

Eco Ready

Policy brief

Addressing food systems climate impact - co-benefits for food security, environment and social impacts

October 2026

Key messages

- **Food security depends on more than just the volume of agricultural production.** ECO-READY's MAGNET modelling indicates that food prices, dietary patterns, trade, labour markets, and environmental policies all influence food availability and affordability.
- **A sustainability-oriented transition can deliver combined benefits.** The Green Road (SSP1) pathway is associated with lower agricultural greenhouse gas emissions, reduced fertiliser use, and improved food affordability compared with less sustainable policy pathways.
- **Climate action and environmental sustainability should be pursued together.** The Life Cycle Assessment (LCA) identifies fertilisers, fossil fuels, and pesticides as important production hotspots, while highlighting the need to assess the full environmental impacts of new technologies.
- **Farm-level solutions need enabling policies.** Living Labs identify practices such as crop diversification, intercropping, organic farming, agroforestry, and drought-resistant seeds as relevant options for locally adapted transitions and enhanced farm resilience towards climate change.
- **Policy must address the whole food system.** Climate-resilient agriculture requires coherent production, consumption, trade, advisory, and investment policies, supported by evidence on environmental and social trade-offs.

Introduction

Climate change is increasingly recognised as a major threat to European food security by affecting crop yields, agricultural productivity, and the stability and affordability of food supplies.

At the same time, **agricultural practices can contribute to climate mitigation and adaptation or exacerbate environmental pressures**, affecting the natural resources upon which food production depends and hence the resilience of food systems. This interrelationship calls for integrated policy approaches that consider the co-benefits and trade-offs between climate resilience for agricultural production, environmental sustainability, and food security to promote positive outcomes and prevent unintended consequences.

This challenge is reflected in current EU policy discussions. The **European Food Security Crisis preparedness and response Mechanism** (EFSCM) provides a forum for addressing risks to food supply and security, including climate hazards such as drought. Meanwhile, the **European Climate Resilience and Risk Management** offers an opportunity to better integrate climate risks into agricultural, water and food policies.

The **ECO-READY Horizon Europe project** aims to ensure a sustainable and resilient food supply in the face of climate and biodiversity crises, delivering scientific evidence on the policy pathways to be pursued. This policy brief provides recommendations to strengthen coherence across climate, agriculture, water, and food policies and support a more climate-resilient and food-secure EU food system.

Sustainability scenario improves food security and climate mitigation

ECO-READY uses scenario modelling to project possible pathways towards a sustainable and resilient European food system.

The modelling framework used:

1. **MAGNET** (an economy wide modelling tool tailored for agri-food analysis) to assess alternative global future scenarios and their implications for European agriculture, food security and climate change and
2. **environmental Life Cycle Assessment (LCA) and Social Life Cycle Assessments (S-LCA)** of ten products across the ten ECO-READY Living Labs, to evaluate the social and environmental impacts of these products until the farm gate.
3. Subsequently, these methods have been combined in a **prospective LCA analysis where the MAGNET model was used to create scenarios and update the inventory of the LCA** to explore the future impact of these production systems under **three different socio-economic scenarios.**

The scenarios represent contrasting pathways for economic development, agricultural production, dietary patterns, trade, and environmental governance. They build on the Intergovernmental Panel on Climate Change (IPCC) Shared Socioeconomic Pathways (SSPs), which describe alternative global socioeconomic futures, and were further refined through a co-design process with the 10 ECO-READY Living Labs to reflect different assumptions

regarding socioeconomic development, agricultural productivity, policy choices, and consumer behaviour.

The three scenarios modelled are:

- **Green Transition (SSP1): a sustainability-oriented future** within the 1.5 °C global warming limit and with agricultural systems operating within ecological boundaries underpinned by Nature-based Solutions and agroecology, drought resistant crops, robust land-use regulations, and a shift to more plant-based diets. Increased global cooperation results in reduced trade barriers, and a greenhouse gas emission tax is introduced, primarily impacting fertiliser use for agriculture.

- **Middle Road (SSP2): the continuation of current trends** with some, slow and moderate, progress towards climate goals and less input-dependent agriculture in the long-term.

- **Rocky Road (SSP3): a fragmented world** with weak international cooperation and limited climatic ambition, characterised by unambitious and ineffective climate and land-use regulation policies, unstable agricultural production, and high consumption of animal products. A de-globalisation of trade is also established.

Results show that **the Green Road performs best in delivering on both climate and environmental ambitions**, with significant **reductions in greenhouse gas emissions, land demand, and chemical fertiliser use.** The MAGNET modelling outputs indicate that the Green Road reduction of chemical fertilisers and food waste, dietary shift towards less meat consumption, and cleaner energy inputs greatly lower the global greenhouse gas (GHG) emissions of the food chain and improves its impact on land coupled with a reduction on land use. The LCA also shows that environmental impacts per kg of product can also decrease under the Green Road scenario for the case studies analysed.

The focus on a low carbon emission agriculture also contributes to food security under specific conditions. Food availability (total food production) is highest in the Rocky Road, however, high **food utilisation** in the Green Road showcases a more balanced diet with low food waste. This reduces prices resulting in a lower share of income spent on food indicating a better food affordability. In the meantime, food affordability is worst in the Rocky Road with high prices and consumption driven by high meat demand.

While **food production significantly increases in the Rocky Road** due to low regulation of land and high fertiliser inputs, **food prices remain high due** to a combination of high demand for meat requiring more agricultural resources and a reduction of global trade for production inputs. The high food production of the Rocky Road, with a diet low in fruits and vegetables and high demand for meat, does result in an increased demand for, and wages of, low-skilled agricultural workers, which does have a limited positive impact on affordability. However, the Rocky Road with lower cooperation and technological investment results in lower productivity per worker and makes Europeans less wealthy compared with the Green Road. For these reasons, **the average share of income spent on food and overall food prices are most positive in the Green Road scenario** and least in the Rocky Road scenario. The figure below showcases how the Rocky Road with high production costs and high food availability fails to deliver on the food affordability and utilisation side.

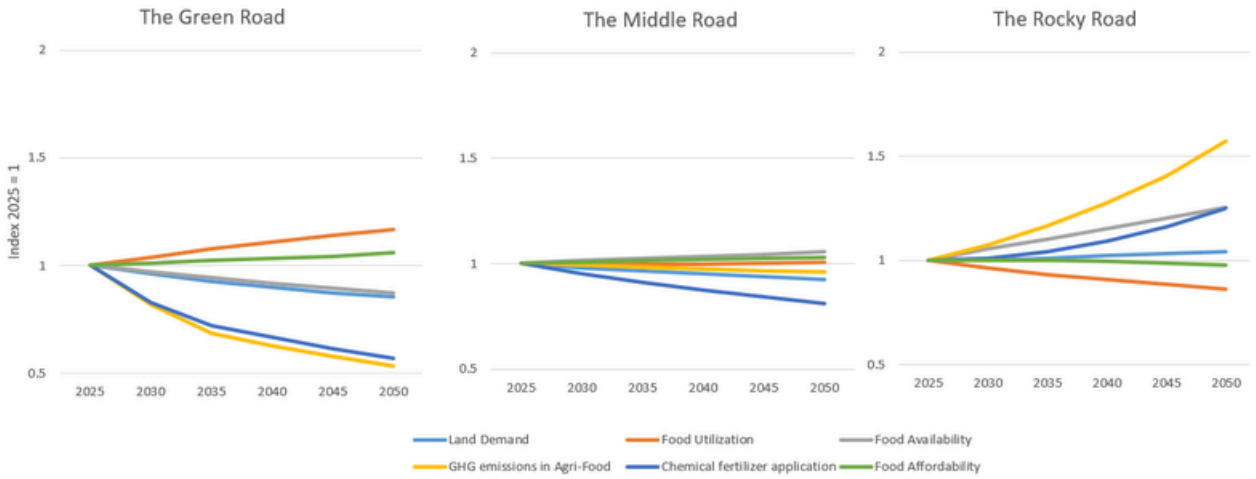


Figure 1: Trade-off analysis summarising the overall results for each scenario in the EU across the three scenarios, allowing for a comprehensive comparison of their potential impacts.

Securing the climate-oriented agriculture co-benefits on environment and social impact

One of the major co-benefits in the support of climate objectives through the reduction of dependence on fertilisers, fossil fuels, and other external inputs relies on **lower environmental burdens and reduced social risks.**

The LCA findings and Living Lab experiences point to opportunities to connect climate action with soil health, water retention, biodiversity, and resource efficiency. Lower use of chemicals, fossil fuels, and other external inputs through **precision agriculture approaches** (for example utilising GPS data and Internet of Things (IoT) sensors) **circular approaches** to reduce resource use, **organic practices** (such as green manure and biological and mechanical pest management), and **Nature-based Solutions** have been highlighted for their capacity to reduce both environmental burdens and social risks from farming systems.

However, the extent of these benefits depends on local conditions, production methods, and implementation. Economic modelling helps identify broad trends but cannot determine which practice will work best in every farming context. The Living Labs illustrate the importance of tailoring interventions to local soils, water availability, production systems, and farmers' needs. New technologies and practices should therefore be assessed through life cycle thinking and, where possible, monitored for their environmental, economic, and social outcomes.

The project results highlight how our food system is integrated into the global economy and linked with many larger societal trends. Therefore, while on-farm innovations and agricultural production increases are important contributors to food security, securing resilient food systems should go beyond the farm level.

As seen, **maintaining trade links** with the rest of the world and a **skilled workforce while increasing technological efficiency** help keep costs down in the Green Road. Crucially food demand management, i.e., **encouraging sustainable diets**, reducing food waste can have a significant impact on

the pressure of agricultural systems and in turn reduce food prices and increase affordability. As the Rocky Road scenario indicates, intensifying inputs to increase food supply will not be enough to keep up with increased food demand from unsustainable diets and an increasing demand for animal-based proteins.

However, as important as the system level analysis is, the application of the lessons learned will depend on specific farm geographies, cultivation methods, conditions, and priorities. Therefore, **methods should be tailored to the specific local conditions so that trade-offs are limited and social and environmental impact minimised.** Life cycle thinking should also be applied to new interventions to assess whether their uptake would meaningfully reduce environmental and social burdens on a case-by-case basis.

Moving forward, climate shocks may lead to further unpredicted outcomes that were not modelled here using LCA, nor included in the MAGNET projections. The effects of extreme climatic events such as droughts or floods would undermine agriculture yields while increasing recovery and production costs, showing how **early investment towards minimising climate change impact into mitigation methods are essential**.

Policy recommendations

1

The European Commission and Member States should improve policy coherence across climate, water, biodiversity, and food security through approaches that reward packages of practices delivering multiple benefits, rather than assessing interventions in isolation. These packages of practices would include actions towards soil protection, biodiversity, water retention, and rural employment. Such approaches would need clear criteria, appropriate monitoring and adaptation to local conditions. This can help ensure that interventions deliver complementary benefits and avoid shifting environmental pressures between resources, regions or stages of the food chain.

2

As part of the European Climate Resilience Framework, the European Commission and Member States should recognise food security as an outcome of interconnected climate, water, soil, biodiversity, and socioeconomic risks. They should encourage climate-risk assessments for agricultural production and food supply chains, including compound risks such as drought combined with heat stress, and promote Nature-based Solutions that strengthen soil health, water retention and ecosystem resilience.

3

The European Commission, European Council and European Parliament should establish a fully EU funded, sub-ringfenced budget for agri-environmental climate actions in the next Common Agriculture Policy (CAP), to deliver on climate and biodiversity, thus

strengthening food security in the EU. Policy frameworks must support farmers in the transition towards a more sustainable and resilient food system.

4

The European Commission and Member States, through their National and Regional Partnership Plans, should support practices that reduce avoidable dependence on fertilisers, fossil fuels, and other external inputs while maintaining productive capacity. Support should recognise context-specific combinations of measures, including crop diversification, intercropping, organic practices, agroforestry, soil protection and water retention.

5

Member States, national CAP networks, and advisory services should promote CAP instruments and national support programmes facilitating farmers' access to drought-resistant seeds, diversified crop options, suitable machinery, and tailored advisory services. Innovation pilots and knowledge exchange can help establish which interventions are effective in different farming systems and under different climate pressures.

6

European, national, and local authorities should promote plant-based diets in Europe to support environment and climate objectives and recognise the role of food consumption as a key driver of food-system transformation.

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This project has received funding from the European Union's HORIZON-CL6-2022 research and Innovation programme under grant agreement N ◦ 101084201. This publication reflects only the views of the author. The European Commission and Research Executive Agency cannot be held responsible for any use which may be made of the information contained therein.