

# Climate change impacts on food security in the European Union

## SUMMARY

In a geopolitical context which temporarily affects food security, climate change remains the most common driver of food insecurity. It will continue to disrupt the entire food supply chain in the long term – from production (upstream) to storage, processing and distribution (downstream). On the supply side, rising temperatures and more frequent extreme weather events harm key crops like wheat and grain maize, and challenge livestock and seafood. Southern Europe is particularly vulnerable, raising climate justice issues within the EU, while some northern regions could experience more favourable conditions for specific crops. Impacts on pollinators, pests, diseases and labour productivity further reduce yields. The resulting economic losses threaten producers' livelihoods and affordability for consumers, worsening food insecurity.

Along the supply chain, climate change affects both the quality and quantity of food, raising concerns about sufficient access to nutritious food. Moreover, the EU's reliance on imports from trade partners, themselves vulnerable to climate change, especially for animal feed, raises concerns about the future of EU food sovereignty and dietary traditions key to food security.

The EU's responses span several policy areas, including food production (agriculture, fisheries and aquaculture), climate adaptation, water, soil and biodiversity. However, challenges remain in coordination and implementation. The EU's strategic focus has recently shifted from building a sustainable food system towards a competitive and resilient agricultural sector. While ex-post measures, such as improved insurance schemes, are paramount, they should not overshadow ex-ante adaptation efforts that promote a sustainable food system, integrating new technologies, sustainable farming and evolving dietary trends.

*This briefing focuses solely on how climate change affects food security in the EU, while acknowledging global interdependencies. A [2023 EPRS paper](#) explores the climate impact of the EU agrifood system.*



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Author: Liselotte Jensen with Charlotte Hourdin; Graphic: Samy Chahri

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## Introduction

In its 2019 Special Report on Climate Change and Land, the Intergovernmental Panel for Climate Change (IPCC) [states](#) with high confidence that 'observed climate change is already affecting food security through increasing temperatures, changing precipitation patterns, and greater frequency of some extreme events.' The United Nations' Food and Agriculture Organization (FAO) [adds](#) that climate extremes are the most common drivers of food insecurity globally. The economic effects of the COVID-19 pandemic, the war in Ukraine and the United States' [trade war](#), which restricts export opportunities for farmers, [further exacerbate](#) these impacts.

While [regions at lower latitudes](#) are most affected, Europe is the fastest-warming continent, with [2024](#) marking the warmest year on record. In its June 2025 outlook, the European Commission [highlights](#) a significant rainfall deficit across Europe, resulting in limited regeneration of dried soils from the previous summer and lower crop yields.

Although Europe is one of the regions with the [least food insecurity](#) in the world, there are strong concerns about the availability, affordability and quality of food products for consumers. Currently, [8.2 %](#) of the European population faces moderate-to-severe food insecurity, which notably affects disadvantaged groups and eastern European countries. Climate change has already increased the food insecurity of about [12 million](#) Europeans. On 19 February 2025, the Commission presented its [Vision for Agriculture and Food](#), which focuses on the agrifood system's competitiveness, attractiveness and resilience.

## Climate change impacts on food production in the EU

Climate change affects food production both directly and indirectly, disrupting the food supply chain's upstream activities. Global warming and extreme weather events **directly** impact agricultural yields. The IPCC's Sixth Assessment Report [states](#) with high confidence that climate change leads to a **northward movement of agro and marine climatic zones** in Europe and an earlier start of the growing season. The European Environment Agency (EEA) [illustrates](#) this shift, which has been going on for at least 40 years, as one progressing at a pace of [50-150 km](#) per decade. Mediterranean-type climates may expand to parts of western Europe by 2070, while snowy climates may disappear in central European mountains, and temperate ones may replace them in northern Europe. Furthermore, **higher levels of atmospheric carbon dioxide** (CO<sub>2</sub>) may enhance crop productivity at lower temperature increases by maximising photosynthesis and minimising water loss during transpiration. However, elevated CO<sub>2</sub> concentrations [reduce](#) nutritional quality, including crop protein, zinc and iron content.

More frequent, severe and complex **extreme weather events** also affect the stability of the food supply (see Figure 1 below). These events are mapped in the 2024 [European state of the climate](#)

### Key concepts related to food security

**Food security** exists 'when all people, at all times, have physical and economic access to the sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life'.

The IPCC details the four components of food security.

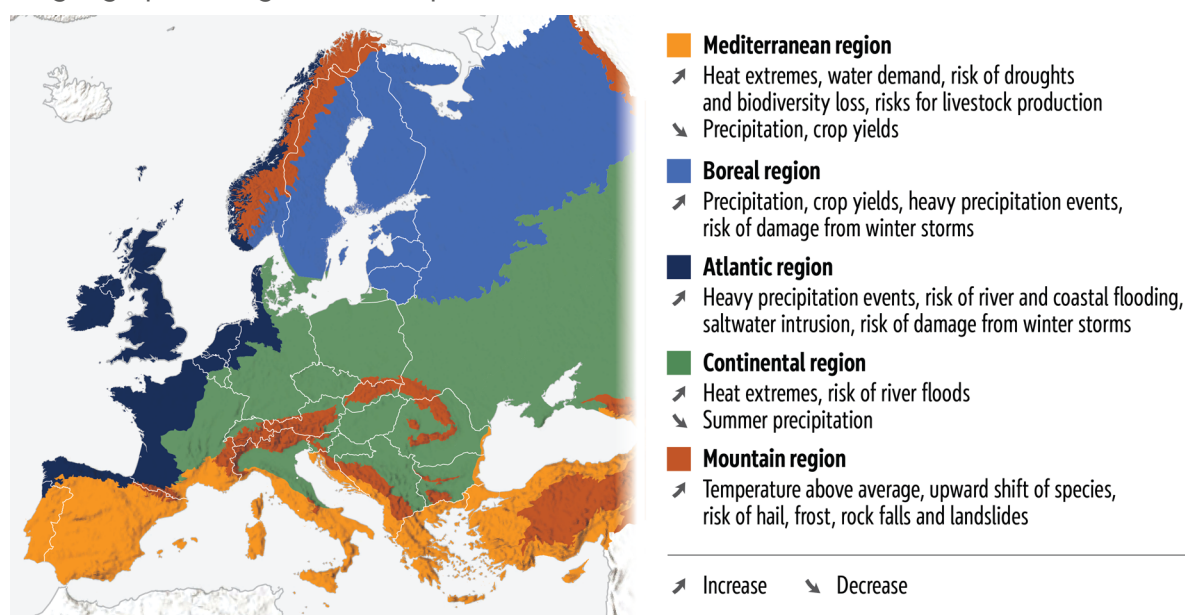
- **Availability** depends on the production of food and its storage, processing, distribution and exchange.
- **Accessibility** involves the ability to obtain food, including purchasing food at affordable prices.
- **Utilisation** is related to the nutrient composition of food, its preparation and the overall state of health, all affected by food safety and quality.
- **Stability** concerns people's ability to access and use food in a steady way.

**Food systems** encompass production, processing, distribution, preparation and consumption of food, as well as socio-economic and environmental outcomes. **Food system resilience** refers to capacity to respond to disturbances over time.

Sources: [Rome Declaration](#) (1996), IPCC ([2019](#)).

[report](#) by Copernicus, the EU's Earth observation programme. On record, 2024 underwent the second highest number of heat stress days and tropical nights, and the most widespread flooding since 2013. These extreme events show [overall trends](#): a general increase in extremely hot summer temperatures, drier conditions in southern Europe and more frequent heavy rainfall episodes in northern and central Europe. By 2100, heatwave days could increase fivefold in cooler regions and up to thirtyfold in warmer ones, while drought severity in southern Europe may triple. As a result of these extreme weather events, crop losses over the past decade were up to [30 %](#) higher relative to predicted trends. Currently, droughts (54 %), heavy rain (21 %), frost (16 %), and hail (9 %) account for [80 %](#) of agricultural losses in the EU.

Figure 1 – Key climate change impacts on the agricultural sector for the main biogeographical regions in Europe



Data source: [EEA](#), 2019.

Climate change increases the seasonal variability of [water availability](#) across the EU, with [one third](#) of the area already experiencing **water stress** all year round. A sufficient level of water quantity and quality is key to food security. The agricultural sector accounts for around [30 %](#) of annual [water abstraction](#). Over 80 % of irrigation needs occur in southern Europe, peaking in spring and summer.

There is [high confidence](#) that **regional differences** in climate risks across the EU are growing. As a result, food production gaps between southern and northern Europe will widen, with the North being less vulnerable and potentially gaining from new opportunities. This may affect mutual reliance and trade patterns across Member States. For instance, southern Member States export water-intensive crops, such as fruits and vegetables, to northern ones, which experience less water stress. In its 2024 European Climate Risk Assessment ([EUCRA](#)), the EEA [rated](#) the level of risk to crop production from climate hazards as substantial for Europe and critical for southern Europe in the medium term (2041–2060). A 2025 global [study](#) of six staple crops found that a high-emissions scenario would reduce crop yields in Europe by [21.5 %](#) by the end of the century.

**Wheat** is the most widely produced cereal in the EU, accounting for [46.3 %](#) of total 2023 production by weight. Between 1961 and 2014, the impact of climate change on wheat yields [ranged from](#) -7 % in Spain to -30 % in Germany. Looking ahead, the Joint Research Centre (JRC) [expects](#) that, under a [high emissions scenario](#), wheat yields in southern Europe could drop by up to 49 % by 2050, as water scarcity limits the benefits of atmospheric CO<sub>2</sub>. Conversely, the JRC estimates a 5–16 % increase in northern Europe, due to higher precipitation, more CO<sub>2</sub> and a shorter growing cycle.

Grain **maize** represents [22.5 %](#) of the EU's cereal production and will be the most climate change-affected crop in Europe. Climate indicators are better suited to predict yield anomalies for maize than for wheat, despite maize's higher heat tolerance. Unlike wheat, which is largely rain-fed, maize is mostly irrigated in Europe. Consequently, maize yield [projections](#) vary depending on irrigation conditions, although all scenarios estimate substantial reductions. Assuming a 2°C warming and fully irrigated conditions, the overall decrease would reach 1-14 % in northern Europe, and 4-22 % in southern Europe, where maize is most widely cultivated. Some yield gains are projected in a few northern Member States, such as the Netherlands and Lithuania, reaching +5 % around 2050. However, if the irrigation infrastructure does not fully remain in place due to insufficient water availability, a collapse of European maize production could occur around 2050, with all Member States experiencing yield reductions higher than 23 %, even exceeding 80 % in southern Member States, including Portugal, Bulgaria, Greece and Spain.

The EUCRA [assesses](#) the risk to **livestock production** in Europe as a result of warming and diseases to be substantial in the mid-term. There is [high confidence](#) that heat and humidity affect animal health and thus product quality. Climate change also affects grassland production and the composition and quality of fodder, especially in southern and eastern Europe.

Regarding **fisheries and aquaculture** in Europe, the EUCRA [identifies](#) a critical mid-term risk. Warming induced algae blooms are a main threat to fish stocks, while jellyfish blooms pose risks to marine aquaculture, and reduced water availability and quality threaten terrestrial aquaculture. In 2022, European seafood production employed more than [150 000 people](#), mostly in southern Europe, where fishing communities are the most vulnerable. [Ocean acidification](#) poses a major threat to seafood production, particularly shellfish production. [Estimates](#) for 2050 show that the Mediterranean habitat suitable for mussels will shift northward. Mussel habitat losses will occur in the Mediterranean and the Black Sea, while gains will occur in northern Member States such as Denmark, and the habitat will remain stable in others such as the Netherlands. Overall, mussel habitat losses (290 000 km<sup>2</sup>) will considerably exceed gains (170 000 km<sup>2</sup>).

Furthermore, climate change **indirectly** threatens food security by disrupting related systems, notably through loss of biodiversity, spread of diseases and a reduction in labour productivity. There is [high confidence](#) that Europe is undergoing a **decline in pollinator** ranges due to climate change, resulting in lower pollinator richness in southern Europe and higher in northern Europe, particularly under a +3°C scenario. Combined with climate-driven shifts in seasons, [mismatches](#) may arise between the life cycle of pollinators and crop flowering, such as [olives](#) and [apples](#). Pollinators affect [35 %](#) of global crop production, including many highly nutritional fruit and vegetable crops.

Warming leads to the spread of pests and **diseases**, affecting food safety and the health of European crops, especially cereals. Certain crop moulds (or fungi) produce mycotoxins, which cause health issues to humans and livestock, from acute poisoning to immune deficiency and cancer. Recent EEA data indicate potentially harmful exposure to specific mycotoxins in [14 %](#) of the adult population in Europe. As these fungi occur in specific temperature and humidity conditions, climate change affects their range due to warming and extreme events, but also due to weakened crop resistance and movement of disease-carrying organisms such as insects and birds. While prior to 1985 the FAO suggested that mycotoxins affected 25 % of global crops, a 2019 [analysis](#) estimates this figure may now have reached 60-80 %. The EEA [warns](#) that developed countries with moderate climates face the highest risk of new climate-induced contamination. There is robust evidence that, under a +2°C scenario, contamination of maize in southern Europe and of wheat in north-western Europe due to extreme heat will increase significantly, whether in the field or during storage. Norman van Rhijn et al. (2025) [mapped](#) the expected progression of contamination by different fungi.

As mentioned above, climate change also indirectly affects food security by reducing **agricultural labour productivity**. The JRC [projects](#) a 1.6 % decline in labour productivity in Europe by 2080 due to heat stress, especially in southern and eastern regions (up to 5.4 % in Greece). Southern workers

are more vulnerable because more of them have physically demanding jobs in agriculture, forestry, and fishing. In the 10 European countries most affected by heatwaves in 2003, 2010 and 2015, the agricultural sector recorded average direct economic losses of approximately [€53-80](#) per worker, with Cyprus, Italy and Spain particularly affected.

## Socio-economic implications of climate change impacts

Climate-related impacts on the food supply chain have several social and economic consequences. On the **food production** side, reduced yields result in economic losses but also in higher and more unstable prices, raising affordability concerns for food security. The European Investment Bank (EIB) finds that Member States currently experience an average economic loss of around 6 % of annual crop and livestock production due to climate change, amounting to [€28.3 billion](#), with south-eastern Europe most affected. By 2050, this loss could reach €40 billion under a high emissions scenario.

Yield losses have **social consequences** on producers and consumers. The EIB [estimates](#) that only 20-30 % of climate-related crop losses are insured, with significant [variations](#) across Member States. In southern and eastern Europe, farmland values could fall by [5-9 %](#) per degree of warming, with lower profitability possibly leading to farmland abandonment. For consumers, inflation reduces food affordability. Extreme heat in 2022 [reduced yields](#) in some regions of western Europe and increased food inflation in Europe by [0.43-0.93](#) percentage points. Warming projected for 2035 would amplify this inflationary impact by up to [50 %](#). In 2024, [9 %](#) of EU citizens could not afford a meal containing meat, chicken, fish or a vegetarian equivalent every second day.

Climate change also directly disrupts **downstream activities**, including storage, processing, distribution, transport and trade. Higher temperatures and humidity shorten post-harvest storage time, altering product quality during processing and increasing food safety risks from pests and insects. Cold chain integrity risks being disrupted, raising the incidence of food-borne diseases or increasing prices due to higher energy needs. Lower water levels on major transport rivers increase navigation disruption risks, especially in southern Europe, as seen during the 2022 drought. Agrifood products represent [10 %](#) of the tonnage transported on the Rhine and 23 % on the Danube. Heat, flooding and storms impact infrastructure, such as road and railways, which are highly vulnerable to summer heat. This leads to food loss, particularly for highly perishable, nutrition-dense items.

### Climate change impacts on global trade partners and implications for EU food security

Climate change affects food production globally, including in key EU trade partners. Global yield losses due to climate change vary across regions, with Asia experiencing the largest share of total economic losses. More than half of EU imports of rice, maize, wheat, cocoa, coffee and soy in 2023 originated from countries with low to medium climate readiness, with rice being the most at risk. Furthermore, one-third of global soybean production losses in 2012 resulted from climate change and associated hot, dry weather in the Americas. At 2°C warming, the production deficit could increase by half.

Changes in production volumes affect food prices. The IPCC has high confidence that climate change could increase cereal prices up to 29 % globally by 2050, particularly affecting low-income consumers. Overall, prices will be less stable; lower latitudes will undergo more pressure, and higher latitudes will experience stronger seasonality changes. Consequently, prices in the EU will also rise, affecting food affordability. Southern Europe is particularly susceptible due to its high dependence on imports. Moreover, as the EU imports around 70-75 % of its protein animal feed – including soybean – mainly from Argentina, Brazil and the United States, the meat sector is particularly at risk.

Sources: FAO ([2023](#)), Foresight Transitions ([2025](#)), Hamed et al. ([2025](#)), IPCC ([2022](#)), EEA ([2024](#)).

While the EU has a positive **trade** balance for agricultural products by value, it is a net importer of seafood, fruits and nuts, oilseeds, protein crops, coffee, cocoa and spices. According to the Commission's medium term outlook report, extreme weather would increase soybean producer price by almost [90 %](#) by 2035, transmitting this inflation to consumers, although at a lower scale. It further [estimated](#) a decline in the EU's global market share for wheat, meat and dairy products, by 2035 (see box above). The EUCRA assessed the medium term risk on EU food sovereignty as [critical](#).

Overall, climate change leads to higher food prices and lower quality. Another indirect social consequence is the inevitable **change in diets**. Some cultural food crops, such as olives and wheat, are most at threat. Additionally, a [reduction](#) in the production and consumption of animal products may be necessary to increase cereal availability for human consumption and preserve food security.

## EU policy and governance responses

The EU's response to climate risks affecting food security consists of a patchwork of policies, which the EUCRA [rates](#) as medium in readiness and lacking alignment and coherence. The common agricultural policy (CAP) and the common fisheries policy (CFP) influence the upstream food supply chain through their impact on food production. The EUCRA [rates fisheries and aquaculture](#) policy-readiness as medium. The CFP focuses on sustainable fish stocks management without addressing long-term climate impacts. The IPCC [stresses](#) the risk of resulting conflicts among Member States.

The EUCRA also [considers](#) that the current EU policy response to the risks facing **crop production** is insufficient, as [confirmed](#) by the IPCC, mainly because agricultural policies mostly address near-term conditions. Some explanations include limited investment resources, low political prioritisation of adaptation, institutional constraints and insufficient access to adaptation knowledge and international best practices. The CAP, being the main agricultural policy, [aims](#) to ensure that food supplies are available and that they reach consumers at reasonable prices. The CAP includes mandatory and voluntary measures that directly support climate adaptation. In order to receive the full amount of direct 'per hectare' payments under [Pillar 1](#), farmers [must comply](#) with statutory management requirements (SMRs) originating from other EU legislation, including on climate, and with nine standards for Good Agricultural and Environmental Condition of land ([GAECs](#)), with the first three concerning climate change.

Beyond these mandatory conditionality requirements, Member States must propose one 'scheme for the climate, the environment and animal welfare' ('eco-schemes'), as well as 'agri-environment-climate commitments' (AECCs) schemes. Eco-schemes, which may focus on adaptation practices at the Member States' discretion, provide additional payments on top for farmers who voluntarily participate. These schemes can include investments in research, advisory services, technical assistance, best practices training and adaptation measures. Farmers voluntarily participating in AECCs receive support for measures concerning agro-ecology, conservation agriculture and forestry, among other areas. However, these measures depend on voluntary participation, allocated resources and farmers' incentives and uptake. They tend to support individual farm-level practices targeting specific climate risks rather than encouraging a more integrated, systemic approach at the farm or landscape level. For instance, [eco-schemes in central and eastern Europe](#) focus on cropland management with limited incentives to go beyond baseline requirements. Additionally, the EUCRA [suggests](#) making CAP interventions more binding in high-risk regions.

On 14 May 2025, the Commission presented a [simplification package](#) proposing amendments to CAP legislation. Regarding [GAEC 2](#), which concerns peatland and wetland conservation, the proposal allows Member States to exclude GAEC2 from the conditionality baseline of eco-schemes and AECCs, to make it easier for farmers to comply with baseline requirements. Farmers may receive separate additional compensation for conservation efforts. Peatlands and wetlands are key [nature-based solutions](#) for reducing the impacts of extreme climate events. Mid-July 2025, the Commission will present a legislative package for the post-2027 CAP.

In light of the 2024 extreme climate events, the Commission proposed additional financial flexibility measures under the CAP's Pillar 1. Following Cyclone Chido in Mayotte, co-legislators [adopted](#) exceptional adjustments to support outermost regions. The use of the [crisis reserve](#), traditionally limited to market disruptions, was temporarily [enhanced](#) to aid farmers' recovery in Spain, Croatia, Cyprus, Latvia and Hungary. However, the Commission's CAP simplification package now [proposes](#) to revert the crisis reserve's use to market crises only. The proposal would still [allow](#) Member States to dedicate up to 3 % of their annual national envelopes to support farmers cope with disasters or animal diseases. Similarly, lawmakers recently [agreed](#) to reallocate unspent CAP Pillar 2 funds from the previous budget period to cover farmers' operational losses from late 2024 floods and wildfires. The EUCRA found that existing CAP measures are [inadequate to address future climate risks](#).

Under the European Green Deal, the [farm to fork](#) strategy (2020) promoted a sustainable and **resilient food system** that would provide food and nutrition security, including for the most deprived. Pursuant to this integrative approach, the Commission had planned to propose a [legislative framework for sustainable food systems](#) for the end of 2023, which was later set aside. Still, under this framework, following Parliament's adoption of its [resolution](#) on ensuring food security and long-term resilience of EU agriculture, the Commission proposed a [new regulation on plants produced by certain new genomic techniques](#) (NGTs) in July 2023, which is currently being discussed between the [Council](#) and Parliament. NGTs' improved resistance to climate change, including to crop diseases and droughts, could contribute to the resilience of the food system.

Following farmer protests and the elections to the European Parliament, the Commission adapted to the new political landscape. It published its [Vision for Agriculture and Food](#) on 19 February 2025, focusing on four priorities towards 2040, including enhancing the **competitiveness and resilience** of the sector, particularly by maintaining EU leadership in global markets, protecting farmers' interests and reducing critical import dependencies. The vision proposes stronger incentives for farm-level adaptation and improved access to agricultural insurance. The Commission also plans to further develop the European Food Security Crisis Mechanism ([EFSCM](#)), which ensures food supply in times of crisis, and to link it to broader EU crisis management. A recent foresight study on [Future-proofing](#) the vision highlights that a reactive approach should not overshadow proactive measures.

Broader **climate policies** also directly influence the resilience of the food system. The [European Climate Law](#) (2021) requires Member States to adopt national adaptation strategies and plans, considering agriculture, water and food security threats. Moreover, the National Energy and Climate Plans (NECPs) are a key tool for bridging agricultural, food and climate objectives. However, the Commission [assessed](#) that only seven NECPs properly embed adaptation measures and stressed Member States only partially integrated its recommendations. The NECPs' assessment also revealed that many Member States will not fully meet their obligations under the Land use, land-use change and forestry ([LULUCF](#)) Regulation, which also tackles grassland maintenance and peatland restoration, contributing to soil preservation, biodiversity and overall resilience.

The [EU climate adaptation strategy](#) (2021) concerns drought, ecosystem services, nature-based solutions and local as well as international stakes. While various policies have been promoting a systemic approach to adapt to environmental and climate impacts, [analysis](#) shows insufficient implementation and limited consideration of potential synergies. The Commission published its [preparedness union strategy](#) on 26 March 2025, highlighting climate change and food-related risks in relation to vital societal functions, with an [announced](#) climate adaptation plan as a [key action](#) by the end of 2026, followed by legislation. The plan will cover five main areas: risk governance; a common framework for assessing, monitoring and communicating risks; making tools available; a market for climate solutions; and mobilising finance and insurance. On 4 June 2025, the Commission published its [water resilience strategy](#), including security and preparedness measures.

As climate change is not an isolated event, **biodiversity, soil and water policies** also enhance food system resilience. The [biodiversity strategy for 2030](#) (2020) includes agricultural land measures to be integrated into the Member States' CAP strategic plans. These measures include precision agriculture, organic farming and agro-ecology. The strategy also tackles pollinator decline through the EU Pollinators Initiative (2023). Within this framework, co-legislators adopted the [Nature Restoration Regulation](#) in June 2024 and, linked to its [Article 10](#), the Commission, on 19 June 2025, published a [draft](#) delegated act to monitor pollinator populations. Article 11 seeks to enhance biodiversity in agricultural ecosystems, considering climate change risks and setting progressive targets for the restoration of organic soils in drained peatlands. Linked to the [soil strategy for 2030](#) (2021), a provisional agreement was reached on 10 April 2025 on the proposed [soil monitoring law](#), aiming to assess soil health, protect and restore soils, and ensure their sustainable use.

## Outlook and recommendations

Various policy options exist along the food supply chain. **Technological solutions** mostly focus on the supply side. 'Smart agriculture' can enhance farmers' responses to climate impacts, using precision agriculture technologies to tailor inputs and management. Moreover, improved irrigation can reduce wheat yield losses, but droughts have already led to irrigation failures in southern and eastern Europe. Moreover, the EU is promoting new genomic techniques to improve crop tolerance. Research [suggests](#) that new fertiliser technologies can also enhance plant protection mechanisms. However, the IPCC [warns](#) that technology is more effective for heat stress and drought than floods, and relying too heavily on '[technosalvation](#)' reduces the range of solutions available for adaptation.

**Sustainable farming practices** offer ecological adaptation options. The EUCRA [highlights](#) the importance of diversifying crop and livestock species for resilience co-benefits. The Institute for European Environmental Policy has [found](#) that crop rotation and intercropping can enhance soil quality and reduce disease risks for wheat and potatoes. Wheat also benefits from agroforestry and no-tillage practices. Mulching can increase potato yields by [30-40 %](#). [Traditional landrace crops](#), which are more resilient and nutritious, along with local knowledge, are crucial in high-risk environments. The IPCC [recommends](#) training programmes and policy support to ensure the implementation of sustainable farming practices for adaptation in the EU.

Further along the supply chain, fostering **sustainable food systems** would greatly contribute to food security in the EU. Reducing meat consumption, and shifting to [alternative protein sources](#) could lead to a [19 %](#) reduction in the need for arable land and a 12 % reduction in water usage worldwide, while also diversifying income streams for farmers between seasons. Promoting research and development of [novel foods, neglected and alien species](#) would improve food nutritional quality and availability amid climate change. The IPCC [notes](#) that reducing food loss and waste would decrease the land area needed for food production, thereby enhancing the resilience of the food system.

The EEA has [proposed](#) four imaginary scenarios describing what a sustainable European food system might look like in 2050, with varying degrees of integration of nature and technology-based solutions. The EEA also considers **socio-economic solutions** for consumers, such as promoting the right to adequate food for all through different income distribution systems, as well as dynamic food pricing that reflects the health and environmental costs of nutrition.

## MAIN REFERENCES

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[ep@ep.europa.eu](mailto:ep@ep.europa.eu) (contact)

[www.eprs.ep.parl.union.eu](http://www.eprs.ep.parl.union.eu) (intranet)

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