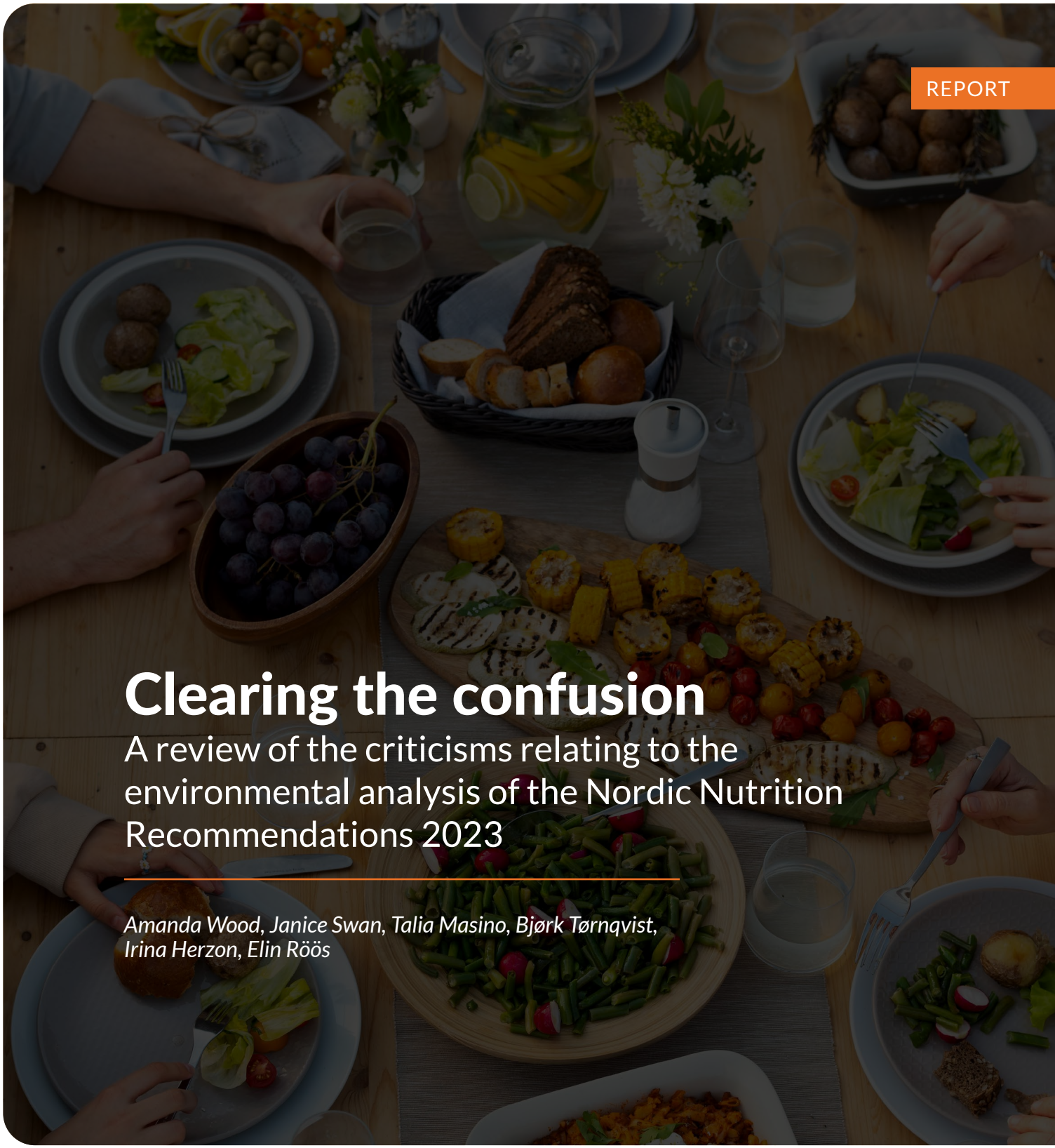

REPORT

Clearing the confusion

A review of the criticisms relating to the environmental analysis of the Nordic Nutrition Recommendations 2023

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Executive summary

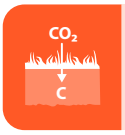
For the first time in its nearly 50-year history, the latest edition of the Nordic Nutrition Recommendations (NNR) provides food-based recommendations that support both healthy people and a healthy planet. Many stakeholders around the Nordics have applauded the decision to broaden the NNR analysis to include environmental sustainability. The updated recommendations and the report have been well-received by authorities and leading scientists in the Nordics and internationally. However, the resulting recommendations also attracted criticism from some stakeholders, particularly meat and dairy groups and farming organisations. In this policy report, we assess prominent criticisms of the new sustainability analysis of the NNR. The criticisms were submitted by different stakeholders (e.g. industry groups, companies, and more) during the open consultations of the NNR.

Most of the criticism concerns the recommendation to limit consumption of red and processed meat and the consequences this could have for public health, the environment and Nordic agriculture. Since the NNR provides recommendations on food consumption, it was not part of the NNR work to analyse these consequences of reduced consumption of red meat. National authorities will now have responsibility to implement appropriate approaches to reach the NNR recommendations in their context, and they will likely face similar criticisms when developing national dietary guidelines and broader food system policies. Thus, it is crucial to review stakeholders' criticisms beyond the food consumption implications in order to identify when legitimate points of concern are raised and when common fallacies are promoted. It will be important to take the legitimate concerns apparent in these criticisms seriously in other policy-making venues to ensure a just and fair transition.

Reducing red and processed meat consumption to the NNR's recommendation (maximum 350 grams per week, ready-to-eat) would mean reducing current average red meat intake across the Nordics by approximately 35-50%. We stress that the NNR guidelines did not recommend removing all red meat and/or animal products from diets. From an environmental perspective, NNR 2023 recommended individuals to consume "considerably lower" than the maximum intake of 350 grams of red and processed meat per week (which was recommended for health reasons). The evidence is clear regarding the need to reduce meat intakes in countries where consumption is high - for example, in the Nordic countries - in order to meet environmental targets. National authorities could consider more clearly defining what "considerably lower" means in their context, although this is associated with several challenges.

Dietary guidelines that take health and environment into account are one (small) piece of creating sustainable food systems. Many other policies and strategies are needed to make future food systems - from production to consumption - sustainable and resilient. Strategies and policies should be based on the best available evidence. For example, sustainable dietary guidelines should be based on evidence of what foods are good for people's health and the environment, rather than being based on current production systems or existing policies that lock-in unsustainable practices. The final recommendations in the NNR are well aligned with the scientific evidence regarding the environmental impacts of food groups and diets. National authorities should build on these recommendations when updating national guidelines.

The infographic below summarises the eight common stakeholder criticisms that will be explored in this report.

	Criticism	Response at a glance
	Reduced red meat consumption in the Nordics will lead to fewer livestock grazing species-rich semi-natural pastures, which in turn will reduce biodiversity in these areas.	A large share of production systems for red meat does not contribute to biodiversity conservation in the Nordics, e.g. all imported meat, meat from pigs and intensively raised cattle (these do not graze). Economic incentives for farmers, rather than maintained or increased red meat consumption, are needed to help preserve biodiversity-rich semi-natural pastures.
	Reduced red meat consumption in the Nordics will lead to less carbon sequestration from grazing systems and ley cultivation.	While ley cultivation can promote carbon sequestration, the climate benefit of this sequestration cannot offset (except in exceptional cases) the climate impact caused by other greenhouse gas emissions from ruminant production systems, including methane emissions from animals, emissions from feed production and manure management.
	Methane from ruminant animals is part of the natural carbon cycle and not the core challenge of climate change.	Carbon dioxide emissions are the largest contributor to climate change; however, methane emissions from livestock (and other sources) contribute to maintained or increased global warming and must also be considered if climate targets are to be reached.
	The NNR failed to recognise that livestock are part of resource-efficient agricultural systems in the Nordics.	Animal husbandry with fodder from land where other food production is not possible and from residual products and low-quality grain can be part of a resource-efficient agriculture. However, production volumes under such conditions are much lower than current consumption levels.
	Diets with limited red meat will be nutritionally inadequate.	Diets with meat intakes in accordance with the NNR health recommendation can easily fulfill all nutritional requirements. Entirely plant based diets can also be nutritionally adequate with planning and supplements. However, NNR does not recommend entirely plants-based diets as a general recommendation. Any diet can be nutritionally inadequate if not developed in a healthy and balanced way.
	The NNR analysis lacked Nordic environmental data, thereby weakening and skewing the conclusions about necessary dietary shifts.	Use of data specific to the Nordic region would not change the conclusion that, in order for global climate targets to be met, populations like those in the Nordics that eat a lot of meat and dairy need to reduce this consumption. Much of the food consumed in the Nordic countries is also produced in non-Nordic countries.
	The NNR failed to address the full range of social, economic and environmental sustainability issues.	Sustainable food-based dietary guidelines are a tool for informing consumers and organisations of what constitutes healthy and environmentally sustainable diets. There are many problems in the food system that dietary recommendations do not address. A coherent national or regional food policy with various policy instruments and strategies is required to address all challenges and shape a sustainable food system.
	The NNR failed to consider the impact of limiting red meat consumption on domestic food security and preparedness.	A diet that requires few resources is mainly plant-based, which is why diets based mainly on plants are good for food security and preparedness. For livestock to contribute to food security in times of crisis, different livestock systems are needed than those that currently dominate in the Nordics.

Policy recommendations:

- National authorities and politicians should be aware of common misunderstandings and fallacies that are expressed by stakeholders when discussing food's envirmonmental impact and base official advice on a solid scientific basis.
- The recommendations in the latest NNR are in line with the evidence regarding environmental impacts of food. National authorities should take forward the environmentally-focused recommendations when updating national guidelines.
- National authorities could more clearly define what it means to recommend "considerably lower" red and processed meat intake for environmental reasons. A move from current high consumption levels to the 350 gram per week maximum recommendation, which is based on health, is however a good first step for environmental reasons.
- The next NNR Committee should consider ways to more deeply and clearly embed environmental sustainability into the NNR food-based guidance in coming versions.

Contents

Introduction

For the first time in its nearly 50-year history, the latest edition of the Nordic Nutrition Recommendations (NNR) provides food-based recommendations that support both human health and the environment. The NNR report recommends a mainly plant-based diet with vegetables, fruits, berries, legumes, potatoes and whole grains (except rice), ample amounts of sustainably produced fish and nuts. The recommendations also include a moderate intake of dairy products, a limited amount of meat and a minimal intake of processed meat, alcohol and foods with high levels of added fats, salt and sugar. Many stakeholders have applauded the decision to broaden the NNR analysis to include environmental sustainability, and the recommendations have been well-received by leading scientists and authorities in the Nordics and internationally. However, the resulting recommendations also attracted criticism from some stakeholders, particularly meat and dairy industry groups and farming organisations.

In this policy report, we assess prominent criticisms submitted by stakeholders (private individuals were excluded from our analysis) during the open consultations of the NNR regarding the environmental analysis. Our analysis does not include feedback relating to individual nutrients, individual foods or meal/dietary patterns. We analysed stakeholder feedback submitted in response to all five background papers relating to the new sustainability analysis of the NNR, as well as relevant feedback in response to the draft NNR report.

Critical comments can be divided into the following five categories:

- Risk that reduced red meat consumption will result in negative environmental impacts due to reduced red meat production
- Risk that reduced consumption of red meat has negative health effects
- Objection that the Nordic context was not sufficiently acknowledged in the environmental analysis
- Concern that other sustainability considerations, such as the potential impacts of changed food consumption on certain sectors, were not taken into account when developing the recommendations
- Criticism of the NNR process itself, its methods, analyses or conclusions

For each of the first four overarching categories above, we critically assess one or more of the most frequently expressed points of criticisms. It is beyond the scope of this report to comment on the NNR process, analysis or conclusions. This report will not respond to each specific comment, as there were hundreds of comments, but we have grouped the criticisms into a few main points. While this report focuses on points of criticism in order to identify and address common fallacies and limit the spread of misinformation about Nordic food systems, we acknowledge that many stakeholders made positive and supportive comments in the NNR public consultations. Most supportive comments were submitted by research institutes; NGOs with a focus on environment, youth representation, animal welfare, or vegan/vegetarian diets; industry associations representing the plant-based sector or grocery sector; public authorities focused on health and nutrition; and a limited number of food companies. In addition, support for the NNR was expressed through avenues other than the public consultations. However, our analysis does not aim to capture all feedback to the NNR. Instead, we aim to assess prominent criticisms of the NNR.

Analysis of these criticisms is important, since the broader food system implications raised in stakeholders' feedback was out of scope for the NNR work, which advises only on food consumption. This analysis aims to inform the ongoing translation of the NNR recommendations into national dietary guidelines and broader food system policies. In each of the four sections below, we focus on addressing one or more of the common criticisms identified in our analysis.

Environmentally-focused criticisms of the recommendation to reduce red and processed meat consumption

Criticism #1: Reduced red meat consumption in the Nordics will lead to fewer livestock grazing semi-natural pastures, which in turn will negatively affect biodiversity.

Underpinning many of the environmentally-focused criticisms of red meat reduction is the assumption that reduced consumption will inevitably lead to reduced production of red meat in the Nordic countries. It does not necessarily have to be that way. In some Nordic countries, most of the red meat consumed is produced domestically, as in Norway with beef and Iceland with lamb and mutton. However, Sweden, for example, imports approximately 30% of the red meat consumed (Jordbruksverket, 2023a, 2023b), Finland imports roughly 20% of the beef consumed (LUKE, 2022), and Iceland imports approximately 13-20% of the pork and beef consumed (Directorate of Health, personal communication, 2023; Hagstofa Islands, 2023). This means that, in theory, there is room in these countries to reduce consumption and maintain current production levels, if consumers can be encouraged to choose domestically produced meat. When meat consumption decreased slightly after 2016 in Sweden, Swedish production increased at the same time. This is likely due in part to an increased awareness among consumers to choose a more sustainable meat (Jordbruksverket, 2023c).

Further, countries also have the possibility to export products, both red meat products and other food products. For example, Denmark exports approximately 90% of its pork products (Danish Agriculture and Food Council, 2023), Iceland exports approximately 35% of the mutton produced domestically (Statistics Iceland, 2023) and Norway exports roughly 95% of all fish caught and produced (Norwegian Seafood Council, personal communication, 2023). The Norwegian case illustrates how exports can remain high while domestic consumption decreases - fish consumption in Norway has fallen nearly 11% since 2003 (Fish Focus, n.d.; Welling, 2023).

If there are good reasons to produce a certain product in one place, e.g. due to favourable production conditions, production could be maintained through trade even if domestic consumption declines. There could however be reasons to also reduce domestic red meat production, for example, to meet territorial climate change mitigation targets. The level of red meat production is determined by many aspects (e.g. trade possibilities, types of land and other resources available, and territorial environmental regulations and targets) of which domestic demand is just one. Therefore, a recommendation on a healthy and environmentally sustainable intake of red meat says very little or nothing about how much meat is or should be produced within a country.

Key takeaways:

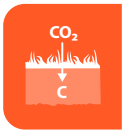
- There is no direct and inevitable link between domestic consumption and production.
- Imported red meat consumed in the Nordics does not contribute to preservation of Nordic biodiversity-rich pastures.
- A large share of the systems that produce red meat do not contribute to local biodiversity conservation through grazing, e.g. pigs and intensively raised cattle.
- Financial support to farmers (e.g. environmental compensation for clearing pasture) and legislation ensuring cattle's right to grazing are needed to preserve biodiversity-rich pastures, rather than maintaining or increasing consumption of red meat in general.
- The impact of grazing in the Nordic countries is not always positive; in Iceland, overgrazing harms rather than contributes to biodiversity conservation.
- Consumers can be encouraged to choose meat that contributes to grazing of biodiversity-rich pastures (for example, in national dietary guidelines), and in parallel it is possible to recommend a lower consumption of red and processed meat in general in the dietary guidelines.

Additionally, not all livestock that provide red meat provide grazing services. Approximately 35-65% of red meat consumption in the Nordics is pig meat (FAOSTAT, 2023), and the vast majority of pigs do not graze or otherwise support biodiversity. Pig production's impact on biodiversity is mostly negative because it is often based on specialised cereal production and contributes to, e.g. local eutrophication. As for ruminants like cattle and sheep, which can graze in biodiversity rich landscapes, not all do graze in current production systems. For example, about 25% of the beef produced in Sweden comes from animals that have never grazed (Hessle et al 2021), such as bulls raised in stables. This illustrates that there is potential to reduce the consumption of red meat, such as pork and meat from non-grazing ruminant animals while still maintaining or even increasing the production and consumption of meat that contribute positively to biodiversity. For this to become a reality, however, different types of policies are required.

In addition, the preservation of biodiversity-rich pastures is not driven by red meat consumption or production level. That is, neither a high consumption nor production of red meat or even ruminant meat ensures the use of semi-natural pastures for grazing. For example, since the 1960s consumption of ruminant meat in Sweden has increased by 40% (Jordbruksverket, 2023a) while the area of semi-natural pastures has decreased during the same period, some 10-30% since the 1950s-1960s (statistics are uncertain due to different classifications of land over time) (Swedish Board of Agriculture, 2009, 2022). These pastures have disappeared as a result of intensification of ruminant production, in which animals, especially dairy cattle, are given more concentrate feed and harvested high-quality forage to increase yields and growth rates. The overall time on pasture has decreased and animals are to a larger extent kept on less biodiversity-rich and more productive pastures (Karlsson et al., 2023). In Finland, this is even clearer. The area of biodiversity-rich semi-natural pastures decreased by 90% since the 1960s while consumption of ruminant meat has remained relatively stable (Lehtomaa et al., 2018; Our world in data, 2023). The current extent of biologically-rich grasslands is the lowest in Finland compared to the countries in the boreal region, and is only three percent of the total grassland area (Herzon et al., 2021).

The reason Sweden lost fewer semi-natural pastures than Finland is due to several factors: the introduction of Swedish legislation in 1988 that ensures cattle's right to graze during the growing season (Herzon, 2021), and better financial support (e.g. continuous and higher payment rates) that has been given to Swedish farmers compared to Finnish farmers for maintaining these pastures (Luoto et al., 2003; Natural Resources Institute Finland, 2015; World Wildlife Fund, 2012). Several reports highlight that economic incentives, for example in the form of agri-environmental payments for farmers, are needed to preserve natural pastures, not increased or maintained overall consumption of red meat (Herzon et al., 2022; Hessle et al., 2019; Holmström et al., 2021; Larsson et al., 2020). Targeted payments help compensate producers for the low profitability of many low intensive grazing systems.

Finally, in some places in the Nordics, grazing harms rather than contributes to biodiversity conservation. In Iceland, the over-grazing of the country's delicate and limited vegetation by livestock, especially sheep, has been a longstanding problem (Marteinsdóttir et al., 2017). Throughout Iceland's history, sheep farming has been crucial for its population's survival, leading to a large number of sheep grazing on the land (Ross et al., 2016). However, with an increasing population and intensified practices, the land's capacity for grazing has been surpassed, and the negative impact of sheep grazing can be observed all over Iceland (Marteinsdóttir et al., 2017). The consumption of plants and the trampling on vegetation cause plant damage and soil compaction resulting in land degradation and the exposure of Iceland's erosion-prone volcanic soils (Arnalds, 2015). Even though the number of sheep has decreased, continuous grazing prevents the regeneration of native vegetation, which leads to biodiversity loss and has a cascading negative effect on other organisms that rely on vegetation for food and habitat (Ross et al., 2016).



Criticism #2: Reduced red meat consumption in the Nordics will lead to lower levels of carbon sequestration in soils from grazing systems and ley cultivation.

Core to this criticism is the idea that the climate benefit of livestock systems - the potential for greater soil carbon sequestration from pastures and forage production compared to annual cropping - would be lost if Nordic populations reduced red-meat consumption. First, 35-65% of Nordic red meat consumption comes from pigs, which do not contribute to forage production or grazing. The remaining 35-65% of red meat comes from ruminants, but considerable numbers of ruminants do not graze, and many eat considerable amounts of annual crops. Thus, changes to the level of consumption of red meat in the Nordic countries will not necessarily have an effect on the amount of ley cultivation or livestock grazing and the carbon sequestration potential.

However, since a recommendation to reduce the consumption of red meat could also lead to reduced demand for ley and forage feed, it is relevant to address this criticism. Livestock systems in which the animals largely eat grass, clover and other perennial feed crops (mainly ruminant systems) contribute to the cultivation of grass or grass-clover leys which, compared to annual crops such as grains, pulses or potatoes, generally leads to higher soil carbon stocks (Ledo et al., 2020). However, ruminants give rise to methane emissions from the digestion of feed, carbon dioxide and nitrous oxide emissions from feed production as well as methane and nitrous oxide emissions from manure management. The climate impact from these emissions substantially exceeds the reduced impact from the carbon dioxide potentially sequestered in soils (Godde et al., 2020; Hammar et al., 2022). In addition, the sequestration potential of soils is time-limited. Although the sequestration potential might be quite high after the introduction of a sequestration-focused management practice (such as going from annual crops to ley), that potential falls near zero when a new equilibrium is reached (Smith, 2014). In addition, any sequestration can easily be reversed over time due to changes in management practices or climatic fluctuations. Research has shown that the carbon dioxide removals from soil carbon sequestration (even in an optimistic scenario) can only in exceptional cases offset total emissions from these livestock systems (Godde et al., 2020).

Although the carbon sequestration in leys cannot compensate for the other greenhouse gas emissions from livestock production, ley cultivation has many benefits for cropping systems. It can help build soil fertility and reduces the need for chemical pesticides and fertilisers. If ruminant production were to substantially decrease, it is important to ensure the cropping that potentially replaces forage feed production is performed in a sustainable way. Keeping ley cultivation in crop rotations could be one alternative, and incentives for farmers to do so might be needed in such a case that the demand for forage feed is decreased. However, note that decreased meat production does not necessarily follow from decreased meat consumption (see Criticism #1). In addition, for the benefits of ley cultivation to be realised, the ley has to be well integrated into the cropping systems, i.e. grown in rotation with annual crops. For much of the ley cultivation in Sweden that is not the case, much of the ley is currently grown on the same fields year after year (Karlsson, 2022).

In summary, although grazing and grass-legume leys can come with a range of benefits, the potential carbon sequestration in the vast majority of cases only offsets a small portion of emissions from ruminant production. That is, even when the carbon sequestration is accounted for, meat from ruminant production systems still has a large climate impact.

Key takeaways:

- Although ley cultivation and grazing can promote carbon sequestration, the climate benefit of this sequestration does not outweigh the negative climate impact of other greenhouse gas emissions from ruminant production systems, except in exceptional cases.
- The cultivation of ley on cropland is driven to a large extent by the need for feed for ruminant animals (and horses). If the ley is integrated with annual crops in mixed crop rotations (which it is only to a small extent currently, at least in Sweden) it can provide many benefits like building soil fertility and decreasing the need for pesticides and nitrogen fertilisers.
- In the case ruminant livestock production would be reduced substantially, incentives for farmers to keep leys in crop rotations could be needed.

Criticism #3: Methane from ruminant animals is part of the natural carbon cycle and not the core challenge of climate change.

Some stakeholders felt that the climate impacts of methane were unfairly assessed in the NNR report, and/or that methane emissions are not as important to consider as carbon dioxide emissions. The reasoning is that methane from animals is part of the natural carbon cycle, where methane is "*constantly disappearing from the atmosphere*", or more precisely being broken down to carbon dioxide, and the carbon dioxide is then taken up by plants through photosynthesis. Critics thus argue that because methane is part of this cycle, it does not contribute substantially to climate change to the extent currently assumed in research.

It is true that methane is fundamentally different in this way from carbon dioxide, of which a large share remains in the atmosphere for thousands of years. Although methane is broken down into carbon dioxide in approximately 10 years, it nevertheless has a substantial effect on the climate. Ruminants convert some of the carbon in their feed into methane, instead of carbon dioxide, which would have been the case if the feed (e.g. cereals) was eaten by a human, pig or chicken, or left to decompose (e.g. grass). During the approximately 10 years that the methane molecules on average remain in the atmosphere, they contribute to global warming which would otherwise not have occurred. Ruminant livestock have thus increased the equilibrium concentration of methane in the atmosphere, and thereby contributed considerably to global warming to date. Methane from livestock contributes a substantial part of global methane emissions, approximately 25% globally, other major sources include fossil fuel extraction, rice cultivation and waste management (Saunois et al., 2020).

Somewhat simplified, it is correct that, as several stakeholders highlight, *constant* methane emissions do not *further* increase temperatures (much). However, constant methane emissions do contribute to the *maintenance* of elevated temperatures that are causing considerable climate damage here and now. Reductions of methane emissions will contribute to cooling and reduced climate impacts, compared to current levels. Reduced ruminant production therefore will lead to a cooler planet than would be the case with constant ruminant production.

It is true that carbon dioxide from the burning of fossil fuels is the major cause of climate change. However, it is not a question of either reducing methane *or* carbon dioxide emissions - both have to be reduced. To reach globally agreed temperature goals, the IPCC highlights the need to reduce methane emissions by approximately 35-70% to 2050 (IPCC, 2022, p. 299), while carbon dioxide emissions need to be reduced to zero and then become negative, that is, removing carbon dioxide from the atmosphere (IPCC, 2022). It is therefore not possible to ignore methane emissions if climate targets are to be met.

Key takeaways:

- To reach globally agreed temperature targets, emissions of carbon dioxide globally need to reach zero and then become negative (remove carbon dioxide from the atmosphere), and methane emissions globally need to be reduced by approximately 35-70%.
- Methane from livestock contributes a substantial part of global methane emissions, approximately 25% globally, other major sources include fossil fuel extraction, rice cultivation and waste management.
- Methane emissions from livestock contribute to maintained or increased global warming and must be considered.

However, methane emissions need not be reduced to zero, in contrast to fossil carbon dioxide emissions. This means that there can be room for some ruminants while meeting temperature targets. The total quantity of methane compatible with temperature targets depends on how other (non-methane) emissions develop over time. The available 'methane budget', i.e. the amount of methane that is compatible with a certain temperature target, is then to be divided between ruminants and other methane sources including waste management, fossil fuel extraction and rice cultivation. If emissions can be reduced substantially from these other sources, there is room for more ruminants than if that is not the case.

The methane budget is globally shared. In other words, for climate change it does not matter where emissions occur. Arguing that methane emissions from countries with constant or decreasing methane emissions should not be accounted for (because these countries' methane-related warming is constant or decreasing) is to implicitly apply a so-called 'grandfathering' principle, which benefits countries with historically high emissions (usually high-income countries) over those with low but potentially increasing emissions (usually low-income countries). The grandfathering principle is usually considered unethical in climate policy (Rogelj & Schleussner, 2019).

Criticism #4: The NNR analysis failed to recognise that livestock are part of resource-efficient agricultural systems in the Nordics.

The Nordics have large areas where growing crops for direct human consumption is currently not economically viable due to e.g. low yields or high investment or production cost, or not possible due to lack of infrastructure, e.g. mills. This is particularly true in the northern areas and the forest districts of Norway, Sweden and Finland. Iceland, of course, has very little total agricultural land, much of which is used for grazing (European Environment Agency, 2017). In areas where only grass production and animal husbandry are viable, it could make sense to graze animals or grow fodder so that livestock can convert this biomass that is inedible for humans into meat and dairy for human consumption. However, currently there are few livestock systems in the Nordics that rely exclusively on such areas for feed. The feed of livestock often includes cereals or protein feed, some of which is human-grade quality (Tillgren, 2021). Feed is also grown on land that could be used to feed humans directly.

It is often difficult to determine which areas can be used for feed production only. It may be biophysically possible to produce food for humans on a given plot of land, yet logistical, infrastructure or economic barriers prevent food production from taking place. For example, some food-grade cereals can be grown far up north, but yields in these areas might be too low to make the production economically viable. It might also be possible to grow certain foods like fruits, root vegetables and tubers in these areas, but not other foods such as some grain legume or oil crops (due to short growing seasons). In other words, current use of land reflects not only biophysical conditions but also current economic, infrastructure and production system realities and priorities. There is potential to change the current output if structural measures are taken (e.g. infrastructure investments, economic incentives) or if priorities shifted. These measures and priorities are determined on a political and societal basis, not a scientific basis.

Still, there are areas and resources that cannot easily be used for production of human edible crops. By using these for livestock production, food production from such resources can reduce the pressure on croplands, which is good because good agricultural land is a limited resource (van Zanten et al. 2018). However, the amount of meat that could be produced from such resources is considerably lower than current Nordic consumption levels - a decrease in the range of 80-90% (Karlsson and Röös, 2019). This is why a reduction in meat consumption does not affect the possibility to utilise these resources for food production.

Key takeaways:

- There are some lands on which it is not economically feasible to produce food without the use of livestock. There are also some crops (e.g. low-quality cereals) and byproducts (e.g. rapeseed cake) that cannot easily be used as food for humans but work well as animal feed.
- If the goal is to produce as much food as possible, the use of livestock to utilise byproducts and land not suitable for other food production can be one way to design a resource efficient system.
- The amounts of meat and milk that could be produced from such 'leftover' resources are considerably less then current consumption levels, which is why a reduction in meat consumption does not threaten the use of such resources within the livestock sector.
- Current livestock systems in the Nordics rely substantially on human edible crops and forage grown on land that could be used to grow food for humans.

Further, arguments that *current* livestock systems in the Nordics are resource efficient because they utilise these resources are flawed since these production systems often use, compared to the production of plant-based foods, considerably higher amounts of other resources including high-quality arable land, human-grade food as feed, water and energy. Livestock feed in the Nordics contains varying amounts of crops that humans can eat directly. For example, feed for dairy cows in Sweden and Norway contains approximately 40-45% cereals and protein feed (Bakken & Mittenzwei, 2023; Cederberg et al., 2018). In Finland, cereals and concentrates make about 30% of the feed of dairy cows (Tuominen et al., 2016), which contributes to 55% of all cereal grown being used for feed and not food. A large part of the cereals used as feed is suitable for some sort of human food consumption (Tillgren, 2021).

Agricultural landscape with fields and pastures on Öland, Sweden. Photo: J Lokrantz/Azote

Finally, the land used to grow feed could often be used to grow food directly for humans. For example, in Norway roughly 90% of agricultural land supports livestock production (Regjeringen, 2014), while roughly 30% of agricultural land in operation is high-grade arable land, and a further share of lower-quality land could be used to grow foods such as roots and tubers (Bakken & Mittenzwei, 2023). In Sweden, about 45% of arable land is used to grow grass and green fodder (Statistics Sweden, 2020). A large portion of this could be used to grow crops fed directly to humans, while still keeping grass and legumes in crop rotations to maintain and increase soil quality, supply nitrogen and help fight weeds (see Criticism #2). This grass-legume biomass can be fed to ruminants as winter feed, thus producing meat and milk, or put through a biogas reactor to produce energy and fertiliser (Koppelmäki et al., 2021). In terms of resource efficiency, it is generally more efficient to utilise land and the crops produced directly for humans where possible.

Health-focused criticisms of the recommendation to reduce red and processed meat consumption

Criticism #5: Diets with limited red meat will be nutritionally inadequate.

Although this criticism may seem to fall outside of the scope of our analysis, the health benefits of red meat were also discussed in stakeholder feedback to the five environmentally-focused background papers. We do not assess how the NNR committee arrived at the health-based recommendation to limit the intake of red and processed meat to a maximum of 350 grams per week. Our aim here is to assess the criticisms raised by stakeholders in their public feedback.

The final NNR report recommends individuals to consume no more than 350 grams of red and processed meat each week for health reasons, and to consume considerably less for environmental reasons. There is no recommendation in the NNR for individuals to eliminate red meat (or meat in general) from their diets. Some stakeholders expressed concern for specific populations whose health might be negatively impacted by a reduction in red meat consumption. The NNR analysis recognises differing nutritional needs among certain populations, such as those who are pregnant or breastfeeding, and it is common for national authorities to develop specific dietary guidelines for certain populations. The nutritional needs of these groups can be accommodated while still also recommending that the general population should decrease red meat intake. Further, many stakeholders commented that the NNR chose to focus on the negative health impacts of red meat, ignoring the positive contributions of red meat to health and nutrition. In both the background chapter on meat and meat products as well as the NNR report, the nutritional contributions of red meat are highlighted. It is clearly stated how red meat is a nutrient dense food and good source of high-quality protein, iron, zinc and vitamins A, B1, B2, B6 and B12.

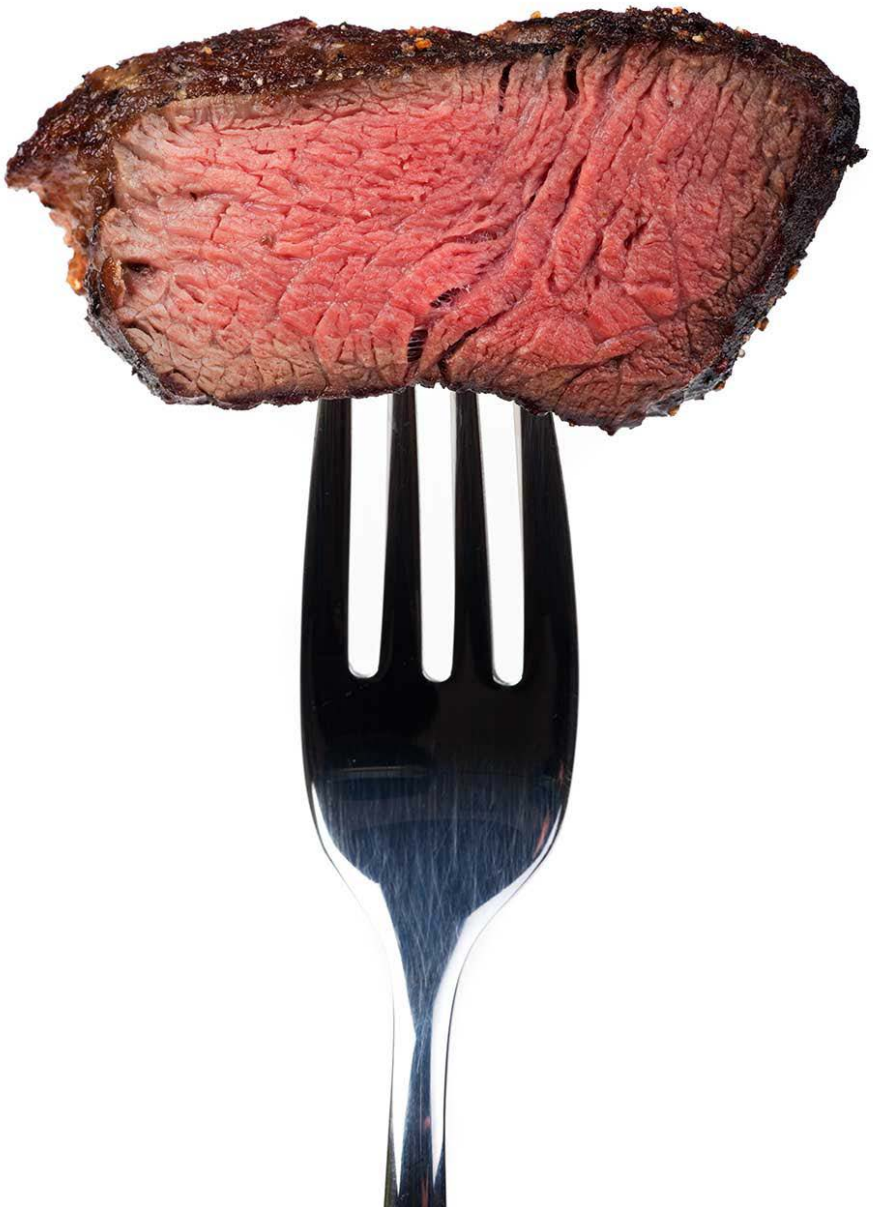
The NNR background documents (e.g. Trolle et al., 2023) and public feedback note several studies that showed certain nutritional deficiencies of some plant-based diets, particularly relating to protein, iron, zinc and B12 (Irz et al., 2022; J. O. Karlsson et al., 2018; Mazac et al., 2022; Springmann et al., 2018). However, the purpose of these studies is to assess the environmental impact of theoretically assumed dietary patterns. The studies also highlight risks with these dietary patterns (which often contain very small amounts of animal foods) when it comes to certain nutrients. However, it is not possible to draw the conclusion from these individual studies - which did not aim to develop nutritious plant-based dietary patterns - that plant-based diets generally lead to nutritional deficiencies. Modelling studies that investigate the environmental impact of different diets typically only test one or a few specific diets, and often use a limited number of food products to represent what populations eat. Thus, slight alterations to the composi-

Key takeaways:

- The NNR does not include a general recommendation to exclude red meat (or meat in general) completely from the diet, and the report highlights that red meat contributes with many essential nutrients.
- Plant-based diets, as well as diets with high amounts of animal-source foods, can be nutritionally deficient depending on which foods are included in the diet and in what quantities.
- The diets of certain populations – such as those who are pregnant or breastfeeding, the sick or the elderly – require special attention. However, the nutritional needs of these groups can be accommodated while still also recommending that the general population reduce red meat consumption.
- The term 'plant-based' encompasses a range of diets – from fully vegan diets to semi-vegetarian or flexitarian diets, which could include moderate amounts of animal-source foods.

tion of the diet or food product substitutions (e.g. fortified versus unfortified milk) could impact the nutritional composition of the diet. This is not to say that these studies do not provide valuable insights into the overall nutritional adequacy of certain diets. For example, they illustrate that it can be easier to meet certain nutritional targets when some meat, or animal-source food, is included in the diet. However, it is wrong to conclude that all diets with limited amounts of red meat will result in nutrient deficiencies.

The term 'plant-based' encompasses a range of diets – from fully vegan diets to semi-vegetarian or flexitarian diets, which, like the NNR's recommended diet, mostly contain plant foods but could include moderate amounts of animal-source foods (WHO, 2021). When looking at the totality of the evidence base, it is clear that plant-based diets can provide adequate nutrition, although diets with very low amounts of animal products require careful planning and potentially supplementation. Regarding vegetarian diets, the Swedish Food Agency states, "*Vegetarian food can contain all the nutrients the body needs*" (Livsmedelsverket, 2023). However, it is important to note that the NNR 2023 does not limit individuals to vegetarian diets. The WHO concludes, "*For individuals who prefer not to consume some or most animal foods, healthful and well planned plant-based meals can provide adequate levels of micronutrients.*" (WHO, 2021). "Well planned" are the operative words here, since poorly designed plant-based diets can lack certain nutrients, just like poorly designed diets with higher amounts of meat and animal-source foods can be nutritionally deficient.



Criticisms that the Nordic context was was not sufficiently acknowledged in the NNR environmental analysis

Criticism #6: The NNR analysis lacked Nordic data, thereby weakening and and skewing the conclusions about necessary dietary shifts.

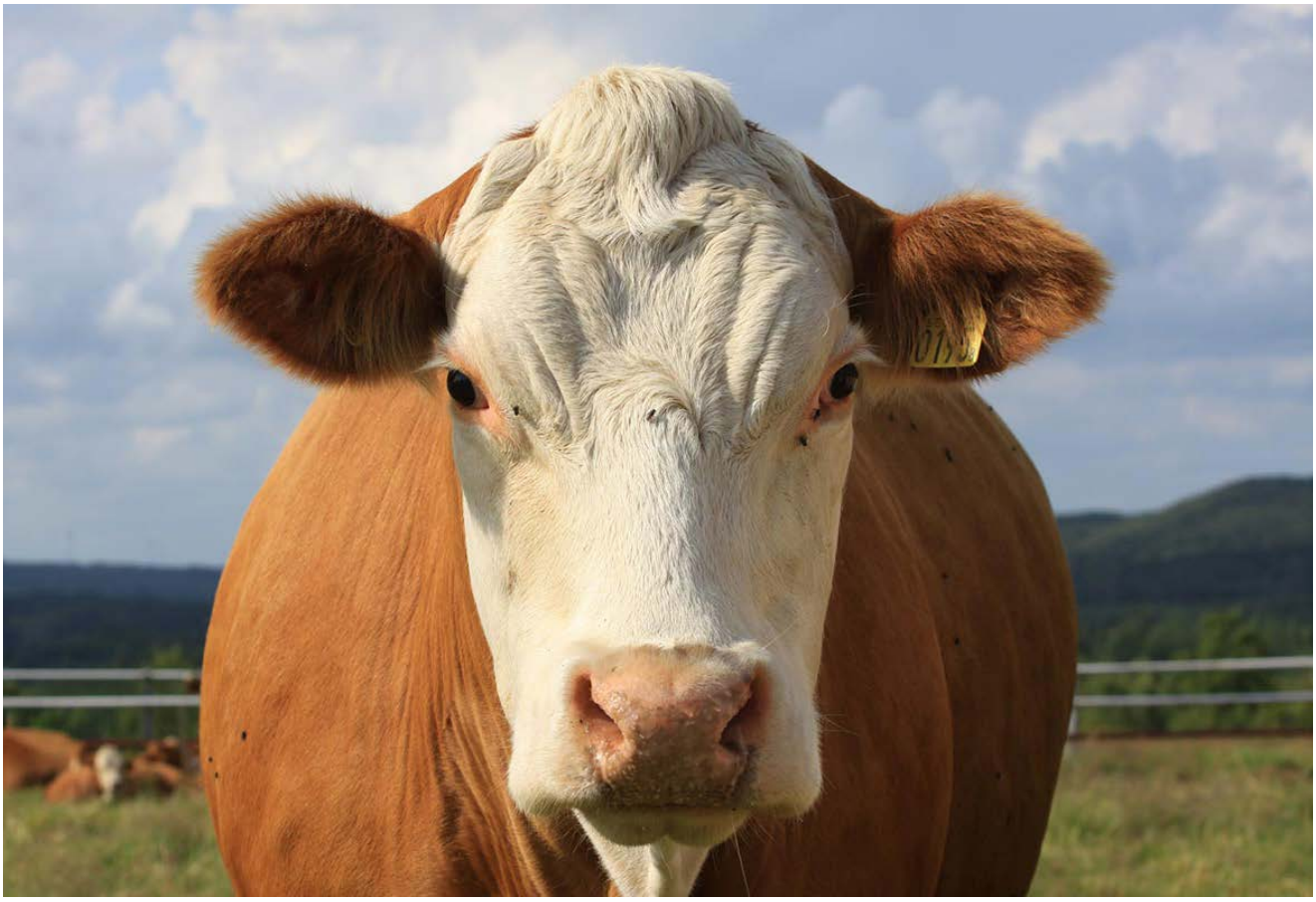
Two themes dominate the criticism from stakeholders arguing that the Nordic context was not sufficiently acknowledged in some/all parts of the NNR environmental analysis. First, stakeholders argued that the lack of Nordic data – here relating mostly to Nordic agricultural conditions, production efficiency and environmental impacts of domestically produced food and feed – made it difficult (impossible) for the NNR to draw credible and robust conclusions on the environmental impacts of Nordic diets. Second, stakeholders offered numerous examples illustrating how Nordic food systems are different from 'global' food systems. For example, stakeholders stressed that ruminants are needed in the northern Nordics for resource efficient systems (see Criticism #4); greenhouse gases are much lower in Nordic agriculture than 'global' systems; and Nordic livestock production contributes to deforestation to a very small (and decreasing) extent (via soy feed). Thus, these stakeholders imply that if Nordic agricultural systems would have been better represented in the analysis, then different conclusions might have been drawn, e.g. that red meat consumption does not need to decrease.

First, we stress that the science regarding the environmental impacts of food production and consumption is well established, at least on the level needed to develop dietary recommendations. The main message will be basically the same for all wealthy nations in which the consumption of meat and other animal products is high. That is, by far the largest potential to reduce the climate impact associated with the diet is through decreased consumption of animal products (Hallström et al, 2015). The use of different or additional data would not change this overarching finding. The reason for this is the large difference in climate impact between animal products and plant-based products. Approximately 30-40% of the climate impact from the Nordic diets is associated with meat (Wood et al., 2019), which makes it difficult to substantially reduce the climate impact of Nordic diets without reducing the consumption of red meat.

Key takeaways:

- The science on the magnitude of environmental impacts of different food groups is well established.
- Additional Nordic-specific data would not change the advice for populations like those in the Nordics to reduce meat and dairy consumption if climate and environmental targets are to be met.
- Even when accounting for the environmental efficiency of Nordic production, the production of animal source-foods generally has considerably higher environmental impacts than those of plant-based foods.
- The quantitative recommendation for red and processed meat intake in NNR 2023 was not based on environmental considerations and thus would not have changed with the inclusion of further Nordic-specific environmental analyses.
- Substantial amounts of foods in Nordic diets are produced in non-Nordic countries.

Stakeholders highlighted that Nordic livestock production is much better for the environment than in many places around the world. They also argued that the use of data of a more global nature in the NNR analysis resulted in an overly negative assessment of the environmental impacts relating to Nordic populations' red meat consumption. Nordic animal production is generally more environmentally efficient compared to a global average and thus has a lower environmental impact per kilo of food produced, yet it still produces



greater climate impacts than production of most plant-based foods (Moberg et al., 2019). In addition, much of the food consumed in the Nordic region is produced outside the Nordic countries, which is why in some cases the use of 'global' data is highly relevant.

Finally, it is important to emphasise that the quantitative recommendation for red and processed meat intake in NNR 2023 (maximum 350 grams per week) is based solely on nutrition and health analyses. Thus, any additional environmental data would have only affected the recommendation to consume "considerably less" than 350g red meat per week for environmental reasons. It will be important for countries to provide more detailed guidance on what "considerably less" means in practice.

Criticisms that other sustainability considerations were not taken into account

Criticism #7: The NNR failed to address the full range of social, economic and environmental sustainability issues.

While a number of stakeholders expressed their support for the incorporation of environmental considerations into dietary guidelines, others expressed a need to also consider social and economic sustainability. Stakeholders noted, for example, that the effects of shifts to more plant-based diets on local livelihoods, incomes, trade balances and local traditions were largely missing from the NNR analysis.

Such issues of social and economic sustainability are crucial societal questions and are relevant for the more general issue of sustainable food systems. Dietary guidelines and the NNR analysis, however, focus on food *consumption* and cannot tackle all food system challenges. Thus, other forums are needed to resolve critical social and economic sustainability issues, such as the impacts of changed production priorities on primary production and food chain actors. Comprehensive national food and agricultural strategies allow for holistic assessments of sustainability aspects and the trade-offs between them. Such strategies are needed to suggest a package of policy instruments that work together to bring about desired food systems (Candel & Pereira, 2017). Policy instruments can include taxes and subsidies, regulations for specific sectors or payment schemes in agricultural production. In other words, dietary guidelines are just one of the many tools needed to guide food systems in a sustainable direction, and their aim is to inform and lay the foundation of what constitutes healthy and environmentally sustainable eating.

For a policy to be effective, it should be targeted (Hassel & Wegrich, 2022). Since food-based dietary guidelines target consumption behaviours, they are less effective than other policy instruments at changing other aspects of the food systems. For example and as mentioned above (Criticism #1), payments to farmers for managing semi-natural pastures is an effective control tool for preserving these lands. Consumers can also be encouraged to choose pasture-fed meat, for example in dietary guidelines, but it is not this recommendation in general that will preserve these lands.

Key takeaways:

- Sustainable food-based dietary guidelines are a tool for informing consumers and organisations of what constitutes healthy diets for people and the environment - they cannot fix all challenges in the food system.
- A coherent national food strategy that includes a package of policy instruments is needed to address different types of sustainability challenges and manage the trade-offs inherent in developing sustainable food systems.
- For policy to be effective it should be targeted. Sustainable dietary guidelines inform about healthy and environmentally sustainable eating, and other policies and tools are needed to solve other food system problems, such as improved production.
- Other forums are needed to address the range of critical social and economic sustainability issues, such as potential impacts on farmers from a shift to more plant-based diets; something which cannot be adequately addressed through dietary guidelines.

Criticism #8: The NNR failed to consider the impact of limited red meat consumption on domestic food security, particularly regarding preparedness for war and disrupted supply chains

Many stakeholders expressed concern that recommendations to reduce red meat consumption did not take into account local resources and the importance of local food production in times of crisis. Although a bit challenging to untangle, these comments often reflect the following assumptions and reasoning: 1) reducing red meat consumption will reduce red meat production in the Nordics, 2) agricultural systems in the Nordics are best suited for livestock production, 3) thus, reducing red meat consumption would reduce our overall food production in the Nordics and 4) this makes us more vulnerable in times of crisis. We should reiterate at the outset that these issues were out of scope for the NNR analysis.

Regarding point 1, we have already discussed that domestic food production and consumption do not directly correlate (Criticism #1). Regardless of dietary recommendations, the Nordic countries may decide to specialise in meat production (like Denmark has for pork production) and export meat, for example on the basis of added value of good animal welfare and low use of pesticides for feed. Whether such a strategy is desirable will depend on many factors. While dietary recommendations can serve as a signal of which foods should be part of a healthy and environmentally sustainable diet and thus which foods are 'desirable', many other factors determine what production strategies a country should implement. These include, for example, local conditions, possible alternative land uses, national environmental targets to be reached, and so on.

Regarding point 2, we have described that there is potential in the Nordics to grow more plant-based food for human consumption (Criticism #4). The potential will vary by country, specific location, crop and other conditions, and a range of technical and market-related factors. We highlighted that a just transition to a more sustainable food system for all will require substantial resources and time.

Regarding point 3, it is crucial to highlight how resource-intensive it is to produce livestock in most current Nordic systems. Feed production requires substantial amounts of cropland and energy. Chicken and pigs eat mainly crops that are suitable for human consumption. Ruminants, especially dairy cows, also consume a considerable amount of cereals and grain legumes. If those crops were instead consumed directly by humans, many more people could be fed. Hence, a diet in times of crisis, when food supply is limited, would be mainly plant-based. In addition, current livestock (and cropping) systems in the Nordics rely on imports, such as feed, fertilisers and fuels, and stable electricity supply. In other words, many Nordic livestock systems currently are not self-sufficient and would be disrupted by the types of international/external crises highlighted in stakeholders' feedback. The crises highlighted by stakeholders (i.e. war or trade disruptions) assume that future crises will be external to the Nordics. If, on the other hand, the crisis is domestic, such as fires, floods or droughts, then production in general will be disturbed, regardless of production system.

Thus, in order for livestock to serve as a crisis preparedness measure, our livestock systems would need to look different than how they do today. That is, they would need to rely primarily on feeds that cannot be consumed by humans, such as grass, roughage and inedible by-products. However, these systems would give substantially lower quantities of meat than currently consumed (Karlsson & Röös, 2019; Röös et al., 2016) yet serve as important suppliers of protein and fat in times of international supply chain disruptions.

Key takeaways:

- Stakeholders focused on crises caused by, for example, war or disrupted supply chains. There are also other crises to consider, most notably disruptions due to extreme weather events caused by climate change.
- In current Nordic production systems, where livestock consume substantial cereal and protein crops, food supply would be more easily increased if humans ate these crops directly.
- This critique is based on the assumption that agriculture in the Nordic countries can mainly produce animal products, but there is potential to grow more crops that can be consumed directly by humans.
- For livestock to contribute to food security in times of crisis, different livestock systems are needed than what currently exist in the Nordics.

Conclusion

This report has addressed a number of concerns and arguments expressed by stakeholders in the open consultations relating to the NNR 2023 environmental analysis. The overarching argument underpinning most of these negative criticisms is that any reduction in domestic red meat consumption will have inevitable and negative impacts in the Nordics regarding, for example, production systems, environmental sustainability, crisis preparedness, individuals' health or other aspects of sustainability. We have shown that these arguments lack substantial support.

However, it is important to take seriously the concerns and fears that are apparent in these criticisms, particularly those concerns about agriculture and what a sustainable transition of agriculture and the food system could look like. Agriculture has long struggled with low profitability and a range of other social, economic and climate-related challenges. A transition must be fair and well anchored, and there are many conflicting goals that must be managed. However, it is important that the design of policies and strategies for a more sustainable food system is based on facts and an understanding of the purpose and limitations of various policy instruments.

The NNR 2023 recommendation for individuals to consume considerably less than 350 grams of red and processed meat each week to reduce the environmental impact of diets is consistent with the scientific evidence regarding the environmental impacts of food groups and diets. High-consuming populations need to reduce red meat intake if environmental goals are to be met. Thus, national authorities should build on the recommendations relating to the environmental impacts of food groups when updating national guidelines. Further, we urge the next NNR Committee to more deeply embed environmental sustainability into the guidelines.

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