



**GIANT
LEAPS**

POLICY BRIEF 8

Production of alternative protein sources for food and nutrition security



OBJECTIVE

This policy brief is part of a series of nine policy briefs developed by the GIANT LEAPS project, which explores the protein transition and the role of alternative protein sources in Europe. It focuses on how public policy can support alternative protein production and innovation that contribute to food and nutrition security (FNS), healthy and sustainable diets, and respect for climate and environmental limits.

Agricultural production and the protein transition involve several competing policy priorities. FNS is fundamental, but it should not be equated with maximising agricultural output regardless of what is produced, how it is produced, or how efficiently resources contribute to human nutrition. Similarly, while competitiveness is a prominent European policy priority, the agrifood sector's performance must be assessed in context, considering its contribution to FNS, use of public resources, and climate and environmental impacts. Neither production nor economic activity alone should determine where public support is directed.

To help policymakers navigate these choices, the brief introduces a framework for assessing agricultural production against four interconnected priorities: FNS, climate action, competitiveness, and a healthy environment. Building on the triple bottom line concept, it gives climate change explicit visibility alongside broader environmental concerns. The framework helps identify which forms of production deliver the greatest societal value and where public support can best advance Europe's long-term objectives.

The second part applies this framework to alternative protein sources and their potential to reduce EU dependencies on imported protein-rich feed, synthetic fertilisers and energy. Diverse, resource-efficient protein sources for human consumption can strengthen Europe's capacity to provide healthy and sustainable diets while reducing pressure on land and other natural resources. The brief concludes with recommendations and a call for action to align public policy, research, investment and the efforts of policymakers, researchers, primary producers and food businesses with Europe's nutritional needs, strategic autonomy, climate objectives and environmental responsibilities. The aim is to develop and scale alternative proteins where they deliver clear societal benefits and contribute to a healthier, more sustainable and less dependency-prone European food system.

SUMMARY

The primary role of agriculture is to provide sufficient, nutritious, safe and affordable food for a healthy population and ensure food and nutrition security (FNS). The starting point should therefore be the nutritional needs of Europe's population, informed by evidence-based dietary recommendations for healthy and sustainable diets, and how European agriculture can best provide them. At the same time, food production must operate within the limits of a changing climate and finite land, water and other natural resources.

Achieving these objectives requires European agriculture to contribute simultaneously to FNS, climate action, competitiveness and a healthy environment. Climate change and extreme weather increasingly threaten production, while geopolitical tensions and resource scarcity expose vulnerabilities in supply chains. Europe also remains dependent on critical external inputs, including energy, synthetic fertilisers and feed ingredients such as soy and amino acids. Reducing these dependencies can strengthen both resilience and European competitiveness.

FNS does not require maximising every form of agricultural production. With finite resources and competing demands on land and water, Europe should prioritise production that delivers the greatest contribution to nutritious and sustainable diets, economic value, climate objectives and a healthy environment. Human edible protein conversion efficiency provides a practical lens for this challenge: reducing unnecessary conversion losses can lower resource use and dependence on imported feed, while opening opportunities for more direct and efficient routes from agricultural resources to nutritious food.

Alternative proteins provide an important means to produce the food and nutrition Europe needs more efficiently. Legumes and other protein-rich crops, aquatic foods, (precision) fermentation and cellular agriculture offer different pathways to reduce resource use and external dependencies. These pathways can help create a more resource-efficient protein supply while opening new opportunities for European innovation and value creation. Europe should create the conditions for promising alternative protein sources and solutions to develop and scale, thereby strengthening FNS while advancing climate action, European competitiveness and a healthy environment.

KEY POLICY RECOMMENDATIONS

Recommendations

1. **Prioritise the 2050 climate goal:** Achieve net-zero greenhouse gas emissions across the EU economy by 2050, balancing residual hard-to-abate emissions with carbon removals.
2. **Ensure food and nutrition security:** Align European food production with the nutritional needs of healthy and sustainable diets, ensuring a sufficient, diverse, safe, nutritious and affordable food supply at all times.
3. **Reduce structural dependencies in the EU food supply chain:** Develop and implement a strategy to significantly reduce the EU's dependence on critical external inputs, including energy, synthetic fertilisers and feed ingredients such as soy and amino acids.
4. **Accelerate innovation in resource-efficient protein production:** Support research, development and innovation in alternative protein sources and production systems that can contribute to healthy and sustainable diets while reducing resource use, external dependencies and environmental pressures.
5. **Support farmers, fishermen and food producers:** Provide targeted support to farmers and other food producers to diversify protein production and reduce dependence on vulnerable external inputs, including by developing alternative protein sources suited to different European pedo-climatic zones.
6. **Develop alternative protein value chains:** Support the establishment and scaling of integrated, resilient and economically viable value chains for alternative proteins, from primary production to processing, distribution and consumers.
7. **Reduce pressure on natural resources and pollution:** Develop and implement initiatives to reduce the use of scarce natural resources, including land and freshwater, while setting and enforcing effective measures to limit pollution.
8. **Address agriculture's impact on biodiversity:** Develop and implement measures to significantly reduce the impact of agriculture on biodiversity loss and promote farming practices that contribute to the restoration and protection of ecosystems.

Call for Action

1. **Governments and regulators:** Make alternative protein production a strategic component of Europe's FNS strategy by mobilising investment, supporting producers and innovation, building the infrastructure to scale, and creating a predictable regulatory environment.
2. **Scientists and research institutions:** Build the evidence, technologies, crops and production systems needed to assess and scale resource-efficient production of alternative protein sources that can contribute to healthy and sustainable diets.

3. **Food primary producers:** Explore opportunities to diversify protein production and reduce dependence on vulnerable external inputs, where alternative crops, production systems and markets are economically and agronomically viable.
4. **Food processors, retail and HORECA:** Build strong European alternative-protein value chains by connecting producers with reliable markets, investing in innovation, and moving alternative proteins from niche to mainstream.

INTRODUCTION

Europe's agricultural sector is facing a combination of pressures that can no longer be addressed in isolation^{67, 78}. This requires a shift in how European agricultural production is considered^{2, 78}. **The starting point should be what Europe needs to eat, rather than how much agriculture can produce**^{16, 28, 35, 49, 58, 80, 87, 90}. With finite land, water and other resources, Europe needs to consider where agricultural production **contributes most to food and nutrition security (FNS), economic value, climate objectives and a healthy environment**^{1, 2, 32, 36, 42, 54, 80, 94}.

Competitiveness should mean creating greater economic and societal value from Europe's scarce resources, while innovation should help deliver healthy and sustainable diets with lower resource use, fewer external dependencies and lower environmental pressures^{9, 20, 35, 57}. **Protein conversion efficiency provides a practical lens** for identifying opportunities to reduce unnecessary conversion losses and use agricultural resources more efficiently⁸⁶. Alternative proteins are an important means of **producing the food Europe needs more efficiently**^{24, 36, 64}.

This policy brief translates this perspective into **eight recommendations and a targeted call for action**. The recommendations address four interconnected objectives (**FNS, climate action, competitiveness and a healthy environment**) and focus on climate mitigation and adaptation, reducing external dependencies, accelerating resource-efficient protein innovation, supporting farmers and food producers, developing competitive alternative-protein value chains, reducing pressure on natural resources and pollution, and restoring biodiversity.

The accompanying **call for action identifies what different actors can do to turn these recommendations into practice**. Governments and regulators need to create the conditions for investment, innovation, scale-up and market development; scientists and research institutions need to build the evidence, technologies and production systems required; primary producers need viable opportunities to diversify production and reduce dependencies; and food processors, retailers and HORECA can help create functioning markets and make alternative proteins a normal part of everyday diets.

POLICY RECOMMENDATIONS

Recommendation 1: Prioritise the 2050 climate goal: Achieve net-zero greenhouse gas emissions across the EU economy by 2050, balancing residual hard-to-abate emissions with carbon removals^{9, 22, 53, 72}

1.a Integrate agriculture into the EU decarbonisation pathway, addressing greenhouse-gas emissions across agricultural production, including methane and nitrous oxide emissions, while supporting measures that maintain food production capacity^{2, 7, 36, 39, 61}.

1.b Support the transition away from fossil-fuel dependence in agriculture, including through renewable energy, lower-emission fertiliser production and alternatives to fossil-based materials and plastics^{47, 57}.

1.c Maintain and strengthen measures to prevent deforestation and forest degradation associated with agricultural supply chains, recognising their importance for both climate mitigation and biodiversity protection⁴⁰.

Recommendation 2: Ensure food and nutrition security: Align European food production with the nutritional needs of healthy and sustainable diets, ensuring a sufficient, diverse, safe, nutritious and affordable food supply at all times⁴⁹

2.a Strengthen preparedness for food and nutrition security crises by maintaining and, where necessary, activating contingency plans to safeguard the supply of sufficient, safe, nutritious and affordable food^{6, 10, 31}.

2.b Maintain targeted support for farmers and fishermen where it is needed to sustain the production of safe, nutritious and affordable food and the agricultural capacity required for FNS, particularly in regions and production systems facing structural or climate-related constraints.

2.c Align the European food basket, including domestic production and imports, more closely with evidence-based recommendations for healthy and sustainable diets, while considering affordability, cultural preferences and regional production conditions^{3, 11, 13, 16, 32, 38, 49, 58, 65, 94}.

2.d Ensure that healthy and sustainable food remains economically accessible, particularly for lower-income households, through targeted support, public procurement and measures that improve the availability and affordability of nutritious food¹⁶.

Recommendation 3: Reduce structural dependencies in the EU food supply chain: Develop and implement a strategy to significantly reduce the EU's dependence on critical external inputs, including energy, synthetic fertilisers and feed ingredients such as soy and amino acids^{20, 24, 26, 34, 45, 72}

3.a Reduce the risk associated with concentrated external dependencies by diversifying suppliers, sourcing regions and supply routes for critical agricultural inputs, including feed, fertilisers and energy^{6, 10, 26, 35, 47, 76}.

3.b Increase European production of strategically important protein sources and other agricultural inputs where this is agronomically, economically and environmentally viable, prioritising sources that can contribute directly to human nutrition or reduce dependence on imported feed^{47, 76}.

3.c Reduce dependency on imported feed by developing and implementing plans to reduce the overall protein conversion losses of the EU agricultural sector^{20, 24, 40, 75}. This should include:

- reducing livestock numbers where this is necessary to reduce feed demand,
- shifting from animal foods with high protein conversion losses towards those with lower conversion losses, and
- promoting hybrid food products and alternative proteins,
- preferably using little or no animal-based feed to avoid unnecessary additional animal-protein conversion steps.

3.d Align CAP support with the final food and nutrition value delivered, providing production-linked support preferably once along a food value chain thereby avoiding cumulative support for successive stages where this creates an unintended advantage for production pathways with high protein conversion losses.

Recommendation 4: Accelerate innovation in resource-efficient protein production: Support research, development and innovation in alternative protein sources and production systems

that can contribute to healthy and sustainable diets while reducing resource use, external dependencies and environmental pressures^{20, 64}

4.a Support research and innovation in alternative proteins to strengthen European innovation capacity, promote the competitiveness of the EU economy and prevent the development of new dependencies^{8, 9, 15, 16, 18, 20, 24, 30, 33, 38, 43, 44, 50, 64}. The upcoming EU 10th Framework Programme (FP10) should not overlook the importance of food innovation in achieving protein diversification. Upscaling existing technologies is also important, which is why these topics should also be part of the plans for the new European Competitiveness Fund.

4.b Support research and innovation in alternative protein sources with high potential to lower GHG emissions, reduce the use of scarce resources such as land and water, and improve protein conversion efficiency^{8, 12, 19, 20, 24, 32, 86}.

4.c Require transparent and comparable assessment of the nutritional, environmental, economic and social performance of alternative protein production pathways, including resource use, climate impacts, circularity and protein conversion efficiency, to build the public evidence base and guide future R&I and investment decisions^{7, 12, 18, 19, 20, 24, 36, 42, 47, 48, 61, 68, 69, 81, 86, 88}.

4.d Focus specifically on research and innovation in legumes as alternative protein sources, as these crops can provide nutritious plant-based protein while improving soil fertility through biological nitrogen fixation and reducing the need for synthetic fertilisers⁷⁴. This should include research in feedstock utilisation strategies and protein fractionation and functionalisation, to achieve higher-quality ingredients for alternative protein products with less processing.

Recommendation 5: Support farmers, fishermen and food producers: Provide targeted support to farmers and other food producers to diversify protein production and reduce dependence on vulnerable external inputs, including by developing alternative protein sources suited to different European pedo-climatic zones^{10, 17, 20, 33, 44, 46, 50, 64, 77}

5.a Invest in the conservation and characterisation of plant genetic resources, including traditional varieties and underutilised crops, to safeguard valuable genetic diversity for future protein production and changing climatic conditions^{64, 82}.

5.b Invest in long-term value-chain breeding of crops with high potential as alternative protein sources by developing varieties that meet the needs of the entire value chain^{64, 74}.

5.c Provide targeted financial support to farmers, fishermen and other primary producers to transition towards viable alternative protein sources and production systems economically attractive, particularly where initial costs or market risks could hinder adoption^{44, 46}.

5.d Close the European scale-up investment gap by strengthening access to growth capital for alternative protein companies and technologies, mobilising institutional, private and public investment, and creating conditions that enable promising European innovations to scale and commercialise in Europe^{15, 30}.

5.e Provide farmers with targeted advisory services, training and practical knowledge on alternative protein crops, diversified production systems, relevant technologies, markets and business opportunities.

Recommendation 6: Develop alternative protein value chains: Support the establishment and scaling of integrated, resilient and economically viable value chains for alternative proteins, from primary production to processing, distribution and consumers^{17, 18, 20, 33, 43, 44, 50, 60, 64, 70, 77}

6.a Provide regulatory support for innovative alternative protein sources and products, including appropriate regulatory guidance and, where suitable, regulatory sandboxes to facilitate safe and predictable market entry^{18, 44, 70, 84}.

6.b Support the scale-up of promising alternative protein value chains through access to pilot and demonstration infrastructure, processing capacity, technical expertise and public and private investment^{8, 17, 18, 20, 30, 43, 44, 64, 74}.

6.c Policy should help overcome the scale and aggregation barriers that can keep promising protein crops trapped in low-production, weak-market cycles, particularly by linking R&I, production, processing and market development^{18, 64, 74}.

6.d Strengthen coordination across alternative protein value chains by connecting primary producers with processors and reliable markets, addressing supply-chain bottlenecks and supporting the development and market uptake of alternative protein products^{18, 59, 60, 64, 74}.

6.e Public procurement, including schools, hospitals and other public institutions, can help create reliable early markets for nutritious and sustainable protein options^{5, 16, 17, 20, 33, 38, 44, 85}.

6.f Encourage retail, food service and HORECA to develop measurable (net zero) transition plans and actively support the shift towards more sustainable protein consumption, by helping to create reliable demand for European alternative protein value chains^{18, 50, 59, 63, 70, 85}.

Recommendation 7: Reduce pressure on natural resources and pollution: Develop and implement initiatives to reduce the use of scarce natural resources, including land and freshwater, while setting and enforcing effective measures to limit pollution⁵⁵

7.a Support R&I into protein production systems that require less agricultural land and other scarce resources, including single-cell and fermentation-based proteins, microalgae, insects and cellular agriculture, while assessing the full resource requirements and environmental impacts of each production pathway^{36, 46, 68, 86}.

7.b Improve water efficiency across agricultural and protein production, including through more water-efficient crops and production systems, improved water management and technologies that reduce freshwater requirements and pollution^{10, 41}.

7.c Reduce pollution from agricultural and protein production, including nutrient losses, pesticides and other chemical pollutants, while promoting production systems that reduce pressure on soils, freshwater and surrounding ecosystems^{27, 42}.

Recommendation 8: Address agriculture's impact on biodiversity: Develop and implement measures to significantly reduce the impact of agriculture on biodiversity loss and promote farming practices that contribute to the restoration and protection of ecosystems^{22, 23, 55, 79, 93}

8.a Ensure sufficient land and freshwater areas for nature by sustainably protecting existing natural and semi-natural areas and maintaining the extent to support biodiversity and functioning ecosystems^{2, 93}.

8.b Strengthen incentives for ecosystem services, including farmland biodiversity, pollinator protection, soil health, water quality and landscape restoration, rewarding farmers and land managers for measurable environmental outcomes^{10, 79}.

8.c Maintain and strengthen sustainable management of European fisheries and aquaculture, including effective protection of fish stocks, reduction of unwanted catches and other ecosystem pressures, and promotion of production practices compatible with biodiversity and healthy aquatic ecosystems.

8.d Develop integrated regional food and land-use strategies that balance food production, climate mitigation and adaptation, biodiversity, water management and other ecosystem services^{2, 10, 21, 22, 41, 52, 54, 67, 79, 93, 94}.

CALL FOR ACTION

For governments and regulators:

Governments and regulators should create the conditions for a successful transition towards more resource-efficient protein production.

General agricultural and investment policy:

- ✓ Provide a coherent policy framework that aligns agricultural, food, research, investment and demand-side measures^{16, 28, 33, 38, 52, 67}.
- ✓ Review CAP support across food value chains to avoid cumulative production-linked support for successive stages where this creates an unintended advantage for pathways with high protein conversion losses.
- ✓ Create targeted financial incentives for farmers and other food producers so that growing and producing alternative proteins becomes financially attractive³³.

Alternative protein sources and value chains:

- ✓ Support initiatives such as (community) seedbanks to conserve, characterise and make available traditional varieties, old cultivars and underutilised protein crops, safeguarding the genetic diversity needed for future breeding and innovation^{17, 82}.
- ✓ Invest in value-chain breeding programmes that bring farmers, breeders, processors, food manufacturers and other value-chain actors together to develop protein crops that meet shared needs, strengthening competitive European protein value chains^{17, 74}.
- ✓ Invest across the full innovation and scale-up pathway, from field to demonstration and commercialisation, so that promising European alternative-protein innovations can scale and commercialise in Europe^{24, 30, 33}.
- ✓ Help build the infrastructure and supply chains needed to scale production of alternative protein production and help develop competitive European value chains^{8, 15, 24}.
- ✓ Actively shape a food environment in which alternative proteins can become a normal part of everyday diets, creating the consumer demand needed to support the development and growth of European alternative-protein value chains^{5, 50, 63}.
- ✓ Enable innovation through a predictable and supportive regulatory framework that allows safe and sustainable protein products to reach the market^{27, 38, 43, 69, 84}.

For scientists and research institutions:

Scientists and research institutions should provide the knowledge and technologies needed to accelerate the development of alternative protein sources^{43, 64, 72}.

- ✓ Develop crops and production systems fit for the future with particular attention to reducing the dependencies and strengthening the resilience of the European food system⁶.
- ✓ Strengthen research across the alternative protein value chain, from crop production and processing to product development and market applications⁴⁴.
- ✓ Build a robust evidence base on social and environmental impacts of different protein sources and production systems, including through transparent and comparable life-cycle assessments^{36, 60, 70, 72}.
- ✓ Understand consumers and societal acceptance by investigating consumer preferences, perceptions, behaviour, and the factors that enable the adoption of alternative proteins^{5, 59, 63, 85}.
- ✓ Assess the wider economic, social, environmental, legal and policy conditions needed for alternative proteins to contribute to food and nutrition security and a more resource-efficient food system³⁵.

For primary producers:

Primary producers should be supported in exploring viable opportunities to diversify protein production and reduce dependence on vulnerable external inputs.

- ✓ Produce healthy food for a healthy population while preserving the environment^{4, 56, 58, 65, 94}.
- ✓ Explore viable opportunities to diversify protein production, including new crops, production systems and technologies suited to local conditions and markets^{17, 25}.
- ✓ Build resilience by reducing dependencies on vulnerable external inputs, such as imported soy and amino acids for feed, and by exploring alternatives to synthetic fertilisers⁷⁶.
- ✓ Contribute to lower protein bioconversion losses by exploring crops, products and production systems that can provide food directly or reduce unnecessary conversion steps, where they are agronomically and economically viable.

For food processors, retailers and HORECA:

Food processors, retailers and HORECA should help turn alternative protein sources into accessible products and functioning markets^{18, 59}.

- ✓ Invest in products that consumers want to eat by developing affordable, nutritious, tasty and convenient alternative-protein products that fit into everyday diets, improving their availability and visibility, and working across the value chain to build reliable markets³⁰.
- ✓ Build and strengthen European alternative-protein value chains by connecting European farmers and other protein producers with food manufacturers and developing reliable markets for European protein sources³⁰.
- ✓ Make alternative proteins visible, accessible and easy to choose by moving them from niche to mainstream and making them a familiar part of everyday food offerings⁵.
- ✓ Lead the market through collaboration and innovation by actively shaping the transition towards food products based on proteins with lower bioconversion losses, while working across the value chain to accelerate innovation and respond to changing consumer needs²⁵.

BACKGROUND INFORMATION

Europe is facing a combination of pressures that are increasingly difficult to address in isolation. Climate change and extreme weather threaten agricultural production, while geopolitical tensions and resource scarcity expose vulnerabilities in supply chains^{6, 26, 35, 36, 57}. The Draghi report highlights the wider vulnerability of the European economy to external dependencies and the need to strengthen Europe's competitiveness, productivity and resilience^{14, 15, 89}.



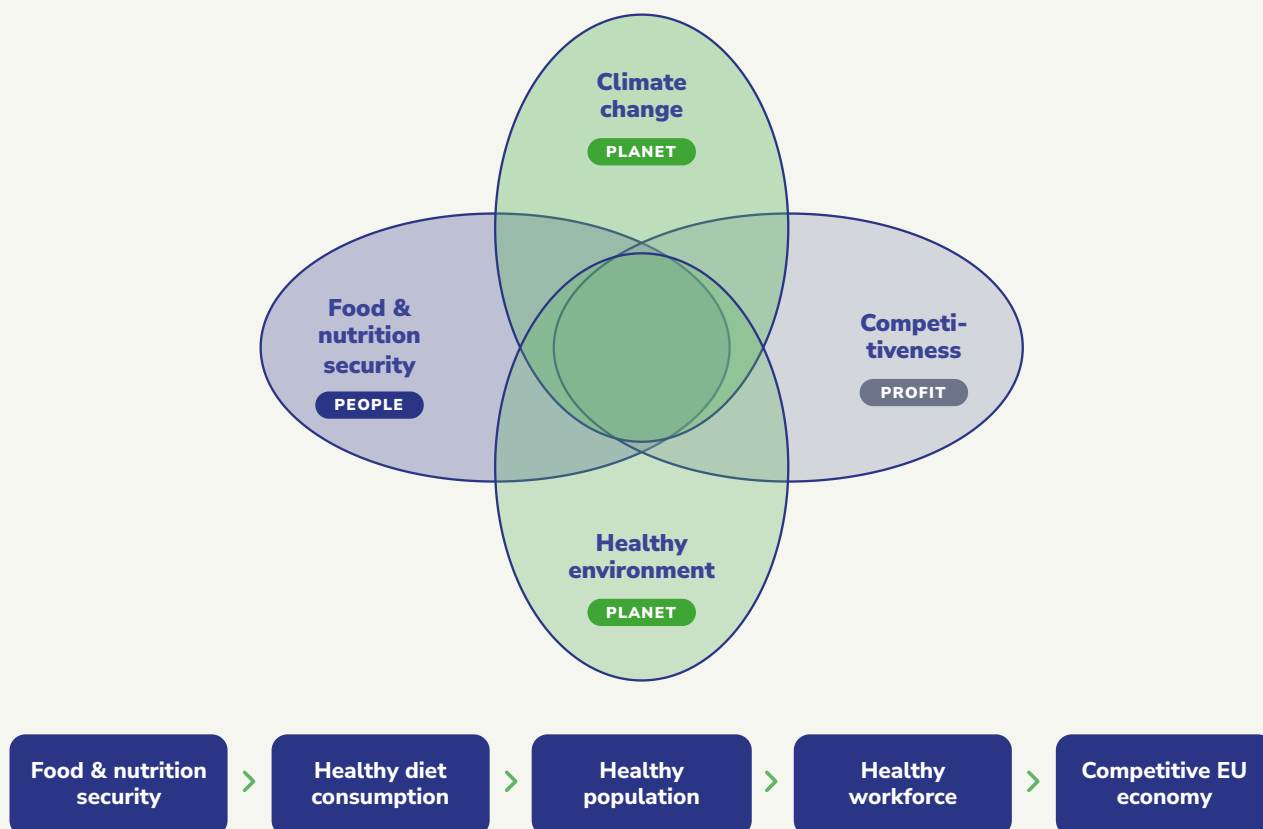


Figure 1: The four key priorities in food production: to tackle climate change, to ensure food and nutrition security, to maintain competitiveness of the EU, and to protect the environment, incl. tackling biodiversity loss (the picture is a variation of the Triple Bottom Line).

Against this backdrop, European agriculture needs to contribute to four interconnected objectives: **food and nutrition security (FNS), climate action, competitiveness, and a healthy environment**^{16, 52}. Agricultural production must provide adequate nutrition and support healthy and sustainable diets, while remaining economically viable and operating within environmental and resource constraints^{27, 35}. These objectives therefore need to be considered together when determining **what Europe produces, how it produces it, and how scarce agricultural resources are allocated**¹.

Climate change

The summer of 2026 provided a stark reminder that **climate change is intensifying and increasingly threatening agricultural production**^{36, 72, 76}. Across Europe, extreme heat, drought, wildfires and water scarcity affected agriculture and ecosystems, with significant crop losses and growing pressure on farmers and rural economies³¹. In her 2026 State of the Union address, Commission President Ursula von der Leyen described the summer as a “summer of truth” for climate change and stated: **“Almost no part of our continent was spared.”**⁴⁶ The Commission reported that around 12 million tonnes of crops were lost during the summer⁴⁶. Extreme weather events, particularly prolonged heatwaves and wildfires, not only damage crops and harvests but also severely worsen working conditions for agricultural workers, increasing heat-related health risks³⁹.

Climate change is therefore an immediate challenge for European agriculture, requiring both **mitigation and adaptation**^{56, 61, 71, 72, 78}. Agricultural production must become better able to cope with heat, drought and extreme weather, while reducing greenhouse-gas emissions^{7, 10, 40}. The economic consequences of climate change are also becoming visible in the **insurability of agricultural production**⁹². The German Insurance Association (GDV) reports that only around **1.3% of Germany’s agricultural crop area is currently insured against drought**, because premiums and deductibles for multi-peril insurance are often

too high for farmers to afford³¹. Drought is particularly difficult to insure because it can affect large areas simultaneously, creating potentially very high losses for insurers³¹. Maintaining Europe's future capacity to provide healthy and sustainable diets will require both **lower-emission production and agricultural systems adapted to a changing climate**¹⁰.

This conclusion is reinforced by an assessment from the UK's **Joint Intelligence Committee**, which examined the national-security implications of ecosystem collapse driven by climate change and the overexploitation of nature³⁷. It concluded that degradation of critical ecosystems poses significant risks to food and water supplies, economic security and national security, with cascading consequences including **food insecurity, migration, geopolitical instability and conflict**^{6, 22, 37, 55}.

This requires changes in both what Europe produces and how it produces it.

Food and nutrition security

Food and nutrition security (FNS) means that everyone should have reliable, long-term access to sufficient, safe and nutritious food that supports a healthy life. The objective is therefore not simply to produce enough calories or protein, but to enable people to follow **healthy and sustainable diets throughout their lives**^{28, 58, 83, 94}.

There is growing recognition that dietary recommendations need to consider both human health and environmental sustainability^{3, 81, 83, 94}. The EAT-Lancet Commission established a global framework for healthy diets within planetary boundaries, while national recommendations are increasingly integrating health and environmental considerations⁵⁸. The Nordic Nutrition Recommendations, for example, recommend a predominantly plant-based dietary pattern rich in vegetables, fruits, whole grains, pulses, nuts and seeds, with limited consumption of red and processed meat and ample consumption of fish from sustainably managed stocks⁴. Germany's 2024 dietary guidelines similarly considered nutritional adequacy, health effects, environmental impacts and habitual dietary patterns^{13, 65}.

This provides an important starting point for European food policy: **we should first consider what people need for a healthy and sustainable diet, and then determine how agricultural production can best provide it**^{2, 11, 28, 65, 79, 81}. Recent modelling by Daas and colleagues further illustrates how dietary and protein requirements can be assessed against nutritional and environmental objectives^{3, 12}.

Access to healthy food is equally important⁷³. Even when sufficient food is available, people may not be able to afford or access a healthy diet, particularly those facing poverty or socioeconomic disadvantage^{28, 73}. Governments therefore have an important role in ensuring that **healthy and sustainable food remains economically accessible to all**. Targeted measures for vulnerable groups, as demonstrated by Brazil's recent progress in reducing severe food insecurity, together with approaches such as healthy school meals and sustainable public procurement, can help ensure that those most at risk are not left behind^{28, 73}.

Adequate nutrition also supports healthy development, physical and cognitive potential, healthy life years and a productive workforce. FNS is therefore not only a matter of preventing hunger; it is a foundation for **public health, human wellbeing and European competitiveness and prosperity**⁷³.

Competitiveness

Competitiveness is essential for a prosperous European economy and, consequently, for long-term FNS. As highlighted in the Draghi report (2024), Europe needs to increase investment to achieve the digitalisation and decarbonisation of its economy while strengthening its defence capacity¹⁴. To safeguard prosperity within a sustainable environment, Europe needs to increase productivity and strengthen its economic competitiveness^{15, 89}.

Competitiveness: what does it mean for agrifood?

Competitiveness is ultimately about the capacity to create value from scarce resources. For most sectors, financial value creation is a central measure. Agrifood is different: its primary societal function is to provide the food and nutrients people need, while also providing substantial employment and supporting economic activity across rural areas, processing, logistics and related industries. **The question is therefore not simply how much financial value agrifood can generate, but how effectively it creates economic and societal value while contributing to FNS^{32, 91}.**

Two recent strands of evidence illustrate why this distinction matters. **McKinsey's analysis of 134 publicly traded agrifood companies** found an average total shareholder return (TSR) CAGR of around **6% between 2010 and 2025**, below the S&P 500⁵³. BCG's analysis of 38 major agribusiness companies similarly found median TSR of **4% between 2020 and 2024**, with agriculture lagging almost all other sectors^{62, 91}. These analyses cover publicly traded companies and do not capture family-owned businesses or cooperatives, but they nevertheless suggest that conventional agrifood production is not generally among the strongest sources of financial returns.

The Dutch experience illustrates a second dimension. The Netherlands is widely regarded as an agricultural success story, yet recent WUR analysis shows that its current food production, consumption and exports require around **1.6 million hectares of agricultural land in the Netherlands and another 4.7 million hectares abroad**, much of it for imported food and animal feed^{40, 80}. Despite its very large agricultural exports, the Netherlands is a net importer of calories and protein⁸⁰. **Deloitte's report *The Hidden Bill* provides a further perspective. It estimates that the current Dutch agri-food model generates €13.3 billion in economic value while imposing €18.6 billion in hidden societal and environmental costs, resulting in a net annual deficit of €5.3 billion⁶⁶.**

Agrifood competitiveness therefore needs to be understood differently from competitiveness in many other sectors. The sector should first ensure its fundamental contribution to FNS, while creating employment, economic activity and value in ways that use land and other resources efficiently and respect climate and environmental limits^{26, 43}. Financial value remains important for investment and economic viability, but it should not be pursued independently of these wider objectives.

This requires attention to **where investment and public support generate the greatest long-term value**, because today's policy and investment choices will shape Europe's future food production, resource use and competitiveness^{15, 30, 62, 72, 77, 89}. European research and innovation are strong, but too many promising ideas struggle to reach the market and scale into successful businesses^{17, 25, 30}. For agriculture and food, innovation should increasingly contribute to healthy and sustainable diets, efficient resource use, lower climate impacts, reduced external dependencies and a healthy environment⁷⁷. The use of R&I funding to provide financial support to farmers and fishermen in response to high fossil-fuel prices in spring 2026 and high artificial fertiliser prices in July 2026 also illustrates the trade-off between using scarce innovation resources to address short-term cost pressures and investing in longer-term structural competitiveness⁵⁴. Temporary financial support for food producers may be appropriate when transitioning to new crops, particularly where initial costs or risks could hinder adoption^{33, 45, 77}.

The **circular bioeconomy** can support this transition by creating greater value from biological resources, residues and by-products while reducing resource losses^{2, 88}. Emerging areas such as **plant-based foods, precision fermentation, cellular agriculture and other alternative-protein technologies** illustrate how research and innovation can create new opportunities for European value creation while potentially contributing to FNS and environmental objectives^{8, 45, 77, 88}.

Competitiveness should therefore not mean preserving the status quo. It should mean using Europe's investment, knowledge and entrepreneurial capacity more effectively to build an economically strong food and agricultural sector that delivers what society needs (healthy, sustainable and affordable diets), while reducing pressures on climate, natural resources and the environment^{8, 9, 14, 24, 30, 33, 53}.

Healthy environment

A healthy environment is essential for Europe's long-term prosperity, FNS and quality of life. Agriculture depends on healthy **land, water and ecosystems**, but can also place significant pressure on them. Three closely connected challenges are particularly important: **natural resource management, chemical pollution and biodiversity loss**^{4, 51, 52, 55}.

Natural resources. Land, freshwater and healthy soils are finite⁴¹. The EEA estimates that 62% of European soils show signs of degradation, while pressures on freshwater resources are increasing in many parts of Europe^{22, 35, 41}. Efficient use of land and water is therefore essential for both FNS and the long-term capacity of European agriculture^{2, 22, 32}. Healthy soils also support water retention, nutrient cycling, biodiversity and carbon storage.

Chemical pollution. Agriculture can contribute to contamination of soil and water through pesticides and nutrient losses⁴². Emerging contaminants such as **PFAS** add further challenges because of their persistence and mobility. Recent action in Denmark concerning pesticide active substances that can form and leach TFA into groundwater, and the subsequent review of relevant substances in the Netherlands, illustrate the importance of addressing such risks before persistent contaminants accumulate in Europe's water resources²⁷.

Biodiversity. Europe's biodiversity continues to decline: 81% of assessed habitats and 62% of assessed non-bird species of community interest are in poor or bad condition^{23, 79, 93}. Agriculture is among the important pressures on habitats and species, alongside land-use intensity, resource overexploitation and pollution^{79, 93}. **Wild bees, hoverflies, butterflies and other pollinators provide essential ecosystem services, including pollination of crops and wild plants**, yet habitat loss, pesticide use and other pressures contribute to their decline. The impact of the EU food system is also felt outside the EU. Many of the agri-food commodities imported into the EU are **produced at the expense of millions of hectares of forests and other natural ecosystems**, fuelling climate change and biodiversity loss^{76, 93}. Protecting biodiversity is therefore part of maintaining the ecological conditions on which agriculture and human wellbeing depend^{42, 51, 79, 93}.

These pressures raise a fundamental question: **how can limited land and natural resources provide the food and nutrients society needs without undermining the natural systems on which future production depends?**^{32, 51, 55, 79, 94}. Where agricultural production is essential for FNS and can be economically and environmentally sustainable, it should become more sustainable and productive². Where production is less necessary or causes disproportionate environmental pressures, reducing production intensity or returning land to nature can create space for biodiversity, carbon storage, water regulation and other ecosystem services^{22, 36, 54}. European responsibility for agricultural environmental impacts cannot be assessed only by looking at what happens on European farms⁴⁰.

The objective should therefore not be to maximise agricultural production, but to use Europe's limited land and natural resources where they provide the greatest contribution to FNS and sustainable economic activities, while supporting climate action and a healthy environment^{17, 32, 48, 79, 90, 94}.

Producing alternative protein sources

Against this backdrop, Europe should first determine how much and what type of food is needed to provide its population with adequate nutrition, and then consider how these needs can be met with the most effective use of land, resources and public support^{13, 19, 24, 32, 41, 81, 83}. This also applies to protein^{12, 81}. Current production relies heavily on livestock, which requires substantial quantities of agricultural

resources and imported feed^{21, 24, 41, 90}. The EU currently imports around **74% of the high-protein feed used in the Union**, while around **70% of the crude protein from cereals, oilseeds and pulses produced and consumed in the EU goes to feed**^{19, 24, 29, 33, 90}.

Improving protein conversion efficiency should therefore be a central objective. Where livestock production makes appropriate use of resources such as grassland that cannot readily produce food for direct human consumption, it can remain part of European agriculture^{19, 21, 29, 75}. At the same time, the climate impacts of livestock production, particularly methane emissions from ruminants, need to be reduced^{33, 36, 71}. Where crops that could provide food directly to people are first converted into animal products, substantial conversion losses occur^{2, 19, 24, 90}. Increasing the production and use of alternative protein sources can reduce these losses, lower pressure on land and other resources, and reduce dependence on imported feed^{6, 7, 8, 48, 70}.

It is important to distinguish **alternative protein sources from alternative protein products**^{17, 33, 64, 83}. Alternative protein sources include agricultural and aquatic resources as well as proteins produced through fermentation and cellular agriculture that can be consumed directly, used in cooking, or processed into other foods⁷⁰. Legumes, pulses, oilseeds, algae and other protein-rich crops and biomass can therefore contribute directly to European protein supply^{17, 33, 64, 83}. Alternative protein products, including meat alternatives, are one possible way of using these resources^{64, 83}. Citizens ultimately decide how these foods are consumed: they may prepare plant-based meals, choose alternative products, consume conventional animal products, or combine them⁸⁵.

Different protein sources also provide different benefits. Legumes are particularly promising because they provide protein directly for human consumption while their biological nitrogen fixation can reduce the need for synthetic nitrogen fertilisers and contribute to more sustainable crop rotations¹⁷. European production of soy is already possible in suitable regions, alongside faba beans, peas, lupins, lentils and other legumes. Aquatic foods should also be considered. Sustainably managed capture fisheries can provide protein and other essential nutrients without requiring agricultural land or terrestrial feed production. The relevant question is therefore how much seafood can be supplied sustainably by European waters and neighbouring European fishing nations, including Norway, the United Kingdom and Iceland. Aquaculture should likewise be assessed according to its **protein conversion efficiency**, which can vary substantially between species, feeds and production systems.

The use of animal-based feed deserves particular attention. Improving protein conversion efficiency should not only consider the conversion of feed into food, but also the origin of the feed itself⁴⁰. In aquaculture, for example, fishmeal and fish oil derived from fish are used to produce farmed fish, creating an additional biological conversion step. Similar questions arise when animal production depends on feed that could otherwise contribute directly to human nutrition. **Where possible, European protein strategies should therefore favour feed sources that do not compete directly with human food and that avoid unnecessary additional conversion steps.**

The European Protein Action Plan identifies insects and other novel feed sources as potential ways of reducing dependencies in animal feed²⁰. This could also provide an early market for the European insect sector, helping producers to develop processing capacity, supply chains and markets while food applications continue to develop. **However, the contribution of insect-based feed should be assessed on its overall resource and protein conversion efficiency**, including the substrates used to rear insects. The objective should not simply be to introduce another protein-conversion step, but to use insects where they can efficiently transform low-value or non-food biomass into useful feed without creating additional competition with human nutrition.

There is no single European pathway towards more sustainable protein consumption^{11, 13, 17, 18, 19, 43, 58, 63, 79, 87}. Dietary choices are influenced by culture, traditions, availability and familiarity. Different countries may therefore favour different combinations of protein sources^{3, 5}. The Nordic Nutrition Recommendations, for example, provide scope both for greater consumption of plant-based foods such as legumes and for fish from sustainably managed stocks⁴. Hybrid products, combining animal-derived and alternative proteins, may provide another transition pathway by increasing the share of alternative protein without

requiring consumers to replace familiar foods completely. Such approaches can complement fully plant-based meals and other alternative-protein products^{3, 5}.

This does not require waiting for a single technological solution. **Many of the measures needed to improve the protein conversion efficiency are already available**, while innovation can further expand the range of options. Farmers and fishermen can play a central role by producing protein-rich crops, sustainably sourced aquatic foods and other alternative protein sources suited to European conditions. Food processors, retailers and consumers then determine how effectively these resources are incorporated into diets.

Public support should consequently focus on **ensuring the food and nutrients required for FNS**, while creating conditions for more resource-efficient and sustainable forms of food production to develop and scale¹⁷. Production beyond these needs should increasingly be able to compete without relying on public support¹⁷. **Setting measurable objectives for improving protein conversion efficiency – including by increasing the direct contribution of plant-based proteins to human nutrition and reducing unnecessary conversion of edible agricultural protein through feed and livestock – could provide a practical way to guide this transition**^{19, 24}.

Alternative proteins provide an important means to produce the food and nutrition Europe needs more efficiently^{19, 24, 25}. Legumes and other protein-rich crops, aquatic foods, (precision) fermentation and cellular agriculture offer different pathways to improve resource efficiency, reduce external dependencies and expand the range of foods contributing to FNS^{19, 24, 42, 43, 70}. These pathways can help transform Europe's protein supply while opening new opportunities for innovation and value creation^{24, 42, 43}. Europe should create the conditions for promising alternative protein sources and solutions to develop and scale, thereby strengthening FNS while advancing climate action, European competitiveness and a healthy environment^{32, 38, 42}.

ACTIONS

The evidence above points to four priorities for European agriculture. **Europe needs to produce the food and nutrients required for healthy and sustainable diets; production must become more resilient to climate change and less dependent on vulnerable external inputs; scarce land, water and other resources need to be used where they create the greatest value; and innovation should help develop more resource-efficient ways of producing protein**²⁰.

1 Climate action — change what we produce and how we produce it.
Reduce agricultural greenhouse-gas emissions while adapting production to heat, drought, water scarcity and other climate impacts.

2 FNS — start with nutritional needs.
Define the food and nutrients needed for healthy and sustainable diets, ensure sufficient and reliable production capacity, and keep healthy food accessible and affordable.

3 Competitiveness — direct investment towards value creation.
Strengthen innovation, productivity and scale-up in activities that create economic and societal value while contributing to FNS, climate action and a healthy environment.

4 Healthy environment — use resources where they create the greatest value.
Use land, water and ecosystems efficiently, reducing pollution and restoring natural systems where agricultural production is no longer the most beneficial use of resources.

These priorities provide the basis for eight recommendations covering climate action, FNS, external dependencies, resource-efficient protein production, support for producers, value-chain development, natural resources and biodiversity.

INSPIRATIONAL EXAMPLES

Below you may find a small, representative, but not all complete, list of initiatives that show that Europe's options extend from improving existing farming practices and supporting farmers to developing new ingredients, technologies and consumer products. That breadth reinforces the brief's central message: support should follow demonstrable contributions to FNS, climate action, competitiveness and a healthy environment.

Sustainable farming

Organic farming

Organic farming offers valuable approaches to several interconnected challenges facing the EU. By avoiding synthetic mineral fertilisers and reducing reliance on external inputs, it can help lower dependencies on imported resources. Practices such as crop rotations, legume cultivation, cover cropping and organic soil management can improve soil health, water-holding capacity and resilience to drought. By avoiding most synthetic pesticides and supporting diverse cropping systems, organic farming can also contribute to biodiversity conservation and reduced environmental pressures. Outcomes depend on the farming system and local context, but organic farming offers practical lessons for more resource-efficient and environmentally responsible agriculture.

Casa Diffusa dei Semi: Strengthening seed sovereignty

Casa Diffusa dei Semi (the Distributed Seed House) is an Italian network of growers who save, reproduce and share seeds, preserving locally adapted varieties and traditional knowledge. By enabling farmers and communities to exchange seeds, the initiative supports agrobiodiversity and greater autonomy over the genetic resources underpinning food production. Through practical workshops and community exchange, it keeps seed-saving skills alive and treats seeds as a shared resource. It illustrates how community-led initiatives can help maintain crop diversity and reduce dependence on concentrated commercial seed markets.

Urgenda's 7-Vinkjes project: Long-term support for biodiversity-friendly farming

Urgenda's 7-Vinkjes project supports farmers in transitioning towards nature-inclusive, regenerative agriculture through seven practical measures covering soil health, fertilisers and pesticides, landscape features, trees, biodiversity and livestock management. Participating farmers receive €1,000 per hectare annually for up to ten years, for a maximum of 30 hectares per farm, alongside knowledge and advice. This long-term approach is designed to give farmers the time and financial certainty needed to change their practices, while sharing transition risks with society. It illustrates how targeted, predictable support can help farmers deliver public environmental benefits while developing viable farming businesses.

Kipster: Circular poultry farming

Kipster, a Dutch egg-production model, demonstrates how livestock can contribute to a more resource-efficient food system. Its chickens are fed mainly on surplus food and food-processing by-products unsuitable for human consumption, limiting reliance on conventional feed ingredients, including imported soy. The model also prioritises animal welfare through housing designed around chickens' natural behaviour and raises male chicks for meat rather than routinely culling them at birth. Its expansion into the United States illustrates the potential to adapt and scale a circular approach internationally.

Alternative proteins

European legumes: Growing protein for direct human consumption

European-grown fava beans, peas, lentils and other legumes offer a practical way to diversify protein production while reducing reliance on imported soy. As nitrogen-fixing crops, legumes can also contribute to crop rotations and reduce fertiliser requirements under appropriate management. Developing value chains that connect farmers with processors and food manufacturers can create markets for locally grown legumes and make plant-based protein ingredients more accessible. European initiatives and companies, including Roquette, a GIANT LEAPS partner developing pea- and fava bean-based protein ingredients, illustrate how crop production and food innovation can help build value chains that support FNS and reduce external dependencies.

Kern Tec: Turning fruit-processing by-products into food ingredients

Kern Tec is an Austrian food-tech start-up that transforms apricot, cherry and plum kernels from the fruit-processing industry into valuable food ingredients, recovering protein and oils from materials that might otherwise be discarded or used for energy. These ingredients can be used in products such as dairy alternatives, spreads and snacks. By valorising existing resources, Kern Tec helps reduce waste and creates additional value from agricultural production without requiring more land to grow the ingredients. Its model illustrates how circular innovation can diversify protein sources and develop new food value chains.

Edonia: Making microalgae a versatile protein source

Edonia, a French food-tech start-up, transforms spirulina, a protein-rich microalga, into a versatile, grain-like food ingredient through a patented process. Its Edo® ingredient can be incorporated into everyday foods, offering manufacturers and foodservice operators another source of protein for prepared meals and other products. In October 2026, Edonia raised €15 million to scale up production and expand commercialisation. The company illustrates how microalgae-based ingredients can diversify Europe's protein supply, although their environmental benefits depend on cultivation, energy and processing requirements.

The Protein Brewery: Scaling up mycoprotein

Based in Breda, the Netherlands, [The Protein Brewery](#) produces Fermotein®, a mycoprotein ingredient made by fermenting fungi. Rich in protein and containing fibre and micronutrients, it offers a versatile ingredient for food products including nutritional powders, bars and other foods. In July 2026, Fermotein received EU authorisation as a novel food, opening a regulatory pathway for its use in the European market. The company also secured a further €18 million in investment to support expansion. It illustrates how fermentation biotechnology can diversify Europe's protein supply without requiring livestock production, although the overall environmental benefits depend on feedstock, energy and processing requirements.

Bugging Denmark: Urban insect farming

[Bugging Denmark](#), based in Copenhagen and Giant Leaps partner, demonstrates how urban farming can introduce alternative protein sources closer to consumers. By producing edible crickets and yellow mealworms, it explores a form of food production with potential for high protein conversion efficiency and low land requirements, particularly when insects are raised on suitable residual resources. Its urban location creates opportunities to use by-products from local businesses and connect production with consumers, restaurants and communities. Through food festivals, public events and educational workshops, it also helps familiarise consumers with insect-based foods. Its example highlights the potential of circular urban production, while recognising that environmental performance depends on feed inputs and production methods.

Solar Foods: Producing protein from air through fermentation

[Solar Foods](#), a Finnish partner in the GIANT LEAPS project, produces Solein® using gas fermentation. Microorganisms are cultivated using carbon dioxide, hydrogen and electricity rather than conventional agricultural feedstocks. This approach has the potential to reduce dependence on agricultural land, imported feed and weather-dependent production, while creating new opportunities for European food innovation. Solar Foods began operating its first commercial-scale production facility in Finland in 2024 and is developing a larger facility to expand capacity. Its approach illustrates how biotechnology can diversify protein production, although environmental performance depends particularly on access to low-carbon electricity and efficient production.

RespectFarms: Bringing cellular agriculture onto the farm

[RespectFarms](#) is developing a business model that integrates cultivated meat production into existing farms, enabling farmers to diversify their activities and potential income. In June 2026, the first cultivated-meat farm officially opened on a working dairy farm in Schipluiden, Zuid-Holland, the Netherlands. By combining cellular agriculture with existing agricultural infrastructure, the model explores how emerging food technologies can complement conventional farming rather than simply replace it. It offers a novel approach to linking biotechnology with rural businesses, while its potential resource and environmental benefits will depend on energy, production processes and scale.

PlanetDairy: Hybrid foods as a practical route to the protein transition

PlanetDairy, a Danish food-tech company, develops hybrid foods that combine dairy ingredients with plant-based ingredients, including fava bean protein. Its hybrid milk and cheese products aim to retain familiar taste and functionality while reducing reliance on conventional dairy ingredients. In 2025, PlanetDairy partnered with Dutch dairy producer Farm Dairy to bring hybrid milk products to Albert Heijn, illustrating how this approach can reach mainstream retail. Hybrid foods offer a potential route to diversify protein sources without requiring consumers to switch entirely to plant-based alternatives. Their actual environmental benefits depend on product composition and the ingredients they replace.

ABOUT GIANT LEAPS

The EU-funded project GIANT LEAPS aims to accelerate the dietary shift towards a more sustainable and healthier food system, aligning with the EU Green Deal objectives and the Farm to Fork Strategy. The ambition of GIANT LEAPS is to transform European diets by reducing the consumption of traditional animal-based proteins, targeting a goal where 50% of total protein dietary intake is derived from alternative protein sources – such as plants, microalgae, insects, and single-cell proteins – by 2030. To achieve this goal, GIANT LEAPS employs a multi-actor approach, actively engaging with policymakers, production sectors, and European citizens. This collaboration fosters key innovations, methodologies, datasets and information that empower all stakeholders in the food system to make informed decisions, strategic investments, and sustainable choices. Ultimately, the project seeks to facilitate a large-scale dietary shift towards alternative protein-rich foods, maximising both nutritional and environmental impacts.

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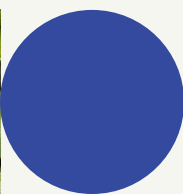
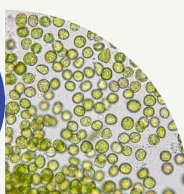
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ANNEX: A POSSIBLE POLICY-SUPPORT DECISION TREE

1 START

Does this production contribute to food and nutrition security (FNS)?

YES → go to 2

NO → go to 8

2 What is being produced?

Is it food intended for direct human consumption?

YES → go to 3

NO → Is it feed?

YES → go to 4

NO → go to 8

3 Sustainability of direct human food

Does the production perform well against the relevant climate, resource, pollution and biodiversity criteria?

- climate / GHG emissions?
- resource use (land, water, healthy soil)?
- chemical pollution?
- biodiversity?

YES → go to 5

NO → go to 6

4 Feed

*This is where the **protein-conversion argument** becomes particularly powerful:*

Does the feed production support food production that makes a necessary and valuable contribution to FNS?

NO → go to 8

YES → go to 4a

4a Could the resources be used more directly to produce nutritious food for humans, without losing important societal/environmental functions?

YES → go to 6

NO → go to 5

5 Resource-efficient production

Is this production resource-efficient and does it minimise unnecessary protein-conversion losses, imported dependencies and environmental pressures?

YES **HIGHER PRIORITY FOR SUPPORT**

NO **TARGETED / TRANSITION SUPPORT**

6 Production with lower FNS efficiency

Does the production provide other important public value that justifies support?

- carbon storage
- biodiversity, water regulation and ecosystem services
- use of land unsuitable for direct human food
- rural livelihoods/territorial functions
- strategic resilience / reduced critical dependencies
- transition towards more sustainable production

YES **TARGETED SUPPORT / PAYMENT FOR PUBLIC VALUE**

NO → go to 7

7

Is temporary support needed to enable a viable transition towards a more FNS-efficient/resource-efficient system?

YES **TARGETED, TIME-LIMITED TRANSITION SUPPORT**

NO **LET MARKET COMPETITION DETERMINE PRODUCTION**

8 Outside FNS

Does the production nevertheless deliver a clearly demonstrated public good?

YES **SUPPORT THE PUBLIC GOOD, NOT SIMPLY THE PRODUCTION VOLUME**

NO **NO PRODUCTION-LINKED SUPPORT**

GUIDING PRINCIPLE

Public support should follow societal value, not simply production volume or the number of stages in a value chain.