

Land Use and Food Security in 2050: a Narrow Road

Agrimonde-Terra

Chantal Le Mouël, Marie de Lattre-Gasquet,
Olivier Mora, eds



17. Options for Public Policies

Marie de Lattre-Gasquet

Introduction

THE AGRIMONDE-TERRA SCENARIOS demonstrate that the road to global food and nutrition security is narrow. If there is food insecurity at a global level, it means that a number of households are food insecure in a number of countries, and this might be a catalyst for major security problems and costly health issues at the local, national and regional levels. Two scenarios are clearly not able to ensure sustainable world food and nutrition security in 2050. In the 'Metropolization' scenario (both variants), where cities are fed at the expense of rural areas, some groups in rural areas can face undernutrition while in metropolises some people are over and poorly fed and face health problems. In the 'Communities' scenario, the deterioration in agricultural production performance creates a reduction in food availability at the world and regional level. In these two scenarios large groups of the population could be hit by undernutrition and even hunger, and this situation could lead to fights over food supplies, land and water within countries and even between countries. The hunger riots that took place during the 2008 food crisis are manifestations of what could take place before 2050 at a global level if the 'Metropolization' and the 'Communities' pathways develop. The 'Regionalization' scenario appears to be unsustainable in Africa, the Near and Middle East and India because of the 'food sovereignty' approach, which is unrealistic in regions where population growth is rapid. Undernutrition and hunger in these regions could lead to major international migrations and conflicts. With the 'Household' scenario, there are risks of instability in food supply availability when conflicts arise between interest groups, causing a sudden shift in stakeholder networks and alliances. Only the 'Healthy' scenario seems likely to meet the objective of world food and nutrition security in 2050 while managing resources in a sustainable manner.

A foresight exercise aims to inform policy-making and to provide vision at the service of action. After exploring probable futures of land use and food security, it is therefore appropriate to think about possible strategies and policies. The lessons of the process have therefore been translated into six general objectives regarding the issues and choices to be given priority over the medium term, irrespective of the scenario for the future; we also offer operational objectives for each general objective. No policy measures are proposed as these are nationally specific. Second, we propose a few objectives for policies for each scenario.

Whatever the scenario: six general objectives for policies

THERE ARE NO ONE-SIZE-FITS-ALL SOLUTIONS. Each region and each country should find its own pathway related to its past situation and ongoing trends. It needs to identify its own policies and its leverage points and their feedback loops to change pathways. However, there are 'no-regret' objectives, *i.e.* objectives that should be pursued whatever the scenario because of the importance of the challenge in order to avoid catastrophes.

I Objective 1: Building synergetic governance for land use and food security at different spatial scales

It is crucial to build global governance on land use and food security to prevent food crises, land grabbing and degradation, and to mitigate the effects of climate change. Several of the 17 interlinked and integrated Sustainable Development Goals (SDGs) of Agenda 2030 are particularly related to land use and food security. These are: achieving zero hunger (SDG 2), halting the spread of diet-related non-communicable diseases (SDG 3) while empowering women (SDG 4), having affordable and clean energy (SDG 7), mitigating climate change (SDG 13), and sustainably managing forests and reversing land degradation (SDG 15). They can only be accomplished if the existence and experience of the 570 million farms as well as the diversity of the supply chain actors are taken into account, and if all stakeholders recognize the limits of world resources and accept the need for healthier diets and stabilization of climate change and the necessary socio-technical transformation of agriculture as well as investing some of their profits for this transformation. It also implies focusing on systems, on qualitative variables and not only on food availability and the need to increase productivity (Bourgeois and Losch, 2017). Collective action and cooperation could give the issue of food and nutrition security the status of a global public good, as has been done for the environment (climate change and biodiversity). Efforts to reconcile science and society could be undertaken. Ongoing global initiatives and places for discussions are numerous, *e.g.*, Conferences of Parties, Codex Alimentarius, International Plant Protection Convention (IPPC), World Organization for Animal Health (OIE) and Committee on World Food Security. They must take into account a variety of positions but remain as independent as possible from lobbies, whether they are from the private sector or NGOs. Global initiatives have however two limits. First, although governments are involved in the discussions of these initiatives, they do not always implement their recommendations. Second, they could tend to promote uniform standards, but keeping diversity of action is very important because regional and national conditions and consumer and citizens' preferences often differ (OECD, 2016).

Therefore, it is also crucial to reinforce national governance of land use and food security with a wide range of stakeholders who can play multiple roles in land use and food security (*e.g.*, farmer and researcher, consumer and intermediary) (FAO/INRA, 2016). Furthermore, it is only by having policies built with participatory governance that unsustainable land

use and food insecurity can be fought. The continuum of participation in policies can take several formats such as the contribution to predetermined policies, consultation, cooperation and consensus-building. It means including a large variety of stakeholders so that the interest of a few stakeholders does not dominate over the others. Groups which have been hitherto excluded from public policies, for example representatives of landless farmers or smallholdings or of consumers' associations, should be included. They can learn how to professionally negotiate public policy projects for rural development and become 'transactional leaders' who are essential to the proper functioning of public policies, as has been done in countries such as Brazil (Massardier *et al.*, 2012). Participatory governance also means having a reliable and valid knowledge base of the past and present situations of land use and food security. It should include different knowledge sources, *e.g.*, expert and practical knowledge, in order to be socially robust.

But the national level is not enough because it is at the territorial level that most decisions on land use are taken. A territory is a geographical area within which there is "a set of social, economic, cultural and political processes that include systems of local or locally-involved players" (Vanier, 2009). They provide a framework for individual or collective social, technical, organizational and institutional innovation. The promotion of 'terroir' or origin-linked products is a striking example. Access to land, work, production and exchanges fit into a local system of social relations and forms of power, the original combination of which may foster (or on the contrary hamper) cooperation, coordination and information dynamics.

At each spatial scale, for the transformation to succeed, there must be a common understanding of the policies and plan, the roles of each stakeholder and the management of the process.

The toolbox designed by Agrimonde-Terra can be a help in the preparation of policies and strategies at the national and territorial levels (Box 17.1).

For objective 1, operational objectives are:

- Establishing and promoting links between policy makers, industries and services from the agri-food, energy, financial and trading sectors, farmer-based organizations, research organizations and support services.
- Improving commercial integration among farmers, merchandisers and processors within the agricultural value chain, including improvement in risk transfer, technology transfer, product development, logistics and market information transfer.
- Supporting the development of farmers' organizations and cooperatives, promoting farmer-based approaches aimed at enhancing the capacity of farmers' organizations in all spheres of their existence, especially in management and finance.

I Objective 2: Developing coherent and coordinated policies on land use and food security

Having coherent land use and food and nutrition policies that consider the five complementary, interlinked and dynamic dimensions of land use and the four dimensions

Box 17.1. Building national governance for land use and food security: The contribution of Agrimonde-Terra in Tunisia

In March 2015, the ability of Agrimonde-Terra's outputs to be used as a 'tool for dialogue' for the construction of national land use scenarios was tested in Tunisia. A two-day workshop was organized at the initiative of the Institut National de la Recherche Agronomique de Tunisie (INRAT) and part of the Agrimonde-Terra team, with the Syndicat des Agriculteurs de Tunisie (Synagri). Twenty Tunisians from the Ministry of Agriculture, the Ministry of Environment, agricultural development groups, farmers' associations, Bizerte agri-industrial hub and representatives of three development agencies participated.

The Agrimonde-Terra land use and food security system and assumptions were the basis for building land use scenarios for Tunisia. The following method was used:

1. A shared diagnostic of land use in 2015 in Tunisia. A retrospective analysis prepared by the Agrimonde-Terra team formed the basis for discussion.
2. Preparation of assumptions for the future using as a basis for discussion the retrospective analysis and the assumptions prepared by Agrimonde-Terra.
3. Construction of land use scenarios for Tunisia. These scenarios were specific to Tunisia but shared some similarities with the Agrimonde-Terra scenarios.
4. Comparison of the Tunisian scenarios and identification of the most important challenges.
5. Identification of policy objectives and measures that should be taken whatever the pathway, and leverages to shift to the most sustainable pathway.

In 2017, the report 'For a successful, sustainable and resilient agriculture. Strategic options for a new paradigm for agricultural and rural development' prepared by the Forum Agriculture and Rurality (PHARE), a think-tank led by the Institut National de la Recherche Agronomique de Tunisie (INRAT), and the Tunisian report of the Agricultural Transformation Pathway Initiative (ATPi) presented the Tunisian scenarios designed with the help of Agrimonde-Terra. They also used one of the scenarios as a basis for the identification of challenges and future objectives, and recommendations for actions.

In 2018, within the framework of a 'Twinning programme' financed by the European Union to support the Ministry of Agriculture, Water Resources and Fisheries and to strengthen its capacities for developing and implementing inclusive, participatory and long-term agricultural and rural policies, three training sessions on foresight and three training sessions on agricultural policy-making took place for the managers of the Ministry and related institutions. During the training sessions, the participants carried out a very rapid exercise about the futures of land use and food security in a Tunisian governorate. Participants were struck by their own capacity to imagine several possible futures and how these helped in proposing new policy objectives and measures.

Sources: de Lattre-Gasquet *et al.* (2017a); INRAT-PHARE (2017); Elloumi *et al.* (2017).

of food security, as well as the interconnections between the drivers of the land use and food security system, will contribute to the fact that food insecurity does not become a catalyst of global insecurity. Coherence between national policies and global governance, as well as between territorial actions and national policies, must be searched. At the national level, lack of coordination combined with limited economic resources tends to diminish the possible impact of interventions. Policy coherence implies integrating the multiple dimensions of land use and food and nutrition security at all stages of policy making to exploit positive synergies across policies to support food and nutrition security, to increase governments' capacities to balance divergent policy objectives and to avoid or minimise the negative side-effects and impacts of land use policies on food security.

Policy processes must be up to the task of managing complex land use and food security systems and serving the public interest instead of a particular interest. This means breaking out of the policy 'silos' with each policy having its own objectives and time scales, and having a more holistic approach with policy interventions which tackle diverse aspects of a problem simultaneously. It also means avoiding a 'dual policy approach' with, for example, on the one hand policies promoting the conventional intensification of agriculture and on the other social policies to fight poverty. Integrated land use and food security policies are required to overcome the biases of sectoral policies and the decrease in importance of rural development policies. Progress towards breaking out of silos can be achieved through discussions between representatives of various ministries and agencies.

To reach this objective of coordinated and coherent policies, four operational objectives are:

- Reconciling domestic policy objectives with broader international objectives, notably the Sustainable Development Goals (SDG). The SDGs involve significant challenges in terms of both domestic actions and responsibilities at a global level. A number of countries and regional institutions such as the European Union have been active in negotiations and planning the SDGs as well as other United Nations processes about climate change, but are not necessarily developing action plans that are congruent with the decisions taken. Improving policy coherence is a long-term process that requires strong political leadership (Gregersen *et al.*, 2016).
- Agreeing on a limited set of priorities, pursuing a reduced number of objectives but with simultaneous investment in infrastructure, skills, research and innovation, and defining steps towards the goal. This requires weighing the trade-offs among multiple objectives, anticipating the need for agility, looking for synergies and abandoning certain actions. A plan for transforming land use will not succeed if it tries to cover everything. It should focus on the changes that are most likely to impact food and nutrition security, therefore selectively focusing on the points of the system where small changes are likely to cause larger shifts. This means identifying goals on a limited number of crop and livestock value chains and working with stakeholders of the whole value chain (link with objective 1). It also means considering explicitly the trade-offs and communicating them.
- Extending agricultural policies to rural policies promoting all the functions and dimensions of family farming. This means recognizing that family farming has a production

function but also fulfils functions for society and territories. Agricultural production leads also to income generation and capitalisation, management of natural resources, shaping of landscapes, development of food systems, social relations in communities, relationships between generations and genders etc. (Bélières *et al.*, 2015). Production is also a territorialized action and the recognition of family farming also involves recognising its contribution to the creation and renewal of territorial resources (Bélières *et al.*, 2015). Also, better coordination of agricultural, trade, environmental, biofuels and food safety policies that currently buffer farmers from risk is necessary and could facilitate the integration of crops and livestock (Garrett *et al.*, 2017).

– Having evidence-based policies. Data should be used to comparatively assess costs and likely outcomes of different policies, as well as to redirect programmes where outcomes are not meeting targets.

I Objective 3: Promoting changes on both the demand and supply sides for transition towards healthy diets and reduced waste and losses

Attaining food and nutrition security for all, and especially for the most vulnerable households, involves a transition from current diets to healthier and more diversified diets, as well as a reduction in waste and losses at all stages of the food chain, from field to plate. The evolution of diets will vary according to the initial situations, but generally it means more coarse grains, legumes, fruit and vegetables, and less animal products in diets in most regions of the world, with the exception of Africa and India. It also means better quality products which are more nutritious and contain fewer residues from chemical agricultural inputs. On the demand side, public policies, including price and subsidy policies, food processing, storage and transportation norms, and education are essential to accelerate progress towards healthy diets and the reduction of consumption waste and losses. On the supply side, farming techniques and work organization should lead to improvements in the use of inputs and to crop diversification, while improving the quality of soils and water, enriching biodiversity and guaranteeing adequate and stable returns on investments. Changes should also target the reduction of production losses in the field and at the farm gate with minimal negative effects on the environment. Changes in processing (such as the choices made concerning technological processes, additives and ingredients, and packaging), marketing (distribution channels, improvements in labelling with regard to nutrition and the diminution of marketing pressure for food goods rich in energy, saturated fats, trans-fatty acids, free sugars and salt; gradual redrawing of products), waste treatment and secure contracts between farmers and buyers will also contribute to healthy diets and the reduction of waste and losses.

Agriculture and food related industries and services, and their technologies and products, have made a considerable contribution to food security, but negative impacts on health and the environment of a number of food products have now been identified. Despite repeated appeals by nutritionists for public action to curb the rise of obesity and non-communicable

diet-related diseases, few changes have taken place. Some individuals modify their diets, some industries change their strategies to take greater care of health and the environment as they see they can improve their short- and long-term gains, but there are still many obstacles to the implementation of policies favouring transition towards diversified and healthy diets and the reduction of waste and losses. Obstacles relate to the extent of individual and collective responsibilities, to the strategies used by transnational corporations to undermine policies aimed at the control and prevention of non-communicable diseases (Moodie *et al.*, 2013), to the complexity of implementing multi-sectoral policies (Swinburn *et al.*, 2015), and the difficulty of establishing a comprehensive framework to both protect and promote healthy diets (Vandevijvere, 2014).

Change agents, *e.g.* other farmers or people from the public and private sectors with whom farmers interact regularly and trust, play a major role in this evolution. They might provide knowledge, financial services, inputs or marketing services.

The operational objectives are:

- Producing data to provide detailed information about past and current diets, about waste and losses etc. to consumers.
- Setting up norms and standards for industry about the use of sugars and fats, use of energy and water, and packaging.
- Encouraging diversity in the organization of agriculture as well organizational innovations (*e.g.*, access to capital through microfinance, warehouse receipting and inventory credits, and cooperation and mutualizing of investments), behavioural changes (such as weather-proofing grain stores or thinking more carefully about discarding wholesome food), and technical changes (*e.g.*, storage, packaging, product stabilization and communication infrastructure) (Ingram *et al.*, 2016).

Objective 4: Improving the economic, environmental and social performance of cropping and livestock systems or redesigning them

The economic, environmental and social performance of cropping and livestock systems determines the impact of agricultural activities on revenues, food security and the environment and resources. Besides the current dominant conventional intensification path, which has demonstrated its strengths and limits, Agrimonde-Terra has analysed two alternative pathways for cropping systems – ‘Sustainable intensification’ and ‘Agroecology’ – and three alternative pathways for livestock systems – ‘Agroecological livestock’, ‘Livestock on marginal land’ and ‘Backyard livestock’ – with different combinations. These alternative systems are clearly subject to controversy; their agricultural and economic performance and their environmental and social consequences are very difficult to compare because they respond to different logics, with very different outputs and outcomes and a lack of retrospective data; they cannot be reduced to yield or input use levels. However, the five scenarios show that their implementation needs to be examined at the crossroads of four factors: knowledge and investment capacities of farmers and land access, changes

in food supply chains and markets, rural development and urbanization dynamics, and ecosystem constraints. The importance of these four factors varies between regions, but pathways for the transformation of agricultural systems are generally driven by factors of different economic sectors, both in rural and urban areas. The transformation of cropping and livestock systems, as a diversified mosaic of pathways, will be embedded into the current dynamics of the transformation of food chains, rural development and urbanization, household strategies and environmental changes and should be based on regional, national and territorial challenges.

Five operational objectives are:

- Promoting sustainable intensification and agroecology as efficient means for farmers to solve problems linked to input use, soil degradation, climate change, instability of production etc. This could be attained through a variety of actions such as supporting participative research and innovation on sustainable intensification and agroecological approaches and revisiting funding models of agricultural research; deepening farmers's knowledge and education; combining incentive public policies such as regulations, financial support, eco-certification and payment for environmental services (pest control, soil conservation, nutrient cycle and water regulation, biodiversity preservation etc.); supporting local seed production and management; developing metrics to address local context and system complexity in support of decision-making.
- Acting on a territorial scale to encompass natural resources, landscape and knowledge management, organization of local markets, etc and address challenges with local stakeholders.
- Building strong links with consumers in order to build broader coalitions in favour of healthy and environmentally friendly food supplies. This will involve alliances between the sustainable intensification, agroecology, organic farming, biodynamic and permaculture movements.
- Preparing for the digitalization of agriculture by setting up policies that ensure the fair sharing of the value generated by farm data, and setting up contracts that protect privacy, data ownership and data use.
- Abandoning policies that contribute to conventional intensification, such as policies that encourage the specialization of production, policies that create restrictions and fines regarding the presence of manure on cropland, subsidies for chemical inputs or biofuel mandates that inflate the price of individual crops for specific markets (Garrett *et al.*, 2017).

I Objective 5: Rethinking the organization of trade

The importance of trade and the roles of new actors require a rethinking of its organization. Even if only around 13% of agricultural production is officially traded, multilateral trade seems absolutely essential for national food and nutrition security because population growth and the expansion of food production occur at different rates in different geographic regions. International trading of agricultural and food products has changed significantly over past decades, following the liberalization of agricultural markets supported by the World Trade

Organization. It has increased and become far more competitive; new financial actors and intermediaries have emerged putting pressure on traditional actors; transport routes and harbours have become strategic for world security; norms and standards have also become strategic and heavily discussed at the World Trade Organization since tariff barriers have been put under strict discipline; world agricultural markets face significant distortions from interventions from a few governments; pests and diseases are increasingly spread through trade. In this regard, 'Healthy' and 'Regionalization', both scenarios involving more diversified and healthier diets, clearly show the key role that nutritional and environmental standards for the former and indications of origin for the latter could play in regulating multilateral trade towards high nutritional quality products or regional trade towards traditional products.

I Objective 6: Securing access to land for all types of farming structures and caring about rural development

All the above imply securing access to land for all types of farming structures and caring about rural development. Rural development will depend on the capacity to link up with urban and peri-urban areas and to attract younger generations to become active in farming or in agriculture-related activities. Policies and actions are necessary to secure access to land for all types of farming structures, to involve rural inhabitants in decision-making about land policy development at national and territorial levels, to protect the 'global commons', in other words the land that women, men, indigenous peoples and local communities traditionally use collectively, and to improve legal frameworks for contracts.

Four operational objectives are:

- Reinforcing land governance through a combination of interventions integrating tax policies, regulatory provisions (cap on leasing and sharecropping to limit land rents, limitation of land use etc.), and the creation and/or reinforcement of ad hoc mechanisms to facilitate inter-generational transfer outside the family context of holdings, limiting land concentration and securing access rights to land resources (Bélières *et al.*, 2015)
- Adopting land tenure systems that secure access to land for all, but with a special attention to youth and women; developing a legal framework and setting up credit for easier access to land and capital investments. Changes in land tenure systems can be achieved through a variety of means such as the inclusion of customary and traditional use rights in national legislation, changes in inheritance law, property rights and land titling, facilitating training and access to credit. A large diversity of actors needs to be involved, and farmers' organizations, municipalities and local councils have a role to play.
- Improving the working conditions and income of agricultural workers. Today, many hired agricultural workers – many of whom are women – are still employed on a seasonal basis, paid at the end of the day or for piece work. Working conditions are often difficult and job contracts non-existent. Seasonal jobs attract migrants from poor regions but sometimes immigration restrictions prevent seasonal workers from returning to their home country in time for harvest. To overcome labour shortages, some agricultural structures adopt practices such as the use of chemical herbicides or mechanization – even

in countries with high unemployment – leading to health problems and/or soil degradation. Policies should protect agricultural workers and set up a legal framework for job contracts and remuneration levels. The latter should be attractive and, if possible, comparable to other economic sectors. Developing health, education, transport and cultural services in rural areas would also contribute to this objective.

– Setting up an integrated information system and monitoring mechanism on farm structures. The World Census of Agriculture collected by the United Nations Food and Agriculture Organization (FAO) provides data at national scale, but data it is difficult to compare which has contributed to policy neglect of agricultural structures (UNCTAD, 2015). The monitoring of changes in agricultural structures is very important. Further work should be carried out at the international level to better apprehend various drivers of change in farm structures, and be able to compare and monitor them.

Specific policies per scenario

THE SIX OBJECTIVES which have been presented in the previous section should be sought whatever the scenario. In each scenario, specific policy objectives will be pursued and we present here three possible policy trends for the 'Metropolization', 'Regionalization', 'Communities' and 'Households' scenarios. We present important leverage points to shift towards the 'Healthy' pathway which contributes most to reducing undernutrition and overnutrition.

I Policies in the 'Metropolization' scenario

In the 'Metropolization' scenario, there is an alliance between multinational corporations, investment funds and international institutions; markets tend to rule; governments' roles are weak but they will nevertheless enact policies. As many farmers will be integrated within the agri-industrial sector, favour specialization, have access to capital and use highly developed machines and genetic resources, public action should, on the one hand, concentrate on the economic advantages of efficiently using machines, energy and inputs and diversifying production. On the other, public policies should focus on farmers' responsibilities towards consumer health and environmental sustainability. Public policies should also encourage the funding of public research and training programmes by the private sector. Secondly, policies should aim to limit the impacts of diet on health because of the cost to the economy of diet-related non-communicable diseases. If the products sold by agri-food companies overly contribute to diet-related non-communicable diseases, at some point in time these companies will have to pay for these costs. Thirdly, public policies should contribute to reducing the levels of risk faced by poor urban people and marginalized farmers in order to avoid riots.

I Policies in the 'Regionalization' scenario

In the 'Regionalization' scenario, States join in large regional blocs and are therefore ready to share their power with other partners. First, public policies should focus on

meeting the objective of 'food sovereignty and subsidiarity' at the regional bloc level by encouraging centralized land use management and supply policies with a diversification of production. The regions should be able to deal with scarcities, *i.e.* to limit the use of certain products that cannot be produced in the region both on the demand and the supply side. This will require strong governance, organization and support for intra-regional trade through transport, infrastructure, norms, traders' organizations and protectionism. Secondly, agricultural policies should on the one hand encourage all kinds of market-driven opportunities for farmers. On the other, within the region, a mechanism should be set up to help the territories which have limited land or high population density. Thirdly, policy transparency, cooperation and coherence should be encouraged.

I Policies in the 'Communities' scenario

In this scenario, the political and economic context is fragmented and therefore governments have few means for policy-making. Governance takes place more at the local level, not necessarily through policies. Communities develop their own priorities and rules.

I Policies in the 'Households' scenario

The State has little involvement in this scenario. Nevertheless, the numerous groups which are active suggest initiatives that can be later used as the basis of policies. A first factor for the success of multi-active and mobile households will be the agricultural transformation plans led by ad hoc networks which will differentially target agri-food systems and geographic areas. This should be accompanied by laws relative to labour in order to facilitate multi-activity. A second factor of success will be to give farmers the opportunity to raise their household income through improving productivity (instead of increasing volumes), cultivating high-value crops, getting involved in downstream processing and developing non-farm activities. Policies should seek to ensure access to food for all and stability of production. Thirdly, products will be exchanged in many different ways and policies should facilitate the variety of modes of exchanges and trade.

I Leverage points for the 'Healthy' scenario

In the 'Healthy' scenario, States cooperate among themselves and with businesses, civil society organizations and international institutions, and all these actors have a strong commitment towards the mitigation of climate change, regulation of the nutritional quality of food products, health and the shift to a green economy. The role of governments is very important and coherent with international action. Policies promote sustainability and equity instead of relying purely on the market (Godfray *et al.*, 2010). This scenario requires important changes in governance and vision (de Lattre-Gasquet *et al.*, 2017b).

To facilitate the evolution of a complex system, Donella Meadows (1999) proposes accepting the complexity and looking for leverage points in the system, instead of simplifying the system and neglecting the study of causal links.

First, politicians should be flexible, unattached to paradigms and have the ability to offer a vision. The vision should promote 'land uses for food quality, healthy nutrition, and stabilized climate change', which requires collaboration between economic, social and environmental actors for a sustainable world, arbitration between food production and mitigation of climate change, crop and livestock systems, making the best use of productive and human resources at the local level, creation of jobs in the agri-food sectors, and food and nutrition security for all households throughout the year. Also, the issue of food and nutrition security should be given the status of a global public good, as has been done for some environmental issues (climate change and biodiversity). They should also understand that the shift from the current pathway to this new pathway will require time, commitment and investment. Very few actors in the economic sector have yet understood that the shift towards land use for food quality and healthy nutrition can be a source of revenue while being socially and environmentally responsible, and politicians must convince them and support them in this radical move.

Policies should be pragmatic, take into account the limits on resources, the shift to a green economy, the role of soil organic matter and the need for quality food products, but also the complementarity between the public and private sectors. Public investments should be designed to catalyze private sector engagement towards the vision, to encourage an extremely efficient and limited use of natural resources, integrate sustainable agriculture into private and public education and extension programmes (FAO/INRA, 2016), and promote social and environmental responsibility.

The rules of the system (incentives, punishments and constraints) should limit the consumption of non-healthy products by reducing the accessibility and availability of foods high in saturated fats, salts, sugars and refined carbohydrates (especially ultra-processed products) via regulations and taxes. Policies should encourage the consumption of healthy products by increasing accessibility to diverse foods rich in fibre and nutrients (legumes, fruit and vegetables, whole grains, livestock and fish, including farmed fish) and by subsidizing fresh produce.

For the shift towards the 'Healthy' pathway, policies should also address information flows. Adding information is a powerful means of intervention, usually easier and cheaper than rebuilding physical infrastructure. For example, giving more information to consumers about how food is produced could lead to a change in diets which, in turn, could help change the way food is produced. Public agricultural research should target questions that the private sector will never tackle because answers will not generate profits, *i.e.* data collection and analysis, land use in remote areas and poor quality soils, analysis of the economic and social performance of cropping and livestock systems, and externalities, especially those related to carbon. Questions of intellectual property should also be carefully considered.

Finally, special attention should be given to feedback loops in order to reinforce positive impacts and limit negative ones. Policies should carefully consider the time required for changes, in order to avoid underestimating or overestimating the time necessary. The

final leverages to be considered by policy makers should be stocks, flows and numbers. These mechanisms are often targeted by policies, but interventions on them produce only minimal changes and do not change behaviours.

Conclusion

FORESIGHT CAN IMPACT POLICY-MAKING IN VARIOUS WAYS. It can inform policy by detecting emerging threats, identifying new opportunities, generating insights about possible futures and identifying policies that should be adopted without regrets; it can support policy definition by translating outcomes into specific objectives (Da Costa *et al.*, 2008; Cook *et al.*, 2014). This is what has been done in this chapter. Public policy objectives that are valid regardless of the scenario have been identified as well as public policy objectives specific to each pathway. When carried out at the national or territorial level, foresight can contribute to reconfiguring the policy system in a way that makes it more apt to address long-term challenges and facilitate policy implementation by enhancing the capacity for change through the participative process (Da Costa *et al.*, 2008). This requires an entry point into the political system, a promoter and a sponsor. Time is also needed because policy cycles last four to five years whereas foresight has a long-term horizon (Cuhls, 2015).