

HOW TO BUILD A SUSTAINABLE FOOD SYSTEM IN FINLAND?

Proposals for improving the well-being of both nature and people by 2040

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The climate crisis and the loss of biodiversity are challenging our food system. This working paper presents proposals to contribute to a sustainable transition of the food system in Finland. The proposals create a holistic picture in which the perspectives of nature, food production and nutrition are addressed together and in a way that identifies interdependencies.

The working paper proposes five objectives for promoting the sustainability transition of the food system. In order to achieve these objectives, short-term and long-term measures are needed. Many of the actions to promote change still need to be developed – for example, attributing value to ecosystem services or using plant nutrients from municipal waste in food production.

Some measures, such as reducing the number of animals per hectare of arable land in high livestock density areas or, similarly, increasing them in livestock-free areas to boost nutrient cycles and biodiversity, require long-term planning and implementation. It is therefore important to start implementing the transition immediately and throughout the food chain, so that the measures are seen as important in primary production, the food industry, trade and consumption – by all actors of the food system.

Sitra working paper

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Summary

This working paper offers proposals for contributing to the sustainable transition of the food system in Finland. The proposals create a holistic picture in which the aspects of nature, food production and nutrition are addressed together and in a way that identifies interdependencies.

As a northern agricultural country, Finland has its own particularities in terms of climate and soil conditions. With only 7% of its land area used for arable crops and a short growing season, global indicators are not relevant when assessing food sustainability issues. To emphasise security of supply, this paper focuses on primary production, alongside nutrition and social issues.

The food system faces challenges caused by climate change and nature loss. But technology, consumer knowledge and a highly competitive agricultural sector run by innovative farmers will enable the food system to change. Food produced in a sustainable food system contributes to public health. Food is produced and consumed in a way that preserves, optimises the use of and recycles natural resources. This promotes the circular economy and creates added value and profitability for the whole food system.

The sustainability transition can be achieved by following the measures and principles set out under four objectives, which, if successful, will create the opportunity to fulfil a fifth aim.

- 1)** Sustainable agriculture adapts to the limits of nature's carrying capacity
- 2)** Profitable agriculture enables a sustainable food system
- 3)** People in Finland eat sustainably
- 4)** The food system creates local inclusion and well-being
- 5)** High-quality, ecologically sound Finnish food is exported worldwide.

In order to achieve the objectives, short and long-term measures are needed. Many of the actions that promote change still need further development – for example, attributing value to ecosystem services or using nutrients from municipal waste in food production.

Some measures, such as reducing the number of animals per hectare (reducing livestock density), require long-term planning and implementation in specific areas of Finland. It is therefore important to start the change immediately and simultaneously throughout the food chain. For the success of the measures, it is essential that they are perceived by society as being fair.

1. Introduction

At present, the food system is not functioning at its best. One in ten people worldwide face starvation or undernourishment (WFP 2023). On the other hand, the food system also puts much pressure on nature. Up to 80 per cent of global deforestation, which accelerates climate change and biodiversity loss, is caused by food production (FAO 2022). Globally, 50 per cent of habitable land is used for agriculture, making it the main driver of land use and therefore a key player in combating biodiversity loss (Ritchie 2019).

The situation is much better in Finland, where only seven per cent of the land area is used for agriculture (LUKE 2023). As consumers, however, we do not know enough about the origin of food and its environmental impact, and are often unaware of the social impact of the food we eat or of the distribution of income between the food chain actors. The most significant environmental repercussions of the Finnish diet, such as loss of species, take place beyond our borders (Kyttä et al. 2023).

Over the past 50 years, there has been no shortage of food in Finland, but at the same time our diet has become detrimental to our health. Meat consumption has doubled, and many people have begun to take the abundance of food for granted. Food is not appreciated in the same way as when it was scarce. This has led to an increase in food waste. The general increase in prosperity is also likely to play a role: for example, food and non-alcoholic beverages now account for 13 per cent of consumption expenditure (Statistics Finland 2023), while until the mid-1980s, food accounted for more than 20 per cent of consumption expenditure.

Dietary recommendations are essential guidelines that steer us toward a sustainable food system (THL 2023). Agricultural guidelines are also needed to ensure that the food industry and consumers have access to

sustainably produced raw materials in a changing climate and in ecosystems that are fragile due to loss of biodiversity.

A sustainable food system starts with healthy soils and continues with profitable agriculture, including horticulture. It generates local vitality and well-being for nature and people alike. Unless we make changes, we will not be able to take advantage of the opportunities that Finland has in terms of a production environment that includes abundant water resources and a clean natural environment. The particularities of Finland's northern agricultural environment need to be identified in the context of developing the food system, as the basic conditions for food production in this forested country dotted with small fields are very different from those in agriculture-dominated countries with long growing seasons.

Change is needed for many different reasons: The profitability of Finnish agriculture is in crisis (LUKE 2022a), and local involvement in food production has declined as a result of urbanisation. The lack of basic soil fertility improvements such as liming and drainage has increased (Ovaska et al. 2021). There are currently no indicator systems relevant to Finnish conditions for the impact of farming methods on biodiversity or on greenhouse gas emissions or removals. This information gap is currently being filled, and Sitra is involved in promoting the verification of biodiversity and climate impacts at local field scale in co-operation with different research institutes, the Baltic Sea Action Group, and the University of Helsinki (CarbonAction 2023), and as part of the Catch the Carbon project funded by the Ministry of Agriculture and Forestry (LOHKO-KHK project).

In a sustainable food system, food production should be seen as a long-term collaboration with nature. Nutrition and food consumption are part of the food system that

also recognises interdependencies between security of supply and the public nutrition in the context of a changing climate, opportunities provided by nature and hands-on farming practices. Some of the measures will take decades to realise, but we need to address the situation so that the transition can continue and unfold at an appropriate pace. This will ensure that the transition is well managed and widely accepted.

The proposals in this working paper are a continuation of the previous work carried out by the Finnish innovation fund Sitra in the food sector (Sitra 2017, 2021; Landström et al. 2021; Pohjolainen et al. 2023). How we respond to welfare or economic challenges affects our ability to succeed in strengthening the carrying capacity of nature, and vice versa (Sitra 2023). In the agriculture and food sectors, this requires an understanding of the local nature and of practical food production processes, which are covered by the current working paper.

Prime Minister Petteri Orpo's Government Programme (VN 2023) identifies many of the same needs for change as this working paper. Key elements in building a sustainable food system include increasing the profitability of primary production and, in particular, improving the contractual status of farmers. The possibilities include increasing self-sufficiency in protein production with plant-based proteins, achieving a more even distribution of plant nutrients of livestock origin, meaning manure, in different regions, creating incentives for agro-ecology and healthy soils, and increasing food exports, where Finland's abundant water resources, clean soil, and air are strong points.

The new nutrition recommendations (THL 2023) and the social review of the food system

transition (JustFood 2023) as part of the FOOD programme for a sustainable, healthy, and climate-neutral food system (FOOD 2023) must therefore be supported by recommendations on how to ensure the availability of raw materials for sustainable food products. The long-term strategy for domestic food production, which the Government Programme promises to achieve through parliamentary co-operation, complements the food system as a whole.

This working paper contributes to the strategy work in the form of proposals and an overall picture, in which the perspectives of nature, food production, and nutrition are addressed together, and their interdependencies are identified.

The development of a food system is a common effort and concerns all stakeholders. A well-functioning dialogue across sectors is therefore a prerequisite for success.

Furthermore, if the measures proposed by Sitra for achieving the set goals are to be successful, extensive co-operation will be required even at the level of individual actions. Therefore, the working paper does not specify which measures should be implemented by which operator. In addition to the different food chain operators and consumers, public authorities have a key role to play in steering the food system towards sustainability in a comprehensive and socially sustainable way, while at the same time identifying the boundaries set by nature.

Constructive dialogue and an experience of fairness are essential for the success of these measures (Orasmaa 2023). Indeed, the future implementation of these measures will require joint planning.

2. Vision, objectives, and measures

A sustainable food system recognises the natural conditions and the opportunities and challenges of agriculture in terms of developing food security, food safety, and the availability of raw materials. These take into account the dependence on weather conditions, production inputs, and natural functions.

A sustainable food system provides consumers with information that enables them to make informed choices about the origin, nutritional content, and environmental impact of food. If we learn to identify the sustainability measures that strengthen the climate and biodiversity, and ensure that farmers are paid for their efforts, we are moving in the right direction.

This will create a positive change that motivates the entire food sector and promotes the health of people and nature.

OBJECTIVES 4 + 1: How to build a sustainable food system?

These steps lead from sustainable farming practices to the viability of agriculture. The third objective relates to consumers and nutrition. The fourth objective brings together the common goals of production and consumption. Once the first four objectives are achieved, we will have sustainable food products for export as a bonus.

VISION:

What does a sustainable food system look like?

A diverse agricultural sector builds on regional strengths, is economically viable, and reinforces nature. The food system is based on sustainable farming practices and technologies, produces enough food, and generates information to enable sustainable consumer choices. The transition is desired, accepted and motivates all those involved.

Objective 1: Sustainable agriculture adapts to the limits of nature's carrying capacity

Current practices need to be changed so that we can adapt our operations to the limits of nature's carrying capacity, the most important of which are climate change, loss of biodiversity and insufficient circulation of plant nutrients (Richardson et al. 2023). Long-term measures will be specified to mitigate climate change, adapt to it, and to revitalise biodiversity. Local resources for food security, such as plant nutrients and energy, should be secured and used efficiently without compromising the natural functions of a given region but taking advantage of regional strengths. Technological development and digitalisation are enabling the transition. Crucial long-term challenges include the availability of domestic production inputs and updating the technology of wastewater treatment plants to recover nutrients in a safe and plant-available form, which means that the outlook for change extends to 2040.

Measures:

- 1) The circular economy of energy and nutrients – agroecological symbiosis.** Agriculture constitutes a circular economy, mainly based on local energy and nutrient cycles in a collaborative network between several farms and other operators. Agroecological symbiosis (AES, see information box 1) is a form of food production and processing in which farms, food processors and energy producers work together at the regional level (Helenius et al. 2017; 2020).
- 2) Domestic production inputs:** Production inputs are used within the limits of nature's carrying capacity, and dependence on foreign inputs, such as fertilisers, seeds and plant protection products or fuel oil and machinery, does not threaten or endanger domestic food production (Niemi and Jansik 2020).
- 3) Regenerative farming:** Production is based on regenerative cultivation methods that promote soil health, biodiversity, water protection, climate change mitigation and adaptation to climate change in ways that keep the soils productive in different weather conditions and over the long term (for example World Economic Forum 2022; BSAG 2023a). Key measures include diverse crop rotations and a sufficient soilcover.
- 4) Sustainable water management:** Soil aeration and structure are ensured through drainage, which, in turn, is used to store water, for example in constructed wetlands, for irrigation purposes during droughts (Katainen 2023, Luoko 2023).
- 5) Precision farming to optimise production inputs:** Production is resource-efficient when the efforts on arable land are optimised according to the needs of each crop species grown, for example by identifying changes in the weather and variations in soil types. Technological solutions based on digitalisation and the principle of open data sharing allow the production process to be managed and documented in a targeted way (Monteiro et al. 2021; Pesonen 2023). The foundation of a fair data economy is to allow individuals, in this case farmers, with an opportunity to influence how their data is used (Parikka and Härkönen 2020).
- 6) Use of nutrients generated by food consumption:** Anthropogenic phosphorus and nitrogen are recycled in the production of a new crops as safe and plant-available nutrient sources, which requires substantial development of water treatment technology (Sitra 2022).

INFORMATION BOX 1:

Agroecological symbiosis (AES)

is a form of cooperation in food production and processing, in which farms, food processors and energy producers work together. All functions are geographically located close to each other, enabling efficient nutrient recycling and energy production from side streams. AES contributes to a local food culture and strengthens the regional economy.

If agriculture is to adapt to the limits of nature's carrying capacity, it must be economically profitable. Both national and EU support systems should provide incentives to make the above measures part of mainstream agricultural production. More than half of agricultural income comes from markets, which must simultaneously support the transition to sustainability. The key elements here are consumer awareness and public procurement, as well as a better bargaining position for producers to harmonise costs and producer prices.

Objective 2: Profitable agriculture enables a sustainable food system

The agricultural and horticultural producer's contractual status in the food chain needs to be improved to ensure a fair distribution of income and to identify the costs and value of products. Farmers produce both food crops and agricultural ecosystem services, which are strengthened by high biodiversity, and by mitigating and adapting to climate change. Pricing of what is sold and incentives that encourage production are based on the valuation of ecosystem services. Overall, the transition will be underway after 2030, when the accuracy of ecosystem service valuation becomes sufficient and such measures are integrated into the criteria for EU agricultural policy. Some of the measures can even be implemented relatively soon (measures 7, 8).

Measures:

- 7) Fair contractual status:** The contractual status of primary producers is improved to ensure that agriculture has a fair position in the value chain of the food system. This means examining food market, competition and procurement legislation and strengthening contractual status using openly available statistical data on the costs associated with different parts of the food chain (VN 2023).
- 8) Predictable business environment:** Regulatory and pricing-related actions are predictable, creating a stable business environment that enables a market-based approach and competitiveness. Investment subsidies creates confidence for business continuity.
- 9) Measured and verified sustainability:** Measuring and monitoring site-specific management practices promote good crop yields of high quality, while strengthening the environment and improving soil health. Indicators and markets are also thereby established for agricultural ecosystem services so that price formation in the food system is sustainable, transparent, and inclusive. Measurement and monitoring efforts are based on the crop rotation period, with several years considered as a whole.
- 10) Incentives based on ecosystem services:** In addition to crop yields, other farming-related ecosystem services (water and climate regulation, pollination, biological crop protection, cultural landscape) are recognised as agricultural income and paid directly to the farm. The ecosystem services are maintained and improved cost-effectively with result-based incentives. The Common Agricultural Policy CAP is reformed to be based on ecosystem services (Räsänen and Jalava 2023).
- 11) Acceptability:** The risks and potential of the ecological transition, as well as its benefits and costs, are examined to ensure that the transition is controlled and fair.

In an ecologically sustainable food system, fair price formation is based on measurements and sufficiently accurate sustainability criteria that have been proven to be relevant in practice. Moreover, a reliable system indicators describing the local conditions and production methods is essential for sustainable consumer choices when environmental sustainability is considered in addition to nutrition. At best, the consumer willingness to pay can be increased by improving indicators and increasing data transparency. Furthermore, transparent data is needed to anticipate changes in consumer behaviour in order to adapt the supply accordingly.

Objective 3: People in Finland eat sustainably

Finns choose sustainably produced food that meets current nutrition recommendations. Digitalisation allows food labels to include information on nutritional content and additives, the origin and production method of the food, and the resulting impact on climate and nature, so that consumers can be aware of their choices. The transition will take place by the end of the 2020s at the latest, when the labelling or a digital product passport will become the baseline for choice.

Measures:

- 12) Nutrition recommendations for sustainable meals:** Nutrition advice guides people towards eating more sustainable and healthier meals (THL 2023). Consumers eat according to the nutritional recommendations both at home and in mass catering events. The basics of healthy eating and sustainability are made understandable through information-based guidance. The operational environment for sustainable choices is adapted to motivate consumers and challenge their existing attitudes.
- 13) Environmental impact and nutritional information on labels:** In addition to the nutritional content, consumers know how and where the food was produced and the product's impact on the climate and the environment. Consumer choices and public procurement are based on labelling information about the product's composition and its production environment, including primary production and further processing into a food product. To achieve a harmonised labelling system, information gaps in packaging labelling are comprehensively addressed in co-operation between different stakeholders at the national, EU (EU 2022) and global levels.
- 14) Domestic options available:** The availability of domestic alternatives which are produced sustainably and in a clean environment is ensured. Demand promotes diverse and profitable agriculture and food production, which, in turn, is strengthened by consumer choice. The potential of plant proteins and cellular agriculture is harnessed to ensure protein self-sufficiency. The potential of plant breeding and the requirements of crop rotation for plant health and soil functionality are acknowledged in the promotion of land use and food security.
- 15) Raising interest in Finnish food culture:** Food is appreciated and Finns have the opportunity to buy sustainable food produced in Finland. The food system respects the traditional and tasty Finnish food culture, which favours seasonal products and local production. Mushrooms, berries, fish, and game animals are used. Leftovers and their use are a natural part of the food culture. New culinary experiences are part of the evolving food system (Hanska 2023).

16) Avoiding food waste: Purchases, portion sizes, and packaging are planned and designed to avoid food waste at home, in catering services and in shops. Methods are introduced to reduce the environmental impact of food storage. Raw materials are well used in the food industry and in food preparation. Optimising the transport and distribution chain curbs the overall amount of waste and reduces the carbon footprint. Food education increases appreciation of food and, consequently, reduces food waste.

When Finns eat sustainably, their relationship with food becomes more enriched and is seen as part of the cooperation between people and nature. Sustainable choices create local vitality and strengthen community ties. A sustainable food system fosters food security and promotes activities in different areas that strengthen well-being in harmony with nature.

Objective 4: The food system creates local inclusion and well-being

Food is produced, consumed, and processed sustainably based on the characteristics of individual regions. Healthy fields, forests, waters and animals contribute to the overall well-being of people. The wise use of natural resources and sustainable local lifestyles have become established parts of life. A diverse landscape is recognised as an important ecosystem service. The transition will take place by 2040, when plant breeding has provided practical solutions for crop security and species diversity, and livestock farming has been integrated into the local circular economy.

Measures:

17) Local food as the default choice:

Consumers can learn about the production of their food through partner farms, direct-sale farms or farm visits. Awareness increases appreciation of food. Community and engagement inspire choices that promote the local sustainable food system. Professional kitchens are given the opportunity to make informed and updated purchases nearby.

18) Closer connection to nature: A participatory food system brings consumers into fields and forests and close to animals, which reinforces the connection between an urbanised society and the countryside. The understanding of food production as part of natural activities, co-operation with nature, is strengthened through experiencing nature, in which schools and early childhood education play a key role. This increases awareness of the food that comes from the land, forests and waters and as a result produce such as berries and mushrooms are used more often than before.

19) A diverse rural environment: The food system includes diverse vegetation that enriches the landscape, as well as animals that use field biomasses that cannot be harvested for food and, producing manure that can be used as a plant nutrient source. The system allows animals to behave naturally and favours practices such as grazing, which promotes biodiversity, contributes to the animal well-being and preserves traditional landscapes.

20) Balance between the number of animals and the local field area: As a result of long-term guidance, livestock farms with optimised livestock numbers are evenly spread in different areas, which creates opportunities for local manure use, both as fertiliser and as a raw material for biogas. The digestate from biogas production is used as a nutrient source in crop cultivation. The number of animals is

well-proportioned to the sustainable field use in the area and the need for plant nutrients to grow food crops and fodder, which in turn improve soil health.

- 21) Self-sufficiency:** Food production is secured under local natural conditions and through technology. The range of crops is diversified through plant breeding to ensure crop security and diversity. Livestock farming and cellular agriculture contribute to this end by utilising non-food crops and food chain side streams to enable protein self-sufficiency.

With its abundant water resources, Finland has a relative advantage in food production, including for export purposes, thus safeguarding the food supply in areas where the conditions for food production have become increasingly challenging due to climate change. Exports produced and processed in the clean Finnish environment add value to the food chain, enabling the continuity of a sustainable food system.

Objective 5: High-quality, ecologically sound Finnish food is exported worldwide

Finnish food solutions are sustainable, healthy, and multi-valued, and they also generate added value for food exports. Safe, clean, and ecologically produced food is exported abroad. The transition is possible by 2030, when reliable communication on the sustainability of food products through labelling has become mainstream and the position of domestic agriculture in the food chain has been reinforced.

Added-value factors:

- 22) Cleanliness as an export asset:** The food export industry is based on Finland's natural strengths, expertise, and is market-based. Finland's export assets include food safety and clean soil, air, and water (The Economist 2022, Haavisto 2023).
- 23) Processing into end products:** In Finland, healthy, tasty, and ecological consumer products are processed from clean ingredients. The export of raw materials is reduced and the value of food processing is increased.
- 24) Water as an asset:** Finland's extensive water resources enable the export of water-intensive products.
- 25) Functional indicators:** Product quality indicators will be developed towards international harmonisation and transparency, by enhanced metrics. Sustainability is measured with relative water footprint indicators, which measure the water footprint in relation to water sufficiency.
- 26) Environmental handprint:** The value of Finnish food exports exceeds the value of imports. Together, the export and import industries improve the environmental handprint of food in Finland and abroad.

3. Conclusions and next steps

A sustainable food system is a comprehensive whole, from field to fork and back to field as a nutrient cycle. To support the choices made along the way, whether in primary production, the food industry, shops or at the point of consumption, we need a variety of promotional measures that are seen as important throughout the entire food chain. Some of the measures will require further study and understanding to ensure that the changes are acceptable and will steer operations in an environmentally, economically and socially sustainable direction.

To promote the transition to a more sustainable food system, Sitra has identified measures that require either additional research, investment in technology, or a common willingness from different stakeholders to share data. These include the roadmap for protein self-sufficiency, wastewater treatment to increase plant nutrient self-sufficiency, uniform labelling to enable sustainable consumer choices and purchases, and the development of digital product passports. An results-based approach based on the valuation of ecosystem services is seen as a key tool for agricultural guidance, but more research and development are required in this respect.

A relevant, controlled transition needs to be promoted by filling in the information and technology gaps. There is still **very little information available on the impact of Finnish food production on biodiversity** (Tiainen et al. 2020, Kyttä et al. 2023). Impact assessment is hindered by the limitations and deficiencies of the empirical studies and monitoring data. For example, the follow-up studies on the impact of agri-environment measures (MYTVAS) on randomly selected areas ended in 2013 (Hyvönen et al. 2020). As a result, biodiversity has not been quantitatively assessed, for example in the cost-effectiveness analysis of agri-environmental measures. For this reason,

Sitra is investing in the development of biodiversity impact indicators for food production at the University of Helsinki (BSAG 2023b) and on the development of carbon sequestration in fields and the calculation of greenhouse gas balances (LUKE 2023; KHK-LOHKO project).

Replacing animal protein with plant protein requires efforts to improve the **conditions for growing protein crops** (Leg4Life project). These agricultural opportunities need to be mapped out through further studies that outline the path for protein self-sufficiency in food and feed. **Moreover, achieving plant nutrient self-sufficiency will require new technologies and expertise.** The nutrient cycle is severely flawed, with only around one-fifth of the nitrogen generated by food consumption being recovered in wastewater treatment, while most of it is released back into the atmosphere (Sitra 2022).

If consumers are to participate in the development of a sustainable food system, they must have information on which to base their choices. Therefore, the **harmonisation of packaging labels** and the development of digital product passports play a key part in the sustainability transition. More co-operation is therefore needed in this area in the future.

Probably the most challenging question is **how to distribute livestock farms more evenly in Finland?** In the northern production areas, it has been more cost-effective to focus on grass-based livestock farming than on arable farming. Moreover, technology, economies of scale, and competitive markets have driven farms to expand production, which has led to increased livestock density in some areas. To ensure that new solutions are accepted and do not undermine social sustainability, enough time must be allowed for the transition. It is also important to remember that the alternatives for different production lines vary according to natural conditions.

Another challenging area for a sustainable food system is the **valuation of ecosystem services and their integration into the support system**, so that food produced according to circular economy principles will become duly appreciated and profitable. Sitra encourages the introduction of ecosystem accounting and results-based agricultural incentives based on the valuation of the ecosystem services (Jalava and Räsänen 2023). As the accounting process is still under development, and especially the attribution of value

to different ecosystem services of field ecosystems requires years of development, the construction of a sustainable food system must be seen as a long-term development process (Frantzluebbbers and Guillaume 2023). However, although the evaluation work is still ongoing, the agricultural ecosystem services and the results-based approach can already be promoted in the light of current information, as recommended by researchers from the Natural Resources Institute Finland (LUKE 2022b).

INFORMATION BOX 2:

Sitra has identified five themes on which more data and piloting are needed to ensure that we move towards a sustainable food system and achieve the objectives presented in this working paper:

- Biodiversity impact of food production
- Self-sufficiency prospects for plant protein
- Circulation of nutrients from communities
- Harmonisation of labelling on product passports
- Valuation of ecosystem services and integrating them into the support system.

Appendix 1: Links to the Government Programme

Some of the key solutions identified by Sitra for building a sustainable food system have also been identified in Prime Minister Petteri Orpo's Government Programme (VN 2023):

- Swift action and long-term efforts will be needed to solve the escalating crisis in agriculture. The export potential of Finnish food must be utilised better than at present.
- Protein self-sufficiency will be promoted by increasing the cultivation of protein crops to improve security of supply and food security and to raise the share of domestic content in the end product.
- The contractual position of primary producers will be improved through open statistics that show the costs of the different parts of the food chain and by promoting the introduction of cost indices between the parties as proposed by the Food Market Ombudsman, without violating contractual freedom.

In Finland, the use of arable land, and therefore the range of domestic food products, is limited by the harsh northern conditions, which has contributed to the differentiation between livestock and crop production. The Government Programme goal to “move nutrient surpluses to areas where there is a deficit” requires long-term, proactive work to distribute livestock farms more evenly across different areas by strengthening the local natural environment. The “incentives for good agroecology and healthy and productive soil”, as stated in the section on the catchment area of the Archipelago Sea, should serve as an objective for all fields. Regenerative agriculture, in which soil health is managed through diverse crop rotations, should be included in the “actual food production” referred to in the Government Programme and therefore considered as production covered by support systems. Sustainable water management must also be viewed as a part of actual food production. The management of soil moisture by drainage and irrigation is necessary to adapt to and mitigate climate change, and to successfully prevent nutrient emissions as identified in the Government Programme.

Appendix 2: Finland's special features

Finnish agriculture has special characteristics due to pedoclimatic conditions. The following facts provide background information to raise awareness of the history, current state and future of Finnish agriculture.

Finnish natural conditions in arable farming

- Finland is the northernmost agricultural country in the EU, where arable land accounts for only seven per cent of the total surface area. The average size of arable plots is only 2.5 hectares, and they are bordered by forests and vegetated edges between the small plots. In rural areas, forests cover an average of 75 per cent of the land area, and even in Southwest Finland the forest cover is over 60 per cent.
- The length of the thermal growing season, meaning the period when the mean daily temperature exceeds 5°C, limits Finnish agricultural production and the range of domestic food products. The differences between southern and northern Finland are great, which is why Finland is divided into growing zones based on how well different plants can thrive in the area. In terms of crops, grass is the most reliable source of good yields.
- Finland is rich in water resources. Finland gets more rainfall than evaporates, which means that this is a humid country. Most of the runoff is generated in forests, and only three per cent of the annual runoff is used. Due to climate change, the timing of rainfall occurs at increasingly uneven and drought affects Finnish crops.

The role of livestock farming in the Finnish food system

- Due to its natural conditions, Finland is more competitive in livestock farming than in crop production. A resource-wise food system also includes both diverse vegetation and animals, which utilise non-harvestable arable biomass and, by doing so, produce manure as a source of nutrients. The cultivation of perennial fodder grass improves soil health and promotes the preconditions for the sustainable production of annual crops by crop-rotation.
- However, it is clear that by reducing the consumption and production of livestock products, we can free up land areas for nature and improve public health. However, we must be sure that we have enough arable land to achieve crop rotations with perennial crops to promote soil health. At their best, field environments constitute diverse ecosystems, which is why alternative land use must be considered carefully, including in terms of security of supply.
- In the future, livestock farming should become a more integral part of nutrient cycles and a promoter of biodiversity: we need to increase grazing and distribute livestock farms evenly across different areas, so that manure can be used locally and the current regional nutrient imbalance can be corrected. Animals numbers should be in balance with local sustainable field use and the need for plant nutrients to grow food crops and fodder that improve soil health.

The role of peat and peatsoils in the Finnish food system

- Peat is an organic soil type with an organic matter content of more than 40 per cent by weight, according to the Finnish soil type classification used in agriculture and soil testing by farmers. Peat is formed at a rate of about one millimetre per year in peat bogs, which cover one third of Finland's land area. In the food debate, the role of peat is divided into peat soils in arable land and the use of peat as a growing medium for seedlings and as bedding material in animal shelters (Manni et al. 2023).
- When peat used for energy production is removed from the soil, the process yields ancillary products that serve as horticultural peat or animal bedding. The use of peat as animal bedding increases the well-being of animals and enables, for example, antibiotic-free broiler breeding. Peat binds the nitrogen from urine efficiently, and peat manure is an excellent soil improvement agent.
- Peat soils account for about ten per cent of the arable land area in Finland, and they are a significant source of greenhouse gas emissions. However, the emissions can be reduced through different means depending on the characteristics of the field (Kekkonen et al. 2023). The key measures include avoiding the clearing of new fields from forest, rewetting low-yield peat fields, and maintaining the grass cover on productive fields (Lehtonen et al. 2020, Landström et al. 2021).
- Fields with a shallow peat layer and mineral-rich subsoil are often fertile agricultural soils because they are high in water and nitrogen, making them drought resistant and requiring about fifty per cent less nitrogen fertilisers than mineral soils. The porous organic matter binds a lot of water and releases nitrogen through microbial activity.

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