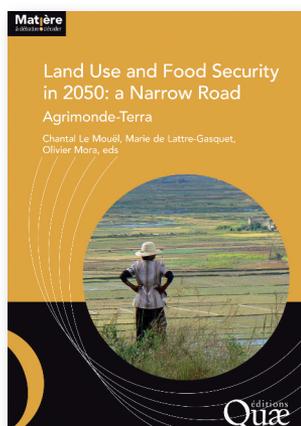


Marie de Lattre-Gasquet

Land use and food security in 2050: a narrow road – Agrimonde-Terra

In 2018 CIRAD, a French research centre working with developing countries to tackle international agricultural and development issues and INRA, the French public research institute dedicated to agricultural science, launched a foresight process relating to 'land use and food security in 2050', called Agrimonde-Terra¹. This process mobilized around 80 international experts in thematic workshops, and a Scenario Advisory Committee to explore the complex interactions between land use and food and nutrition security. Five scenarios for 14 world regions were produced, drawing lessons on land use and food security and making a range of policy recommendations.

Agrimonde-Terra is now a tool for dialogue and learning for use by decision-makers, food producers, non-governmental organizations and researchers. By using the Agrimonde-Terra method, scenarios for land use and food security in Tunisia² were successfully prepared and, following this, on-going trends relative to land use in sub-Saharan Africa³ have been identified.



Scenarios: changes in land use and their consequences for food security

The first scenario "Land use driven by metropolization" (**Metropolization**) links the development of megacities at a global level with a nutrition transition led by global agri-food companies selling ultra-processed foods. This scenario is seen in a global context of development through market forces and rapid climate change, leading to the marginalization of small farmers.

The second scenario "Land use for regional food systems" (**Regionalization**) relates to the increase of medium-size cities and their networking with rural areas to the emergence of regional food systems. These systems are based on family farming and traditional foods, and a set of regional agreements.

2018 Agrimonde-Terra

The **third scenario** “Land use for multi-active and mobile households” (**Households**) links strong individual mobility between rural and urban areas and the development of farm and off-farm employment, to the emergence of hybrid diets. This scenario is based on traditional and modern value chains in a globalized world, where family farms and cooperatives are major actors in land use.

The **fourth scenario** “Land use for food quality and healthy nutrition” (**Healthy**) assumes that due to the increasing cost of malnutrition, a radical move towards healthy diets occurs. This move is fueled by global cooperation and public policies in the context of climate change stabilization and implies that there is a re-configuration of the agricultural system which is backed by new alliances between stakeholders.

The **fifth scenario** “Land as commons for rural communities in a fragmented world” (**Communities**) assumes that in a context of repeated multiple crises, development based on small towns and rural communities occurs. This focus is then placed on managing common property in agriculture in order to ensure food security.

The scenarios listed above do not have the same consequences on the five dimensions of land use (listed below) nor on the availability of food. A comparison between them therefore helps to draw lessons for the future.

Lessons learnt include the point that unless there is a major increase in the economic and social performance of food systems in some regions, notably in India and sub-Saharan Africa, ensuring world food availability in 2050 will involve expanding the world’s agricultural land area to the detriment of forest areas, with major differences between scenarios. It also demonstrates that trade of agricultural products will play a key role in improving world food access in 2050, and that increasing food and nutritional diversity towards healthier diets in 2050, while limiting agricultural land expansion and deforestation will require greater diversification in cropping and livestock systems.

To achieve healthier diets in 2050, more diverse cropping and livestock systems are needed.

At least two scenarios are clearly not able to ensure sustainable world food and nutrition security in 2050: the first “Metropolization” scenario and the fifth “Communities” scenario. Furthermore, two scenarios have ambiguous results: the “Regionalization” and the “Households” scenarios. Only the “Healthy” scenario seems likely to be able to meet the objective of world food and nutrition security in 2050 (reducing not only overnutrition and related diseases, but also undernutrition). This could be achieved at the cost of a limited expansion in agricultural land area at the world level. However, in this scenario, there are potential tensions between the objectives of food security and climate change stabilization, unless agroforestry and farming practices relating to agroecology and sustainable intensification are adopted.

Main novelties of Agrimonde-Terra

- The **five complementary and interlinked dimensions of land use**: agronomic potential, access to land, degree of intensity of land use, distribution of land between different uses and services provided by land. They impact the four dimensions of food and nutrition security at different scales ranging from the household to global level.

- The **variety of alternative assumptions for 2050 for the direct drivers** (urban-rural relationships, farm structures, cropping systems, livestock systems and forest systems) and **the external drivers** (global context, food diets, and climate change) of land use change, the **five scenarios and the method for building them**. Three scenarios (Metropolization, Regionalization and Households) are based on current competing trends identified in most regions of the world. Two scenarios involve potential breaks that could change the entire land use and food security system (Communities and Healthy).

- The **quantitative assessment of the scenarios** with the GlobAgri-AgT biomass balance model. Land-use changes as well as changes in domestic production and international trade of each agri-food product in each region between the initial situation and 2050 are the outputs of the model and they are used to assess the ability of each scenario to ensure world food availability: agricultural land area expansion and deforestation suggest increased tensions over land, which in turn put into question the food availability equation at the world and regional level.

- The **identification of levers and policy recommendations**: Changing the course of ongoing trends will require systemic transformation, strong and coherent public policies across sectors and scales, and consistent actions from a wide range of actors.

The healthy scenario combines ideas promoted by IAASTD

The triggering element of the Healthy scenario are the costs associated with diet-related non-communicable diseases and the consequences of malnutrition on public health. Policy measures to shift consumption patterns to healthier diets are aligned with international measures to fight climate change. Global soil improvement policies lead to the rehabilitation of degraded land for agricultural use and carbon storage. National states and urban authorities shaped more inclusive development processes linking rural to metropolitan areas, improving transport and communication infrastructures, land planning and favoring efficient food value chains.

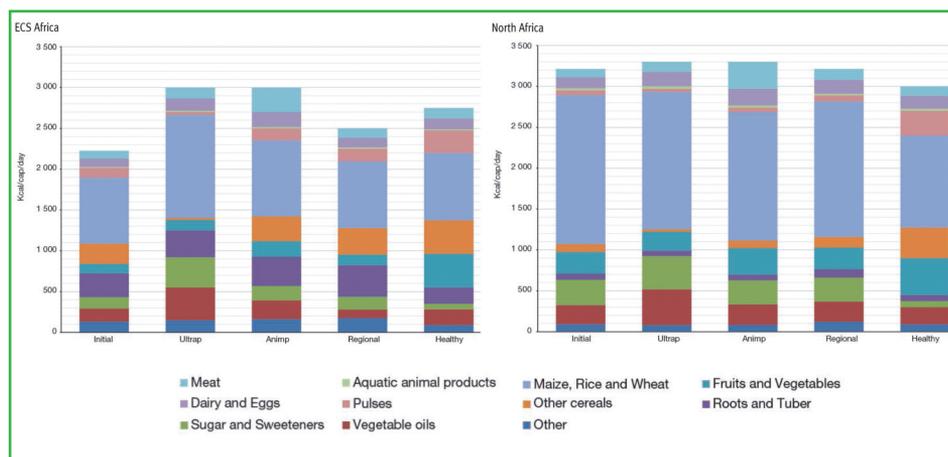
Getting healthy food requires certain types of cropping systems. These include sustainable intensification (i.e. intensification of production combined with the reduction of environmental impacts, input substitution or maximizing input efficiency thanks to new technologies) and/or agroecology. In addition, specific

types of livestock systems (i.e. agroecological livestock in synergy with agriculture and urbanization, and livestock on marginal land) and farming structures (co-operatives, and resilient farms embedded in urban processes) are key.

Nutrition and health, meat consumption

Food diets are the results of food transition patterns, in terms of the types of products consumed, food supply chains, government food policies, and health issues, notably over nutrition and undernutrition. Two assumptions on the futures of diets are based on increased consumption of animal products (Transition to diets based on ultra-processed products, and Transition to diets based on animal products with a shift from ruminant meat to poultry); in two assumptions (“Healthy diet based on food diversity”, and “Regional diversity of diets and food systems”), there is a reduction in meat consumption, except in Africa and India where current level of consumption is below WHO recommendations.

Quantitative hypotheses induce very different changes in food diets from 2010 to 2050 across the regions (see figure below). In India and eastern, central and southern Africa (ECS Africa), all pathways involve an increase in the daily calorie availability per capita. As a sharp increase in population is also expected in both regions (especially in ECS Africa), this means that food consumption will increase significantly under all pathways. In addition, all pathways result in a rise in the share of animal products in diets (meat, dairy and eggs).



Food diets in 2010 (initial) and in 2050 under the different food diet pathways in various eastern, central and southern (ECS) Africa and in West Africa.⁴

Industrial agriculture and small scale farming, land grabbing, multi-functionality, women

IAASTD debunks the myth that industrial agriculture is superior to small-scale farming in economic, social and ecological terms and argues for a recognition of the pivotal role that small-scale farmers play in feeding the world population. Based on analysis of past and on-going trends, Agrimonde-Terra considers the situation is more complex, and has identified six pathways for farm structures. The first one is considered “industrial agriculture” and named “Hit-and-run agro-investments”, i.e. large agro-projects raising financial funds, hiring labor and farmland, renting or grabbing land. Small and family farming can be varied. They can be: “Independent farms commercially dependent”, i.e. small or large scale family farms contracting with industrial enterprises for collection, processing and marketing of standardized products; “Farms producing goods and services to surrounding communities”, “Agricultural cooperatives emphasizing quality”, “Resilient farms embedded in urban processes”, and “Marginalized farms for livelihood survival.

For each scenario of Agrimonde-Terra, consequences of land use on ecosystem services have been appraised. Multi-functionality is one of the services provided by land in the “Communities” scenario. There is collective land management to

Agroforestry and farming practices that improve carbon storage and soil quality can provide healthy diets and mitigate climate change at the same time.

increase the services land provides. The focus is placed on the multifunctional nature of the territory, with land contributing to the supply of biomass for energy, animal feed and materials, and foodstuffs, based on a reinforcement of biodiversity in the territory. The regulating and cultural services of the ecosystem are also enhanced. In certain regions, farmers receive payments for the non-production services they provide.

IAASTD and Agrimonde-Terra insist on respecting the basic rights of women, especially in rural areas in Asia and Africa.

Analysis of past and on-going trends shows that the situation of women is particularly bad as far as access to land is concerned. The worrying situation of women in labor (lower salaries), in economic and social decision-making processes, etc. is underlined.

Climate, energy, agrofuels, bioenergy

Like IAASTD, Agrimonde-Terra considers that climate change is a driver of land use change. The “Healthy” scenario involves strong commitment to mitigate climate change, which requires healthy diets based on food diversity and lower meat consumption in some regions, carbon storage in soils, the production of renewable energy and the maintenance of world forest cover. There are potential tensions between the objectives of food security and climate change stabilization, because of increased competition for land between agricultural and forestry uses. Agroforestry and farming practices that contribute to improved

soil quality and the storage of organic carbon in soils (thus yield potentials) could be very interesting options in this case, since they simultaneously work towards the objectives of food security and climate change stabilization.

Agroecology and sustainable intensification

Agroecology is one of the four hypotheses for the future of cropping systems. It is essentially based on the diversification of crops (including agroforestry) and/or the coupling of crops and livestock, which most often requires a complete redesign of the production system. Yield levels will depend on the characteristics of these systems, which are highly diverse. Sustainable intensification is another type of cropping system that can lead to the Healthy scenario.

Food sovereignty, trade and markets, food speculation

In Agrimonde-Terra, the "Regionalization" scenario is based on a political and economic context of regionalization: states join in large regional blocs to face financial crises, unemployment, pollution, high rates of non-communicable diet-related diseases together; they apply a principle of "food sovereignty and subsidiarity" at the regional bloc's level based on regional food supplies, supported by businesses and civil society organizations. In this scenario, import coefficients of regions are exogenously reduced in order to figure out the inter-regional trade impact of the development of supranational regional blocks as well as the implementation of the 'food sovereignty and subsidiarity' principle.

In the future, one of the key options for public policy will be to discuss the global organization of trade due to recent important changes increased international trading of agricultural and food products, new financial actors and intermediaries, new transport routes and harbors, new norms and standards, spreading of pests and diseases, etc.

My most keenly desired policy change

I wish that policy makers, in tandem with a range of actors including producers, consumers and civil society organizations, education and research institutions and businesses would develop a common, integral and integrating vision for their country, that fits their responsibilities in facing global challenges.

Preparing this vision would help policy-makers transcend on-going paradigms and make them consider "the future as something that we create or build, rather than as something already decided"⁵. The discussions and work necessary to develop a new vision would contribute to changing and empowering individuals as well as groups. It would also help to develop an awareness of their past and their present situation, offering a better understanding of the system and its complexity, and a clear description of what they want.

There is no given pathway to food and nutrition security while simultaneously addressing other major challenges, notably climate change, biodiversity preser-

vation and energy transition. The scope of the challenge is complex, with many overlapping and interlinked issues that cut across sectors, territories and actors; changing the course of ongoing trends requires systemic transformation, public policies and consistent action from a wide range of actors. It requires a common vision. There are a number of on-going initiatives at territorial or national levels that support this vision, policy-makers must listen to these and take them into account.

Endnotes

- 1 Le Mouël C., de Lattre-Gasquet M., Mora O. (eds) (2018), "Land Use and Food Security in 2050: a Narrow Road", Agrimonde-Terra, Ed. Quae, <https://agritrop.cirad.fr/588816/1/ID588816.pdf>
- 2 de Lattre-Gasquet M, Moreau C, Elloumi M, Ben Becher L. 2017. Vers un scénario « Des usages agro-écologiques des terres pour une alimentation diversifiée et de qualité et un système alimentaire territorialisé » en Tunisie en 2050. OCL 24(3): D306.
- 3 See chapter 15 and de Lattre-Gasquet M. et Giordano T., 2019. Quelles perspectives pour l'agriculture et la sécurité alimentaire en Afrique subsaharienne en 2050? Réalités Industrielles, août 2019, p. 50-56.
- 4 Source: Le Mouël et al., 2018, Figure A2.1, p.387-388
- 5 de Jouvenel H., 2004. *An invitation to foresight*. Futuribles, Paris, 90 p.



Marie de Lattre-Gasquet is a researcher at CIRAD and was previously advisor for strategic foresight. Starting her career at ISNAR she joined CIRAD in 1988. She was a coordinating lead author during the IAASTD project, participated in the working groups and committees of the CGIAR, Agropolis, IFS, the EC, and is now vice-chair of Futuribles International. She has also worked at the French National Research Agency (ANR) and the CGIAR system office. Marie holds an MBA and a PhD in management and economics.