Subversive Future Seeks Like-Minded Model: On the Mismatch between Visions of Food Sovereignty Futures and Quantified Scenarios of Global Food Futures

*Yashar Saghai**

Will we, by 2050, be able to feed a rapidly growing population with healthy and sustainably grown food in a world threatened by climate change, water scarcity, biodiversity loss, environmental degradation, and systemic crises? There are too many uncertainties for us to predict the long-term evolution of the global agri-food system. What we *can* do is explore a wide range of futures in order to inform our public debate on the future of food; to anticipate the effects of economic development, trade rules, population growth, and other drivers of change on food security, hunger, and malnutrition; and to make policy decisions about trade and investments in desirable agricultural practices and sustainable technologies.

The tool of choice for approaching uncertain futures is to create scenarios—story lines that vividly describe what different futures could look like—and quantify them to get numerical estimates of how different aspects of the global agri-food system might evolve under different hypotheses (for example, low or high

*I would like to thank Michiel van Dijk, Eric Kemp-Benedict, Kasper Kok, Olivier Mora, Antonio Onorati, and Detlef van Vuuren; participants at the Scenarios Forum 2019, held at the Josef Korbel School of International Studies at the University of Denver; and audience members at the colloquium series hosted by the Department of Philosophy of the University of Twente in the Netherlands for helpful discussions. This research was partly funded by a grant from the Stavros Niarchos Foundation at the Johns Hopkins Berman Institute of Bioethics.

Ethics & International Affairs, 35, no. 1 (2021), pp. 51–67.

doi:10.1017/S0892679421000071

population or income growth). Such quantification is usually done with computer simulation models.

These scenarios are not mere thought experiments. Governments and international agencies rely on these quantified global food futures scenarios to make policy decisions. Scenario analysts and modelers are charged with creating a wide range of plausible, relevant, contrasted, and challenging scenarios. To be relevant, these scenarios cannot disregard visions of food futures and solutions to the current and future global agri-food crises that different social actors advocate. For instance, there are scenarios of technology-driven sustainable intensification, a solution that many experts support. Given that, we would also expect to see among the many scenarios produced over the last twenty years the future advocated by the food sovereignty movement, which claims to represent roughly two hundred million self-described "peasants" (small farmers) worldwide. This movement defends a vision of the future based on relocalized, sustainable, and just agri-food systems, self-governed through direct and participatory democratic processes. It therefore challenges the very foundations of the current global agri-food system and its reliance on international trade and large private and public players. It intentionally repoliticizes the agri-food problem. It is not a fringe movement; it successfully lobbied for the adoption by the UN General Assembly of the United Nations Declaration on the Rights of Peasants and Other People Working in Rural Areas (UNDROP) in December 2018, which explicitly mentions food sovereignty.

Despite this achievement, food sovereignty is conspicuously absent from quantified scenarios of global food futures. More surprising yet, members of the community of scenario analysts and modelers, and members of the food sovereignty movement (and allied academic communities) do not engage with each other. Yet both groups discuss the future of global food with policy-makers and international institutions such as the Food and Agriculture Organization (FAO). The goal of this essay is to inquire why this is the case, as a first step toward mutual engagement and the potential co-creation of food sovereignty quantified scenarios.

To do this, I will first explain the origins of the food sovereignty movement and what it stands for. Next, I will offer an introduction to quantified scenarios of global food futures, before arguing why I think the absence of quantified scenarios of food sovereignty is troubling. Then, I will identify obstacles to the creation of food sovereignty scenarios by examining two such attempts.

Given how divisive and politically charged the debate over food sovereignty is, I want to take a step back and explain my motivation for discussing the issue in this manner. *I am not a food sovereignty defender*. I am a philosopher who works on food ethics (where food sovereignty is widely discussed and gathers a lot of support) and a practicing futurist involved in the creation of scenarios. I also collaborate with modelers who quantify food scenarios. My goal is to understand what stands in the way of creating food sovereignty quantified scenarios, because the representation of civil society voices in scenarios matters to me and because I am convinced that such scenarios would stimulate our collective deliberation on plausible and desirable food futures. This essay is intended to be as much a scholarly contribution as a form of diplomatic mediation.

What Does the Food Sovereignty Movement Stand For?

Food sovereignty is not just an academic concept; rather it is a banner designating the demands, rights claims, values, and vision *in the making* of small farmers engaged in struggles in local contexts and in the international arena. This is why we need to look at the history of the food sovereignty movement to understand what it stands for.

The movement emerged in the 1980s and 1990s in Central and Latin America in reaction to structural adjustment policies promoted by international organizations in developing countries.[1] These policies included deregulation, the privatization of public services, the adoption of modern monocropping, a shift from local markets to agroexport, and the opening of markets to foreign investment. These policies disrupted local markets and provoked a profound crisis among small farmers. Agrarian movements organized against market dependency and contested the power of transnational corporations and international institutions, such as the World Bank and the International Monetary Fund.

The movement crystallized in 1993 with the creation of La Via Campesina (LVC)—an umbrella transnational entity grouping agrarian organizations around the globe (including but not limited to indigenous populations). Its members are smallholding family farmers, farm workers, landless farmers, and medium-sized farmers who practice low-input agriculture and are profoundly attached to nature, and their land and cultures. LVC uses the term "peasant" ("campesino" in Spanish and "paysan" in French) to designate its members as a whole and their valued way of life.

LVC gained visibility in 1996 during World Trade Organization meetings when its members opposed the inclusion of agriculture in free-trade negotiations. This is when LVC started using the term "food sovereignty" to designate its demands, values, and vision. Although in the 1980s the term had been used to refer to state sovereignty and protectionist policies, LVC members reappropriated it and changed its meaning, detaching it from its statist origin.

Food sovereignty was, first of all, a rallying cry for an alternative to economic globalization and the "food security" discourse promoted by the FAO and other international agencies. Its opposition to economic globalization included concerns about free-trade policies and the consolidation of a global agri-food system dominated by a few transnational players with the power to decide what should be produced, how, and at what price. At the time, food security was roughly understood as people's permanent *economic and/or physical access* to food that is sufficient, safe, and nutritious. LVC challenged this notion of food security on the grounds that simply having access to food, or being able to purchase it, is compatible with disrupting local agricultural production systems (through dumping aid or imports) and destroying related cultural practices. LVC activists perceived food security as obscuring *political* questions that needed to be front and center: Who controls the agri-food system? Who decides what to produce and how to produce it? Who sets food prices? Who owns land? How important are the cultural, social, and symbolic values of food—and of farming as a way of life—in contrast to its nutritional value?

Today, LVC claims to represent 182 organizations in eighty-one countries, comprising around two hundred million peasants.[2] It is thus not surprising that what the food sovereignty movement stands for keeps evolving. Over the years, the more positive demands of food sovereignty, beyond opposition to globalization, have gained prominence through grassroots experiments. We can now understand the demands of this movement in modular terms: some demands, such as land reform, are relevant in certain countries but not others. Finally, the movement has followed a strategy of what Priscilla Claeys calls "subversive institutionalization,"[3] lobbying for the integration of a right to food sovereignty into national constitutions and laws (in Bolivia, Ecuador, Egypt, Mali, Nepal, Senegal, Venezuela) and international human rights (see below).

A simple characterization of what the food sovereignty movement stands for is challenging: there are many definitions of food sovereignty and attempts at

synthesis are contestable interpretations.[4] I therefore cautiously propose the following definition:

> Food sovereignty is the right to direct and participatory democratic control over small-scale, largely autonomous, and relocalized agri-food systems based on: (1) sustainability (agroecology or organic farming); (2) social justice; (3) gender equity; and (4) respect for cultural diversity, nature, the value of food, and the peasant way of life. It is also the process that leads to fully realizing that right and vision of the future.

This definition tries to capture some core elements of food sovereignty, correct some misunderstandings, and bring to light underdetermined elements. Food sovereignty is not complete autarky, full self-sufficiency, or dogmatic localism. Twenty years of discussions have made it clear to food sovereignty activists and scholars that extensive material and political autonomy cannot be universally achieved at the local level. The adequate scale lies somewhere between the local and the national, especially in "microregions" (ecological-social-geographic food sheds), which exist below the national level. "Macroregions," which group several countries together, are excluded for ecological and political reasons. For instance, Western Europe is a macroregion but not an ecological zone. Direct and participatory democracy might be possible in a country like Iceland but impossible in India.

Scale also matters because the major sources of ideological inspiration for food sovereignty activists are anarcho-syndicalism, eco-communalism, and left-libertarianism. These ideologies favor autonomous political communities resisting state power and are in tension with the more state-centric commitments of some LVC members who come from a Marxist tradition. Hence, the question, Who is the sovereign? is one of the most disputed among food sovereignty activists and scholars: Is it the peasants, the food producers and consumers, the peoples, or the residents of nation-states?[5] These ideological tensions explain the lack of agreement on what an economic system replacing capitalism and its focus on economic growth would look like.

The definition of food sovereignty I offered stresses a tension between procedural demands of democratic decision-making and substantive normative constraints on the outcome of such deliberation. Thus, organic farming or agroecological approaches are acceptable, but not conventional farming, industrialized processing, or technology-driven sustainable intensification. The latter is rejected because it creates epistemic, material, and financial dependencies between peasants and technology developers.

To sum up, the food sovereignty movement promotes certain demands, values, and rights claims, which point toward a vision of the desired future. This vision has distinctive characteristics but is not fully specified and has internal tensions between procedural and substantive demands.

What Are Global Food Futures Quantified Scenarios?

As I mentioned in the introduction, the long-term future (for example, thirty years from now) of a highly complex global agri-food system composed of many interacting subsystems cannot be known with certainty or even probability. Complexity undermines prediction and forecasting. Components of current agri-food systems include production, storage, transport, processing, packaging, marketing, trade, sale, distribution, consumption, waste systems, and research and innovation. In addition, the global food system is made up of a large number of interdependent national and regional food systems. Each interacts with the environment (biophysical systems) in ways we do not fully understand.

Although prediction and forecasting are impossible, we can decrease uncertainty by exploring a wide range of "plausible futures," that is, futures we have reason to believe *could* happen, though we cannot say how likely they are.[6] The tool of choice for nonpredictive, exploratory anticipation is the creation of narratively rich scenarios that vividly depict a future world. According to a classical definition, a "scenario is a story with plausible cause and effect links that connects a future condition with the present, while illustrating key decisions, events, and consequences throughout the narrative."[7] The scenario-building process can be expert led or participatory and inclusive.

Participants in an exploratory scenario-creation process start by analyzing the global agri-food system and how its components interact. They identify drivers of change for the question at hand. In studies on food security, the main drivers are population growth, income growth, technological change, poverty and inequality, food waste and food loss, dietary patterns, land-use change, biofuels, urbanization, and climate change.

Next, participants select several variables that generate strong uncertainties and give them at least two values that describe how they could evolve. For instance, a recent study identified sustainability (lifestyle and the use of natural resources) and (in)equality as two major sources of uncertainty for global food security. Then, a matrix is created with the two variables and their values (low-high) to create four possible futures (figure 1).[8]

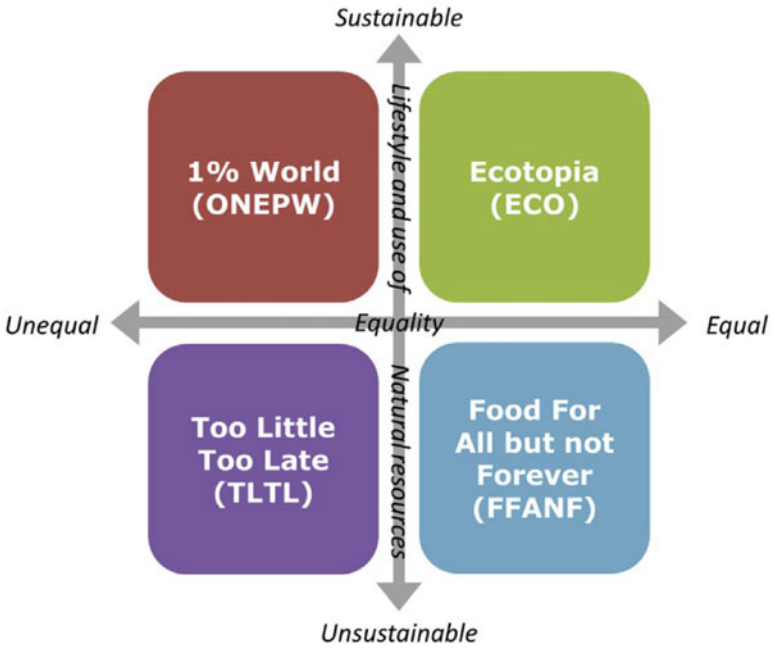

Figure 1. FOODSECURE scenario matrix.[9]

The use of the two-by-two matrix is common but not obligatory; there are multiple ways of creating the scenario space and selecting the main features of one's scenarios. Some techniques are intuitive, while others follow a specific procedure to identify the scenario space. Typically, a set of three to six possible futures is selected and turned into scenarios. Scenarios always come as a *set* since what matters is how different (or *contrasted*) they are.

The matrix produces skeletons of futures that are then fleshed out into narratives of about one to ten pages. The narratives describe in detail those future worlds and the path that leads to them. At first, these descriptions are purely qualitative to allow participants to fill in the blanks creatively and make the future concrete. The story line goes through multiple drafts, relying on the judgment of contributors, before introducing quantification.

The quantification step allows participants to adjust and refine their story lines based on numerical feedback obtained using a computer model designed and validated to simulate how a system and its components behave based on some assumptions, parameters, and boundaries. For instance, how do population growth, income growth, and technological innovation interact when one of them changes? Quantification might show that a story line that participants

judged plausible is based on incoherent assumptions, contradictory scenario elements, or unrealistic views on the evolution of important drivers of change. The story line can then be revised and again sent back for quantification, and the back-and-forth may continue. Not all aspects of the qualitative narrative can be modeled.

Ideally, the model should be sufficiently transparent and simple to enable participants to understand and challenge it. Given that models are always simplified idealizations of interdependent complex systems, they each have strong limitations and represent only part of reality in a useful manner. For instance, an economic model will not represent the way agri-food systems and the climate interact. The "reality check" should therefore go both ways: from models to narratives and from narratives to models. This is the heuristic function of scenario analysis: it is a path for learning what we do not know (the interaction between particular processes, the impact of certain decisions, the need for certain indicators), revealing and questioning our anticipatory assumptions (that is, what we usually expect, hope, or fear will happen).[10]

In food futures studies, three main types of models are used: economic equilibrium models, biophysical models, and integrated models that combine models of different types, including climate models.[11] Economic models are the most widely used; biophysical models are a minority; and integrated models are strongly on the rise. I will explain what these models are in the next sections.

While qualitative scenarios can be created by anyone, the use of models requires heavy investment and computational power that exist in very few places. The main models are produced in the United States, the Netherlands, Austria, France, Germany, and Japan. This is why most quantitative scenario exercises are commissioned by governments of high-income countries (or funded by their research agencies) and international institutions, but rarely by NGOs or governments of low-income countries. Models are costly and difficult to access.[12]

Why Is the Absence of Food Sovereignty Scenarios Troubling?

In a systematic review of all global food security studies that I recently completed with my colleagues from Wageningen University & Research in the Netherlands and the International Institute for Applied Systems Analysis (IIASA) in Austria, we identified fifty-seven global food security quantified scenarios and projection

studies published in English between 2000 and 2018.[13] In this period, only two studies discussed food sovereignty.[14] This is troubling.

Global food futures scenarios are supposed to represent a set of highly contrasted, challenging, and relevant plausible futures to stimulate the imagination and public debate, and to inform important decisions. As there are many plausible futures, the decision to develop a story line for future *X* rather than future *Y* is in part dictated by comparing their social relevance. Food sovereignty's worldwide popularity among small farmers makes it relevant, and its subversive vision makes it challenging. So, scenario analysts and modelers have good reasons to take food sovereignty into account.

We should include food sovereignty for two additional reasons. First, food sovereignty is now recognized by the United Nations as a human right. The adoption of UNDROP in December 2018 went almost unnoticed and received very little media coverage, perhaps because almost all EU member states abstained and the United States, the U.K., and a few other countries voted against it, while 121 mostly non-Western countries voted for it.[15] Its Article 15.4 explicitly mentions a right to food sovereignty. This is the result of the LVC's and other organizations' decade-long lobbying strategy. As scenario analysts often use the Sustainable Development Goals as a yardstick to describe and evaluate their scenarios, there is a case for the view that "third-generation" human rights (collective rights that go beyond the civil and socioeconomic rights of individuals) should also be taken into account.

Finally, the COVID-19 crisis has revived interest in relocalization of essential economic sectors, from health and technological infrastructures to food. This should be a strong incentive for policymakers to fund the creation of scenarios in which multiple degrees of relocalization are analyzed and modeled at different scales.

In the next two sections, I explore the obstacles to the inclusion of food sovereignty in quantified scenarios. To do this, I look at two scenario exercises where food sovereignty was discussed, one of which resulted in a conflict with the economic modeling team and one in which a scenario featuring food sovereignty was created and quantified with a biophysical model. I use both primary and secondary sources to identify these obstacles, adopting a food sovereignty perspective. I refrain from critical comments here because I believe such comments should result from a dialogue with food sovereignty activists to avoid generating further mistrust and misunderstandings.

The Food Sovereignty Vision and Economic Equilibrium Models: A Mismatch

The International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD) was conducted using an inclusive global consultative process designed to "provide decision makers with the information they need to reduce hunger and poverty, improve rural livelihoods, and facilitate equitable, environmentally, socially, and economically sustainable development through the generation of, access to and use of agricultural knowledge, science, and technology."[16] The exercise, initiated in 2002 by the World Bank and the FAO and supported by several UN agencies, was multidisciplinary and involved multiple stakeholders (over eight hundred participants). Its Washington-based bureau was composed of "30 government and 30 civil society representatives (NGOs, producer and consumer groups, private sector entities, and international organizations) in order to ensure ownership of the process and findings by a range of stakeholders."[17] The bureau selected four hundred experts, who produced peer-reviewed reports.

The process, however, did not go as expected. Many of the experts were social scientists critical of globalization, free trade, biotechnologies, mainstream agricultural knowledge production and diffusion practices, and were committed to the defense of smallholders and indigenous cultures. As a result, mainstream experts felt frustrated and the scientist nominated by Syngenta left the forum, vocally criticizing the lack of objectivity of the report in regard to agricultural biotechnologies. Relatedly, the United States, Canada, and Australia expressed their reservations and did not sign the final document. While one of the original objectives of the IAASTD was to develop a set of four scenarios and quantify them, the disagreements between some participants and the quantitative scenario-building team were so intense that the groups rapidly ceased working together. The modeling chapter ended up disconnected from the bulk of the report and there was no adjustment between the outcome of modeling and the narrative scenarios.

Analyzing what went wrong with the IAASTD matters to us because the final report portrays food sovereignty positively.[18] In his study of the IAASTD,[19] Ian Scoones analyzes the internal conflicts that plagued the process. Two points relevant to food sovereignty stand out: the rejection of economic modeling and the affirmation of the value of local or indigenous knowledge.

The team in charge of quantitative scenario building was from the Washington, D.C.–based International Food Policy Research Institute (IFPRI). The IFPRI team proposed to use their main modeling tool called IMPACT (International Model for Policy Analysis of Agricultural Commodities and Trade) to conduct the process. IMPACT is a partial equilibrium model—that is, a detailed simulation of the agri-food sector (rather than the entire economy), in which global food demand and supply are determined by trade and price. The goal was to use IMPACT to quantify global and regional scenarios. Over the months, participants grew more and more frustrated with the quantified scenario work, and four obstacles to collaboration emerged.

First, participants judged that the complexity of IMPACT made it opaque. Those with no technical expertise were not familiar enough with the model's detailed assumptions, parameters, equations, and databases to be able to critically engage with it and adapt it to their needs. I call this the "model opacity obstacle."

Second, participants believed the evidence used as input in the model was too narrow. They claimed that case studies and NGO or farmer-generated success stories of alternative agricultural practices (for example, organic farming and agroecology), as well as local and indigenous knowledge grounded in experience and cultural practices, should be considered as on a par with evidence generated by modern scientific research in agronomy, agricultural economics, and economic modeling. I call this the "epistemic pluralism obstacle."

Third, they raised substantive objections to the use of partial equilibrium models because they saw their internal features as ideologically biased rather than neutral. One reason is that in those models, food demand (purchasing power and food preference) serves as a proxy for food consumption, because the model calculates the point at which demand and supply meet on the market. Equilibrium models are not meant to estimate whether supply satisfies need, though those modeling exercises also estimate the number of people who are food insecure. Relatedly, because of the model's focus on purchasing power, GDP increase is the main criterion used for increased food demand. Thus, a growing world population with increased purchasing power requires increasing supply to meet demand. This creates a bias toward ever-increasing production powered by technological innovation, rather than egalitarian distribution. I call this the "internalized bias obstacle."

Fourth, equilibrium models are fundamentally focused on international or macroregional trade. They use the FAO's food balance sheets that indicate the volume and type of agricultural products exported and imported for each country. In such

a model, global free trade results in positive effects (lowering prices, making food more accessible), and protectionist policies result in negative effects. Trade within nations and at smaller scales is made invisible. In addition, on-farm consumption and noncommercial food transactions are not captured by any indicator and are by definition excluded from equilibrium models. Thus, large corporate players are advantaged over smallholders. I call this the "free-trade bias obstacle."

In conclusion, conflicts within IAASTD reveal four obstacles to food sovereignty defenders' participation in global food quantitative-scenario exercises that use economic equilibrium models: model opacity, epistemic pluralism, internalized bias, and free-trade bias obstacles. These obstacles are normative and ultimately rely on divergent moral, political, and epistemic assumptions.

Food Sovereignty and Biophysical Models

The second scenario exercise we will examine is Agrimonde-Terra (2012–2016),[20] a participatory foresight exercise led by a French team from CIRAD (Centre de Coopération Internationale en Recherche Agronomique pour le Développement) and INRAE (L'Institut National de Recherche pour l'Agriculture, l'Alimentation et l'Environnement). Its objective was to answer the following question: How should land, water, and biodiversity be used to meet food security and environmental sustainability demands by 2050 globally and in diverse regions?

This study is important for two reasons. First, its explicit aim was "to question the dominance of economic models of global commodity markets as the basis for assessing global food security."[21] Second, it developed a food sovereignty scenario. Third, its Scenario Advisory Committee included a representative of the food sovereignty movement, Antonio Onorati, from the International Planning Committee for Food Sovereignty. What alternative model does the Agrimonde-Terra team put forward? Is their food sovereignty scenario satisfactory from a food sovereignty perspective?

The Agrimonde-Terra team and its predecessor, Agrimonde (2006–2009), raise well-documented criticisms against dominant economic models.[22] Both teams share the IAASTD participants' concerns about economic equilibrium models. To subvert the dominant framework, they use a biophysical model. Their biomass balance model, GlobAgri-AgT, quantifies the import, export, and other uses of agri-food products (for example, wheat, maize, dairy); calculates the maximum cultivable area in each region (for instance, to simulate whether an increase in

demand for rice can be satisfied by increasing domestic production or requires imports); and estimates the difference between the actual per-hectare yield of each product in each region, and its potential maximum yield according to local agroclimatic conditions.[23] They thus avoid the focus on market prices and do not obscure the nonmarket side of agri-food systems. Their model's simplicity and transparency make it highly usable by nonexperts in participatory exercises. However, biophysical models are not fully satisfactory from a food sovereignty perspective. Because of the limited resolution of the grid cells used to map the world in biophysical models (usually 1 km^2), smallholders who cultivate areas less than two hectares are still invisible.[24] I call this the "invisible small holder obstacle."

Let us now turn to Agrimonde-Terra's set of highly original scenarios, which depict future worlds as they will be by 2050, using healthy, community, metropolization, household, and regionalization scenarios. The description of the regionalization scenario deserves to be fully quoted since it explicitly features food sovereignty:

> By 2050, political and economic governance in supranational regional blocs arose as a way to address a series of issues such as financial crises, unemployment, pollution and high rates of non-communicable diet-related diseases. Within these blocs, States are managing energy transition and improving food diversity. They seek greater energy autonomy by increasing the production of renewable energy and by using regionally available fossil fuel resources. Regions applied the concept of 'food sovereignty and subsidiarity', wherein as much food as possible is produced within the region and the remaining share is imported. Medium-size cities and small towns became part of regional development, playing a significant role as intermediates between rural areas and larger cities.
>
> Regional blocs shaped food systems by promoting regional food culture, investing preferentially in and reconnecting the food industry to regional production. Medium-size cities and small towns developed industrial and small-scale food processing. This had a positive knock-on effect on employment and income in agriculture and rural areas.
>
> In a context of moderate climate change, diverse crop and livestock systems co-exist, from conventional systems to sustainable intensification or agroecology. Diversification and the search for more autonomy led to making cropping systems more agroecological, with varieties best suited to regional agri-climatic conditions, while also strengthening ties between crop and livestock systems. Depending on the region, cropping systems evolved towards sustainable intensification or agroecology, while livestock systems adopted conventional intensification, based on domestically produced animal feed, or agroecology pathways (technology variants A or B).

> With the development of regional food value chains, nutrition transition towards the consumption of ultra-processed foods was limited, and food access for rural populations was improved. Globally, the regionalization of diets and food systems contributed to limiting international trade which, nevertheless, remains a major concern for net importing regions such as the Near and Middle East, North Africa and West Africa.[25]

This scenario is a positive regionalization narrative, whereas usual regionalization scenarios are negative (involving fragmentation, rivalry, nationalist conflicts). But is this the future envisioned by food sovereignty advocates? I think not. The scale is clearly supranational (these are macroregional blocs), rather than local or microregional. It is therefore difficult to imagine direct and participatory democratic control over these large agri-food systems. The political and spatial dimensions of food sovereignty are missing. I call this the "ecological and political scale obstacle."

There is another problem with this scenario from a food sovereignty perspective: The agricultural practices range from "conventional systems to sustainable intensification or agroecology,"[26] rather than universal adoption of agroecology and elimination of conventional farming and industrial processing. The full transformative potential of food sovereignty is therefore absent: many of the basic structures of the market capitalist economy remain unchallenged. I call this the "incomplete transformation obstacle." This could explain why there is no mention of Agrimonde-Terra scenarios in the food sovereignty documents I could access.

To sum up, biophysical models circumvent some of the obstacles raised by the economic equilibrium models (in particular, the model opacity obstacle), but they raise the ecological and political scale obstacle. In addition, some elements of the regionalization scenario generate the incomplete transformation obstacle. Since integrated assessment models combine economic equilibrium models with biophysical and other types of models, they merely cumulate these obstacles rather than lift them, from a food sovereignty perspective.

Conclusion

In this essay, I have investigated why food sovereignty is absent from global food futures quantified scenarios. I surmised that seven obstacles to the creation of food sovereignty quantified scenarios could be identified from a food sovereignty perspective, namely, model opacity, epistemic pluralism, internalized bias, free-trade

bias, invisible small holder, ecological and political scale, and incomplete transformation obstacles.

How do we move forward from here? I will refrain from proposing an agenda or explaining the modeler's and scenario analyst's views on these issues. Given the lack of communication between them and food sovereignty advocates, it would not be helpful to make a one-sided diagnosis and propose remedies. What is needed is open discussion to better understand obstacles to mutual engagement and to find creative ways of overcoming them. This is best done by sitting down together around a table with a cup of (sustainably grown, fair-trade) coffee, not through journal articles.

What I can say here is that on the scenario and modeling side there are clear indications of readiness for such discussions. At a 2019 quantified scenarios conference, the problem of the absence of food sovereignty scenarios was raised and, in the final report, participants were encouraged to create degrowth and ecocommunalist scenarios.[27] A recent article mentions that we need to invent and use alternative models to quantify truly transformative scenarios that disrupt the usual socioeconomic frameworks.[28] There are also calls to better describe power dynamics and the role of individual actors and groups in generating agri-food systems change.[29] The process I envision is not just another technocratic and depoliticizing exercise: it is clear that we can no longer keep tinkering with existing models.

NOTES

[1] My discussion of the history of the movement is based on Marc Edelman, "Food Sovereignty: Forgotten Genealogies and Future Regulatory Challenges," *Journal of Peasant Studies* 41, no. 6 (November 2014), pp. 959–78; and Priscilla Claeys, *Human Rights and the Food Sovereignty Movement: Reclaiming Control* (London: Routledge, 2015).

[2] "The International Peasants' Voice: Globalising Hope, Globalising the Struggle!," La Via Campesina, n.d., viacampesina.org/en/international-peasants-voice/.

[3] Claeys, *Human Rights and the Food Sovereignty Movement.*

[4] Many definitions of food sovereignty can be found in the "Key Documents (La Via Campesina)" pages of LVC's website (viacampesina.org/en/who-are-we/what-is-la-via-campesina/key-documents-la-via-campesina/) and in the secondary literature provided there. See, in particular, the special issue of the *Journal of Peasant Studies* (41(6), 2014) entitled "Global Agrarian Transformations: Critical Perspectives on Food Sovereignty", guest edited by Marc Edelman, James C. Scott, Amita Baviskar, Saturnino M. Borras Jr., Deniz Kandiyoti, Eric Holt-Gimenez, Tony Weis, and Wendy Wolford. Another important source is Michel P, Pimbert, ed., *Food Sovereignty, Agroecology and Biocultural Diversity: Constructing and Contesting Knowledge* (Abingdon, U.K.: Routledge, 2018).

[5] See, for instance the special issue of the *Journal of Peasant Studies* (36, no. 3, 2009) edited by Raj Patel; and Bina Agarwal, "Food Sovereignty, Food Security and Democratic Choice: Critical Contradictions, Difficult Conciliations," *Journal of Peasant Studies* 41, no. 6 (2014), pp. 1247–68.

[6] For a discussion of plausibility, see Yashar Saghai, "Is a Thriving Food Sovereignty-Based Global Future Plausible?," in *Justice and Food Security in a Changing Climate*, edited by Ivo Wallimann-Helmer and Hanna Schuebel (Wageningen, Netherlands: Wageningen Academic Press, forthcoming).

[7] Jerome C. Glenn and the Future Group International, "Scenarios," in Jerome C. Glenn and Theodore J. Gordon, eds. *Futures Research Methodology*, version 3 (Washington, D.C.: The Millennium Project: Global Futures Studies and Research, 2009), CD-ROM, www.millennium-project.org/publications-2/#method. For a discussion of the scenario process, see Rafael Ramirez and Angela Wilkinson, *Strategic Reframing: The Oxford Scenario Planning Approach* (Oxford: Oxford University Press, 2016).

[8] Michiel van Dijk, Marc Gramberger, David Laborde, Maryia Mandryk, Lindsay Shutes, Elke Stehfest, Hugo Valin, and Katharina Faradsch, "Stakeholder-Designed Scenarios for Global Food Security Assessments," art. 100352, *Global Food Security* 24 (March 2020), www.sciencedirect.com/science/article/pii/S2211912420300055.

[9] "4 Plausible futures for FNS," FoodSecure Navigator, navigator.foodsecure.eu/Scenarios/Scenarios.aspx. Reused under Creative Commons license.

[10] Bruno Dorin and Pierre-Benoît Joly, "Modelling World Agriculture as a Learning Machine? From Mainstream Models to Agribiom 1.0," art. 103624, *Land Use Policy* 96 (July 2020), www.sciencedirect.com/science/article/abs/pii/S0264837717308645.

[11] There are other ways to quantify scenarios that I will not discuss here. For an overview, see Michiel van Dijk, Yashar Saghai, Marie Luise Rau, and Tom Morley, "Global Food Demand Projections: A Review," in *Feeding the World Well: A Framework for Ethical Food Systems*, ed. by Alan M. Goldberg (Baltimore, Md.: Johns Hopkins University Press, 2020), pp. 98–124; and Michiel van Dijk, Tomas Morley, Marie Luise Rau, and Yashar Saghai, "Systematic Review and Meta-Analysis of Global Food Security Projections to 2050" (under review).

[12] Lise Cornilleau, "Magicians at Work: Modellers as Institutional Entrepreneurs in the Global Governance of Agriculture and Food Security," in "The Politics of Anticipatory Expertise," special issue, *Science & Technology Studies* 32, no. 4 (September 2019), pp. 58–77.

[13] van Dijk et al., "Systematic Review and Meta-Analysis of Global Food Security Projections to 2050."

[14] These studies include *International Assessment of Agricultural Knowledge, Science and Technology for Development: Global Report*, ed. Beverly D. McIntyre, Hans R. Herren, Judi Wakhungu, and Robert T Watson (Washington, D.C.: Island Press, 2009); and Chantal Le Mouël, Marie De Lattre-Gasquet, and Olivier Mora, *Land Use and Food Security in 2050: A Narrow Road* (Paris: Editions Quae, 2018).

[15] UN Human Rights Council, United Nations Declaration on the Rights of Peasants and Other People Working in Rural Areas, A/HRC/RES/39/12, September 28, 2018, digitallibrary.un.org/record/1650694?ln=en; and Priscilla Claeys and Marc Edelman, "The United Nations Declaration on the Rights of Peasants and Other People Working in Rural Areas," *Journal of Peasant Studies* 47, no. 1 (October 2019), pp. 1–68.

[16] *International Assessment of Agricultural Knowledge, Science and Technology for Development: Global Report*, p. 3.

[17] Ibid., p. ix.

[18] Ibid., pp. 113–14.

[19] Ian Scoones, "The Politics of Global Assessments: The Case of the International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD)," *Journal of Peasant Studies* 3, no. 3 (January 2009), pp. 547–71.

[20] Le Mouël et al., *Land Use and Food Security in 2050*.

[21] Marie de Lattre-Gasquet and Sébastien Treyer, "Agrimonde and Agrimonde-Terra: Foresight Approaches Compared," *IDS Bulletin* 47, no. 4 (September 2016), p. 39.

[22] Ibid.; Gilles Tétart, "Debating Global Food Security through Models the Agrimonde Foresight Study (2008–2010) and Criticism of Economic Models and of Their 'Productionist' Translations," *Science, Technology and Society* 25, no. 2 (January 2020), pp. 67–85; and Dorin and Joly, "Modelling World Agriculture as a Learning Machine?"

[23] Le Mouël et al., *Land Use and Food Security in 2050*.

[24] Nelly Leblond and Julie Trottier, "Performing an Invisibility Spell: Global Models, Food Regimes and Smallholders," *International Journal of Sociology of Agriculture and Food* 23, no. 1 (2016), pp. 21–40.

[25] Olivier Mora, Chantal Le Mouël, Marie de Lattre-Gasquet, Catherine Donnars, Patrice Dumas, Olivier Réchauchère, Thierry Brunelle, et al., "Exploring the Future of Land Use and Food Security: A New Set of Global Scenarios," ed. Elisabeth Bui, *PloS One* 15, no. 7 (July 8, 2020), e0235597, pp. 8–10, journals.plos.org/plosone/article?id=10.1371/journal.pone.0235597.

[26] Ibid., p. 10.

[27] Brian C. O'Neill, Cecilia Conde, Kristie Ebi, Pierre Friedlingstein, Jan Fuglestvedt, Tomoko Hasegawa, Kasper Kok, et al., "Forum on Scenarios of Climate and Societal Futures: Meeting Report" (working paper 2019.10.04, Frederick S. Pardee Center for International Futures, University of Denver, October 4, 2019), pardee.du.edu/sites/default/files/Scenarios%20Forum%20Meeting%20Report%204oct19.pdf.

[28] Birgit Müller, Falk Hoffmann, Thomas Heckelei, Christoph Müller, Thomas W. Hertel, J. Gareth Polhill, Mark van Wijk, et al., "Modelling Food Security: Bridging the Gap between the Micro and the Macro Scale," *Global Environmental Change* 63 (July 2020), 102085.

[29] Enrica De Cian, Shouro Dasgupta, Andries F. Hof, Mariësse A. E. van Sluisveld, Jonathan Köhler, Benjamin Pfluger, and Detlef P. van Vuuren, "Actors, Decision-Making, and Institutions in Quantitative System Modelling," *Technological Forecasting and Social Change* 151 (February 2020), 119480.

Abstract: Will we, by 2050, be able to feed a rapidly growing population with healthy and sustainably grown food in a world threatened by systemic environmental crises? There are too many uncertainties for us to predict the long-term evolution of the global agri-food system, but we can explore a wide range of futures to inform policymaking and public debate on the future of food. This is typically done by creating scenarios (story lines that vividly describe what different futures could look like) and quantifying them with computer simulation models to get numerical estimates of how different aspects of the global agri-food system might evolve under different hypotheses. Among the many scenarios produced over the last twenty years, one would expect to see the future advocated by the food sovereignty movement, which claims to represent roughly two hundred million self-described "peasants" (small farmers) worldwide. This movement defends a vision of the future based on relocalized, sustainable, and just agri-food systems, self-governed through direct and participatory democratic processes. Yet, food sovereignty is conspicuously absent from quantified scenarios of global food futures. As part of the roundtable, "Ethics and the Future of the Global Food System," this essay identifies seven obstacles that undermine the creation of food sovereignty scenarios by examining two attempts at crafting such scenarios.

Keywords: food sovereignty, food futures, futures studies, scenarios, models, food ethics, UNDROP