9. Eur-Agri-SSPs: Scenarios for European Agri-Food Systems to Support Policy Design

MACSUR Science-Policy Knowledge Forum

In this policy brief, we present the structure and content of five contrasting European scenarios for agri-food systems until 2050 and argue why they can support decision-making in the agri-food system.

Key Messages

- Scenarios inform the design of targeted climate change mitigation and adaptation strategies.
- The European Agri-food shared socio-economic pathways (Eur-Agri SSPs) characterise five plausible European agri-food systems futures with varying challenges for mitigation and adaptation.
- The Eur-Agri-SSPs enhance the understanding of drivers of agri-food systems.
- The Eur-Agri-SSPs facilitate model comparisons across locations, scales and sectors, and can inform policy design and implementation.

Managing uncertainties in decision-making with scenarios

Most decisions in the agri-food system are subject to uncertainties inherent to both bio-physical and socio-economic systems (Tab. 1). System complexity leads to innumerable possible states. Scenario design and analysis, i.e. qualitative or quantitative systematic and consistent elaborations of possible futures, are effective methods to anticipate future developments and cope with uncertainty emerging from system complexity.

The climate change research community developed the shared socio-economic pathways (SSPs; O'Neill et al. 2017). The SSPs describe five contrasting societal future developments, political and economic systems, technological options, and management of natural resources. These SSPs do not take climate change into account but explicitly define the challenges and opportunities for society's mitigation and adaptation actions. The SSPs come with the advantage of internal consistency, a global and holistic system coverage, and a manageable number of contrasting futures. A major disadvantage is the global scale coverage with coarse sectoral and spatial details. Agri-food systems are only a minor component in the SSPs. For regional to national assessments, much more detail is necessary.

In the second project phase of MACSUR, partners combined efforts to develop the Eur-Agri-SSPs. The Eur-Agri-SSPs are based on the SSPs but provide the much-required details to analyse European agri-food systems. The consortium first developed a protocol-based research procedure (Mitter et al., 2019) and then enriched the SSPs with a sectoral perspective in a consecutive, nested, participatory, iterative approach following the protocol with nine steps. The steps include the definition and prioritisation of storyline elements, the drafting, reviewing and finally dissemination of storylines.

Table 1: Examples of sources of uncertainty in the domain of climate change mitigation and adaptation policy making in agriculture

Source of uncertainty	Examples
Incomplete knowledge about highly complex bio-physical processes	Carbon sequestration rates differ by soil management practices and show large spatial heterogeneity.
Climate change uncertainty	The future level of GHG emissions in agri-food systems is unknown today. Its impacts are well understood but are still uncertain for a specific location.
Behaviour of farmers	Uptake of voluntary measures is unclear prior to the start of a policy program and compliance cannot be assured in any situation.
Future socio-economic conditions	Long-term consumption patterns, resulting global market prices and even more so drastic supply-side shocks are difficult to predict.

Relevance of Eur-Agri-SSPs for decision making

The Eur-Agri-SSPs summarise how agri-food systems may evolve until 2050 in Europe given the inherent uncertainties about the future. Apart from scientific uses[1], we highlight two important reasons why policymakers and industry decision-makers should consider the Eur-Agri-SSPs:

1. Decision makers should be aware of the scenario base used for modelling studies such as the global SSPs or the continental and sector-specific Eur-Agri-SSPs since these applications indirectly serve evidence-based decision-making. Knowledge about scenario assumptions is required to interpret the outcomes and conclusions of modelling studies.

2. Scenarios allow actors to consider multiple perspectives of future development, stimulate discussions about future changes and provide consistent interpretations. Once, certain pathways become evident, well-designed scenarios may determine consistent surrounding conditions in ex-ante evaluation processes.

The Eur-Agri-SSPs in a nutshell

The Eur-Agri-SSPs are presented as qualitative storylines and semi-quantitative tables showing directions of change of 50 drivers organized in five major topics: population and urbanisation; economy; policies and institutions; technology; environment and natural resources. They are organised along two major axes indicating challenges to mitigation and adaptation (Fig.1). Hence, the Eur-Agri-SSPs can serve as a basis for developing mitigation or adaptation strategies. Box 1. summarizes the Eur-Agri-SSPs. A list of drivers and their changes in each scenario and a full version of the narratives are presented by Mitter et al. (2020).

Concluding remarks

Private business organisations and public authorities are well aware of the need and power of foresight studies. For example, the European Commission finances the "Competence Centre on Foresight" to "foster a strategic, future-oriented and anticipatory culture in the EU policymaking process". Their study on "Farmers of the Future" gives a stakeholder-derived typology of farmers in Europe in 2040 (EU Commission Competence Centre on Foresight, 2020). The Eur-Agri-SSPs are complementary, describing the framework conditions of farming and many more activities in the European agri-food systems in 2050. The value added of the Eur-Agri-SSPs for policy making is threefold:

1. They enhance the understanding of drivers of the agri-food systems and their relationships from a long-term perspective. Short-term events and processes, such as the COVID pandemic or the Russian war on Ukraine, are not considered. However, the scenarios can be applied to analyse the resilience of the agri-food systems to such crises.

2. They provide a solid basis for integrated modelling of agri-food systems, which can then be used to identify efficient land and water use under climate and policy scenarios, to identify cost-effective policies, or to analyse trade-offs and co-benefits between economic and environmental policy goals.

3. They can directly inform policy design and implementation at various scales because they provide a complete and consistent picture of agri-food systems and their development. The needs of policymakers have been considered when developing the Eur-Agri-SSPs. For example, stakeholders preferred a comprehensive description of drivers related to policies and the economy at the cost of slight imbalances between the topics addressed.

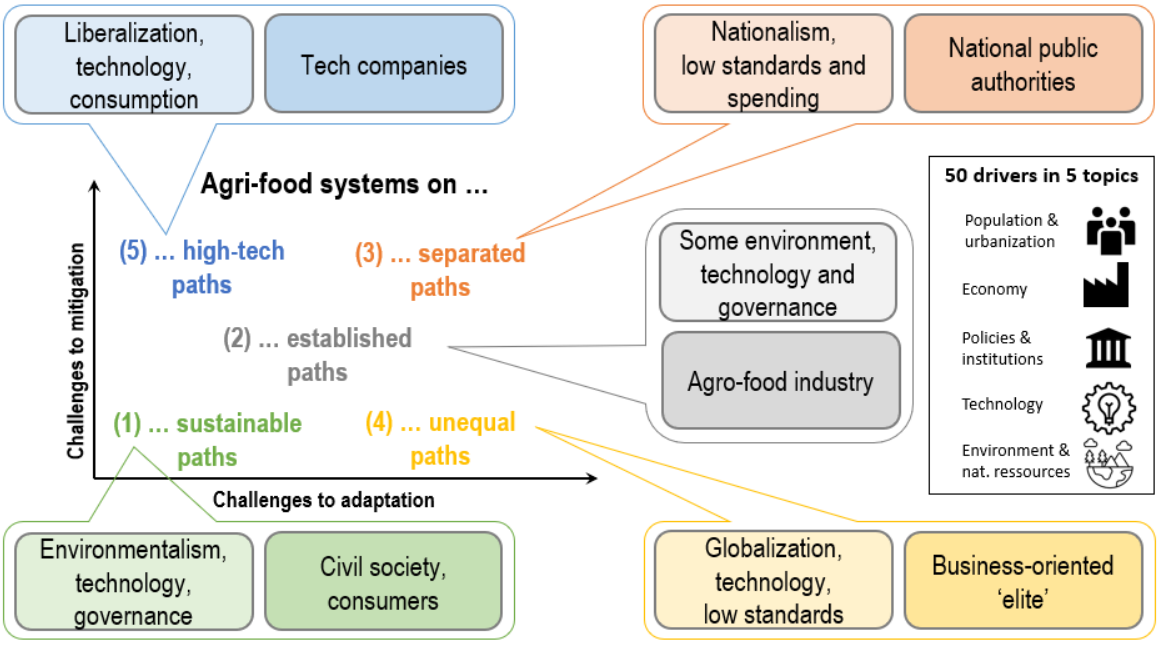

Figure 1: Key processes and actors in each Eur-Agri-SSP. The Eur-Agri-SSPs are organised along their challenges to climate change mitigation and adaptation (based on Mitter et al., 2020).

[1]Eur-Agri-SSPs have been input to scenario assessments in European agriculture (e.g. on emission risks of insecticides in 2050; Desrousseaux et al., 2022). They formed the base for sub-sectoral scenarios (e.g. on soils in the BONARES project; https://www.bonares.de) and have been downscaled to national and regional scales (e.g. to Austria as part of the SALBES project; https://salbes.eu).

Box 1: Summary of the Eur-Agri-SSPs (based on Mitter et al., 2020).

Eur-Agri-SSP1 – Agri-food systems on sustainable paths

In Europe, social and environmental awareness increase steadily and is reflected by effective cooperation between public and private sectors and civil society. This is accompanied by tightened pro-environmental policies; abolished income support for farmers; rising public payments for the provision of regulation and cultural services; technology developments towards low emissions, resource use efficiency and chemical pesticide-free agriculture. European domestic demand shifts towards plant-based diets and bio-based materials, whereas food waste and per capita demand for livestock-based products decrease gradually. Markets are globally connected and trade agreements are strengthened. International trade decreases because short and transparent agricultural supply chains are preferred by consumers and the public.

Challenges to climate change mitigation are low in the agri-food systems because of decreasing demand for livestock-based products and technology development with a focus on reducing greenhouse gas emissions. Challenges to climate change adaptation are also low because of increasing institutional effectiveness, investments in infrastructure, and cooperation along the agricultural supply chain.

Eur-Agri-SSP2 – Agri-food systems on established paths

European development follows historical patterns resulting in slow social, environmental and technological progress. Cooperation between public and private sectors remains challenging with little progress in implementing further environmental standards and policy instruments. European and national agricultural policies are characterized by multiple support schemes to increase international competitiveness, productivity and efficiency, and improve environmental status. Agricultural commodities are mostly traded within Europe even though global market integration advances. Demand for locally produced goods and services increases slowly. Per capita, meat demand remains high. Depletion of natural resources increases because of the continuous growth of the agriculture and food economy, and because pro-environmental regulations and resource-efficient technologies are only developed at a moderate pace.

Challenges are moderate because of slow and insufficient development of European agricultural policy, and reduced investments in infrastructure in rural areas.

Eur-Agri-SSP3 – Agri-food systems on separated paths

Mutual distrust and regional rivalry result in less efficient cooperation between national and European entities, the emergence of national agricultural policies, and relaxed environmental and production standards. Increased self-sufficiency concerns of individual countries influence demand patterns. Public payments aim to maintain the national production potential, whereas demand for environmental services declines. Access to international markets decreases, whereas neo-colonialism and land grabbing gain importance. Market concentration increases within countries. Technology development and diffusion suffer from declining investments and weak cooperation actors in the agricultural supply chains.

Challenges to climate change mitigation are high because of a lack of cooperation between the public and private sectors, decreasing environmental awareness, reduced public payments for environmental services, and slow technological progress that focuses on productivity instead of greenhouse gas emission reduction targets. Challenges to climate change adaptation are high due to a combination of decreasing institutional effectiveness, reduced diffusion of new technologies between nations, tighter budget constraints, a dominance of national agricultural policies, and decreasing investments in infrastructure.

Eur-Agri-SSP4 – Agri-food systems on unequal paths

Increasing social disparities between and within rural and urban areas lead to social segregation. A business-oriented, wealthy upper class dominates European institutions, sets the policy agenda, controls agricultural supply chains, and stimulates technological uptake of energy efficient and renewable energy technologies. European agricultural policies increasingly support economic growth and technology development, from which the large, industrialized farms benefit the most and the interests of a large proportion of society are mostly ignored. Agricultural markets are increasingly globally connected and demand for European agro-food products is increasingly diverse, with a stagnation in domestic demand for feed and non-food commodities. Environmental standards decrease except for selected, scenic, hot spot regions. Natural resources are increasingly overused.

Challenges to climate change mitigation are low in the agri-food systems because of effective European institutions and progress in technology development and diffusion. Challenges to climate change adaptation are high because of growing inequalities in access to institutions and production-related support, globally connected markets, and to education.

Eur-Agri-SSP5 – Agri-food systems on high-tech paths

European residents share a growing faith in technology, material-intensive lifestyles and trade liberalisation. Public payments to the agri-food systems are drastically reduced to conform with liberalised and integrated markets. Environmental standards are considerably lowered, which results in the overexploitation of natural resources in Europe and abroad. Increased private investments in technological know-how and the education of employees in the agri-food systems boost economic growth, which is largely dependent on fossil energy sources. Internationalisation is reflected by improved international trade agreements, globally connected agricultural supply chains, accelerated technological progress and diffusion in the agri-food systems, and expedited structural change.

Challenges to climate change mitigation are high mostly because of decreasing environmental awareness, massively reduced payments for environmental services, and a growing reliance on fossil sources. Challenges to climate change adaptation are low because of increasing investments in social and technical infrastructure, higher economic growth rates and professionalisation in the agri-food systems.

Further Reading:

Desrousseaux, A., Nagesh, P., Gajraj, R., Dekker, S., Eitzinger, J., Sallach, J.B., Boxall, A., Kok, K., 2022. A shared socio-economic pathway based framework for characterising future emissions of chemicals to the natural environment. Futures 144, 103040. https://doi.org/10.1016/j.futures.2022.103040

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