

productions must now be encouraged, as discussed in this report and in several other publications. The technologies are well known and are the objects of ambitious research programs recently initiated, in particular by INRA in France. They should be developed further and their implementation encouraged. In these high-yield countries, considerable space has been given to environmental protection. Biodiversity, including that of cultivated species, must be incorporated into integrated production systems where wilderness areas are included and not considered as part of a distinct and antagonistic system. Ecological assets must be rehabilitated and the ecological benefits provided by the environment must be specifically taken into account and priced.

This project cannot be successful without an appropriate policy for *educating* farmers.

P15 – For such changes to occur, we must **support research and development on (i) new agricultural practices**, such as precision agriculture based on careful management of inputs, and **(ii) new varieties** (obtained by classical plant breeding, genomic and transgenic methods) that are more productive and more efficient in their use of water and fertilizers, and more tolerant to biotic and abiotic stress. This objective is in perfect agreement with the ecological approaches to agriculture defined 30 years ago by André Cauderon, INRA⁶. The research effort is considerable and France can and must contribute through institutes such as CIRAD, INRA and IRD in close association with the private sector, for decades the main channel for bringing research innovations to farmers. Researchers must work in close association with farmers and all parties involved.

P16 – Production of seeds from improved varieties obtained through research must be organized in the countries where they will be cultivated and where the seed industry is non-existent, a common situation in many developing countries.

P17 – Agricultural water management must be improved at all levels: improved efficiency, expansion of areas of irrigated agriculture where possible, improved collection and use of rain water in areas of rainfed agriculture, emergency irrigation, improved drainage, reduced impact on water quality and soil salinization, ecological land management. **Irrigated agriculture**, due to its greatly superior yields compared to rainfed agriculture limits the need to increase cultivated areas and thus favours the conservation of natural environments. Nonetheless, states must be encouraged to choose their water infrastructures carefully and minimize their environmental impacts. France can contribute by offering its expertise in matters of watershed management and ecological impact projections. It has become urgent to launch cooperative programs on

⁶A. Cauderon (1981). Sur les approches écologiques de l'agriculture. *Agronomie*, 1 (8), 611-616.

these topics (for example, concerning the Mekong basin, the major African river basins) ahead of any management project.

P18 – Considerable research effort needs to be made on **agroforestry systems** that associate trees and food crops or trees and grazing. Such systems allow preservation of soil organic matter after deforestation, reduce fertilizer input and crop treatments. Although these systems are widespread in Indonesia and the creole gardens in the Antilles (French Carribean Islands), but have not yet been studied scientifically. France has the research teams and the necessary tropical expertise (especially in Guyana and the Antilles) to develop wide-ranging programs in partnership with the African and South American countries that are interested.

P19 – **Freshwater aquaculture must be encouraged**, particularly in Africa where its development is weak. Overfishing in the oceans must be controlled as well as losses tied to by-catch, as the Académie des sciences has mentioned in several specific reports⁷. The possibility to develop farming of seaweed and its dietary, chemical and energetic uses must be the focus of sustained research programs.

P20 – **Livestock farming** must be encouraged in developing countries where the availability of animal products, in particular from grain-eating animals, is not sufficient. Regarding ruminants, grass-fed animals should be favoured, in particular in pasture areas that cannot support other cultures. The production of red meat by fattening animals on grain must be very severely curtailed⁸. Genetic improvement of animals should be encouraged in order to reach higher nutrient assimilation efficiency.

P21 – Because of low energy yields and direct competition with food crops, **first-generation biofuel production** from cereals or oilcrops **must be severely controlled and even banned**. Second-generation biofuels, derived from harvest residues and cultivation on land unsuitable for both food crop production and pasture must be the focus of accelerated research. The expansion of cultivated areas at the expense of food crops, pasture or protected natural areas must also be controlled. Research on third-generation biofuels (production of oil from microorganisms such as microalgae) resulting in better yields without competing with food crops must be encouraged.

P22 – Finally, **the FAO should be asked to focus once again on a reduction of losses** that occur between harvesting and retailing of food products (the United

⁷Among which *Exploitation et surexploitation des ressources marines vivantes* (L. Laubier, coordinator), RST N 17, December 2003 – Éditions Tec&Doc

⁸Some red meat is produced from culled dairy cows, which in general are not fed on extensive pastures.

Nations had set objectives addressing this topic in 1975 and the FAO produced a Plan of Action in 1977, but close to nothing since). An integrated vision of agricultural production which emphasizes a strengthening of weak points must be encouraged.

P23 – International leasing or purchasing of agricultural land that is today sparsely populated or little exploited may, in the long term, lead to major sources of conflict in case of food shortages. A code of conduct or international regulations must be drawn up to detail the contractual terms and conditions of these actions and guarantee their transparency.

5 | Crisis prevention and management

The risks of recurrent food crises are serious. The last famines in India in the 19th century and first half of the 20th century (before the Green Revolution) were all associated with food distribution problems rather than real scarcity. The situation will be the same at the planetary scale, albeit with new and added risks. Because of population growth and increased risks of extreme climatic events occurring at a higher frequency, the possibility of an absolute scarcity of food cannot be totally excluded.

Four types of recommendations can be made:

C24 – Seasonal undernutrition must be reduced. This is the food deficit occurring between two successive seasons. The solution to this problem is to increase production capacity, as already mentioned regarding small farmers, and in some cases to develop insurance mechanisms against years of severe deficits, in particular for the most fragile populations.

C25 – Stocks must be built up. In addition to maintaining world stocks at appropriate levels (on the order of six months of consumption), vulnerable areas must be encouraged or helped to build up stocks at the regional and even family levels in order to better face risks of accidental deficits. These reserves can be stocks of food, land that can be quickly put into cultivation, or monetary funds.

C26 – The World Food Programme must be revised. The logistics and efficiency of the world food aid program have minimized the periods of regional food scarcity in the last fifty years, but the program must be developed to better accomplish its goals, in particular:

- monitoring of potential food commodity deficits and accelerated triggering of aid procedures jointly with requesting countries;

- redefining the nature of food aid, which has two flaws:
 - food rations are not designed to provide balanced nutrition and can lead to serious dietary deficiencies. They are in reality an outlet for overproduction in developed countries;
 - the flow of free foodstuffs can compete against the marketing of local or regional food production and as such further reduce the autonomous food production capacity of the regions concerned. This issue requires careful examination, which goes beyond this report. In some cases, it may be better to distribute food aid in monetary form (provided that funds reach the intended beneficiaries) rather than in the form of rations. Successful examples can be found in Latin America, where such programs were introduced to reduce deficiency-induced malnutrition, and the aid given to women provided certain conditions were met.

	France	Europe	World	Research
Nutrition:				
A1- Reduce consumption of meat and meat-derived products	X	X		
A2- Regulate the use of sugars and fats by the food industry	X	X		
A3- Combat food waste	X	X	X	
A4- Support direct actions to prevent undernutrition			X	
A5- Strengthen research on human nutrition				X
Demography:				
D6- Decrease family size where necessary, through better education and improved women status			X	
D7- Design policies of prevention and assistance related to climatic migrations			X	
Economy:				
E8- Maintain world trade liberalization, with necessary exceptions		X	X	

Tableau
Summary of recommendations, and level of action required.

	France	Europe	World	Research
E9- Strongly support certain regional or local agricultural markets for as long as necessary			X	
E10- Limit the effects of speculation on agricultural markets		X	X	
E11- Implement ambitious programs for agricultural development in the poorest countries			X	
E12- Create an observatory to monitor and forecast the status of food commodities and world agricultural markets			X	X
Agricultural production:				
P13- Maintain the considerable agricultural production capacities of European farmers	X	X		
P14- Encourage a shift towards intensive ecological farming practices	X	X	X	
P15- Develop research on plant varieties (obtained by natural selection, genomic and transgenic production) and management of inputs				X

Tableau
Continued.

	France	Europe	World	Research
P16- Develop and produce seeds in regions of use			X	X
P17- Improve agricultural water management			X	
P18- Develop research on agroforestry systems			X	X
P19- Encourage freshwater aquaculture			X	
P20- Favour (non-intensive) livestock farming in developing countries			X	
P21- Control, even ban, first generation biofuels	X	X	X	
P22- Re-launch efforts to decrease pre-and post-harvest losses			X	
P23- Regulate international leasing and purchase of agricultural land			X	
Management of food crises:				
C24- Fight seasonal under-nutrition			X	
C25- Constitute regional and family food stocks			X	
C26- Reexamine the World Food Programme			X	

Tableau
Continued.