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FCRN foodsource

A free and evolving resource to empower informed discussion on sustainable food systems

Chapter 9.

What is a healthy sustainable eating pattern?

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Why should you read this chapter?

The environmental and nutritional attributes of different food types can vary greatly. Consequently, diets composed of different sets of food types, will differ in their environmental footprints, and in their nutritional quality; so affecting human health. When such differences are multiplied by many millions of people, the overall effect is considerable.

Human diets are, therefore, an important point of interconnection in food systems via which change is driven – for better or worse – by shifts how people consume. At least in theory, diets might provide a means by which to achieve both health and environmental goals simultaneously. But the reality is not so simple.

Understanding these complexities, helps provide a window on both the opportunities and difficulties of taking a food systems approach, and on the important role that diets play.

The chapter addresses the following:

- What makes an eating pattern sustainable and healthy?
- What dietary patterns would contribute to fewer GHG emissions and other environmental impacts, and are these necessarily healthier, or closer to recommended healthy diets?
- How do the multiple environmental, health, societal and cultural aims of "sustainable healthy eating patterns" support or conflict with one another?

Key points

- When attempting to define sustainable healthy eating patterns (SHEPs) it is important to consider that "sustainable" is in itself a difficult concept to define; as is a "healthy" diet. Both of these concepts are multifaceted, with some aspects receiving more attention. Combining them complicates things further.
- Definitions of SHEPs exist, but these tend to list things they should account for, such as nutrition and health, biodiversity protections, optimisation of natural and human resources, affordability, availability and cultural relevance. This does not give us tools to measure which eating patterns are better for health and sustainability.
- For the idea of SHEPs to be useful, we need to be able to say what they look like on a plate. This requires the development of metrics and methodologies to measure the many different attributes of diets, and understand the ways in which they affect people, and the wider world.
- Our ability to measure these different attributes is still limited. Most research has focussed on greenhouse gases, land, and water footprints via the application of life cycle assessment methods; and on nutritional quality and health outcomes by looking at clinical studies of real diets. Some things such as cultural impacts are extremely hard to quantify and compare, but are still important.
- Multiple studies have shown that healthy diets (as defined by government guidelines), and nutritionally balanced diets containing less or no meat or animal products, are associated with significantly reduced levels of greenhouse gas emissions and associated land-use.

Key points – continued

- Whether a dietary change brings benefits for health and sustainability, depends on what foods are removed, and what they are then replaced by (if at all). For example, replacing sugary snacks with fruits and vegetables may improve health, but increase greenhouse gas emissions.
- While not inevitable, diets that are healthier and more sustainable that today are possible for many people in many contexts. Although what they actually consist of will vary depending on the individual's specific bodily characteristics, their cultural context, and the socio-economic and environmental characteristics of where they live.
- There are also many instances where an improvement in one dimension of a diet with respect to health or environmental outcomes, can lead to increased impacts in another: i.e. a trade-off. Similarly, there may be trade-offs between different environmental outcomes (e.g. lower emissions but greater water use).
- For many, typically in high-income countries, meat and dairy are over-consumed, and consumption of fruit, vegetables, pulses and whole grains is below recommended levels. Making these substitutions would result in decreased environmental impacts, and improved health.
- Many people, often in lower-income countries, do not have sufficient dietary diversity and so would benefit from more meat and dairy, as well as more fruit and vegetables. Making these substitutions or additions to their diet would benefit health, but likely increase the environmental impacts of their diet.
- In high-income countries, significant reductions in GHG emissions can be achieved by average changing diets across the population. But achieving cuts beyond ~40% in an individual's diet-related emissions, may require changes that are culturally unacceptable, and so may not be realistic.
- While general trends can be outlined already, our understanding of sustainable healthy eating patterns is still developing and is highly uncertain. This makes context specific recommendations difficult to provide. Much more research is needed for the concept to be able to be put into practical use worldwide.

9.1 How might we define sustainable and healthy eating patterns (SHEPs)?

9.1.1 General considerations for defining SHEPs

General considerations for defining SHEPs

- 'Sustainable' is a multifaceted concept.
- Often definitions focus only on environmental aspects.
- And within the environment, often only GHG emissions are considered, although land use and water also receive attention.
- Other aspects of sustainability are less well researched.

9.1.2 FAO definition of sustainable diets

The FAO describes the broad characteristics of sustainable and healthy eating patterns

> Sustainable diets are "those diets with low environmental impacts which contribute to food and nutrition security and to healthy life for present and future generations. Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy; while optimizing natural and human resources."

This FAO definition encompasses:

- Nutrition and health;
- Biodiversity protection;
- Optimisation of natural and human resources;
- Affordability and availability;
- Cultural relevance.

This implies that SHEPs should provide the required energy and nutritional content (see Chapter 7 for more on the links between food and health), not negatively impact biodiversity (for example impacts such as deforestation and negative land-use consequences, overexploitation of marine biodiversity – see Chapter 5), optimise natural resources (for example, optimal food production without causing unacceptable greenhouse gas emissions– see Chapter 4) and support human livelihoods (for example, respect working lives of those whose livelihoods depend on food systems), be affordable and available (see Chapter 4 and Chapter 7 for more on food security) and be culturally appropriate and acceptable.

This definition is therefore very comprehensive, encompassing many aspects of sustainability (environmental, socio-economic and cultural) but:

- It is not clear what such a diet might look like 'on a plate'.
- It is not clear what metrics could be used to assess whether a diet is sustainable or not.
- There is therefore a need for metrics to assess how a diet performs across a range of sustainability indicators.

This chapter therefore discusses the research base and evidence pointing towards what SHEPs might look like 'on the plate.'

9.1.3 How might we measure and identify SHEPs?

How might we measure SHEPs?

Dimensions of sustainability	How can we measure them?
Environmental (including climate change, water use and pollution, fossil fuel use, air pollution, land use change and biodiversity loss)	Some of these are covered by environmental life cycle assessments (LCA) and by evolving work on water footprinting, but not all. See Chapter 2 for more on LCA.
Food security (availability, access, utilisation, stability)	Food security indicators available and evolving. See Chapter 7 for more on food security.
Nutrition	Energy, protein, fat, zinc, calcium, iron etc.; nutrient density indicators; health outcomes (non-communicable diseases). See Chapter 7 for more on the link between food and health.
Livelihoods, jobs and economic development	These may include incomes, the retail price index, working conditions, contribution to GDP. Evolving metrics, some certification schemes exist. Social LCA is an evolving research area (see Chapter 2).
Animal welfare	Some certification schemes exist, but different opinions exist as to what constitutes good welfare in different contexts.
Culture	This is a very under-researched and under-considered area in relation to sustainability (see Chapter 10 for more on cultural factors).

9.1.4 How has research attempted to measure and identify SHEPs?

How has research attempted to measure SHEPs?

Environmental impacts	Research into environmental impacts of eating patterns has largely focused on **GHGs**. There is also some research focusing on **water footprints, land-use** and **energy-use**. GHG are often used as a **proxy** for environmental impacts as a whole, although there can be conflicts between, for example, low GHG and water-use in water stressed areas.
Nutrition and health outcomes	Measuring the **nutritional quality** of a diet is complex. Some research focuses on the macro and micronutrient content of different diets. Other studies focus on the actual **health outcomes** associated with different diets and eating patterns.
Dietary Comparisons	Dietary comparisons have been made in relation to both health and environmental impacts. These have often compared **models** of different types of diets (such as vegetarian diets) with actual and recommended diets. Some research has looked at different kinds of **real-life** diets rather than modelled diets.

A lot of work has been done to try and define SHEPs based on various different comparative approaches. Most of them focus on comparing the environmental aspects of different diets (for example “average diets” compared to “vegetarian diets” or “recommended diets”), with GHGs the most common environmental metric used.

Assessments of nutritional quality and health outcomes can be quite basic (protein, energy, fat, fruit and veg) or complex (including assessment of micronutrient contents and nutrient density). Some research has looked at the link between different diets, environmental impacts and health outcomes such as heart disease. This chapter provides a summary of the research findings and the relationships between changes in eating patterns, health and environmental impact.

9.2 Which diets generate fewer GHG emissions and other environmental impacts?

9.2.1 GHG emissions associated with various diets

A systematic review of studies shows GHG reductions are possible by switching to different diets

Figure 1: Percentage reduction in greenhouse gas emissions achievable through switching diets, a review of existing research findings for different dietary patterns.

Source: Hallström, Carlsson-Kanyama and Börjesson (2015).

A comparison of multiple studies shows again that the greatest reductions in GHGs come from vegan or vegetarian diets.

GHG reductions were shown from other diets, such as replacing beef with pork or poultry.

Diets where energy intake is balanced i.e. the amount of energy (calories) consumed is in not in excess of our energy requirements) can also have lower GHG impacts since food not needed is not consumed.

Whilst occasional studies show variations, the trend clearly shows that the lower the meat content the greater the GHG reduction.

Note that none of the studies included in the review take into account the possible carbon sequestering effects of grazing management. The potential that well managed grazing can promote soil carbon sequestration is still an under-researched area, would apply (if borne out by evidence) only to ruminant rearing systems, and is discussed briefly in Chapter 8.

9.2.2 Land use associated with various diets

The picture for land use is similar

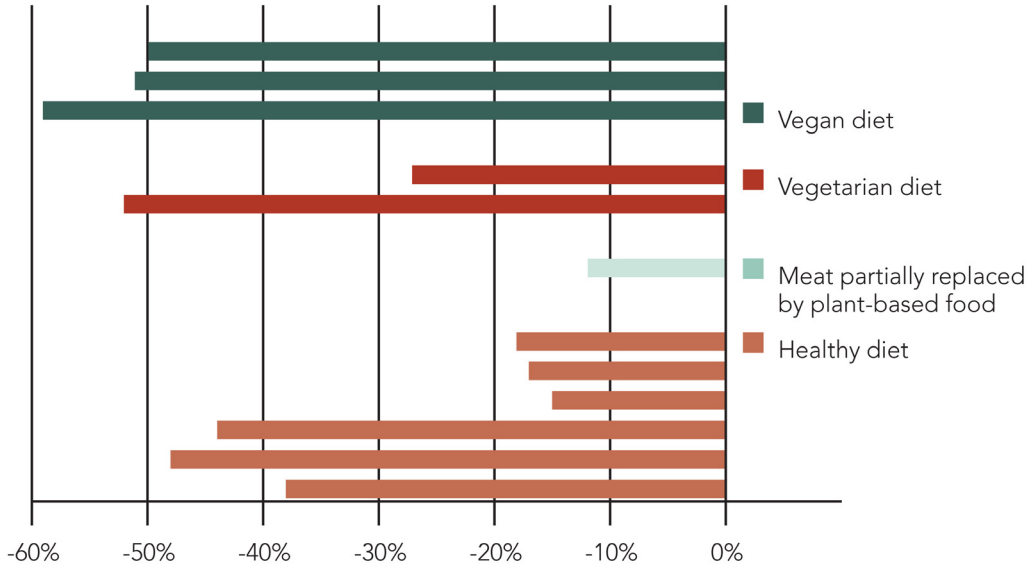

Figure 2: Percentage reduction in land use achievable through switching diets, a review of existing research findings for different dietary patterns.

Source: Hallström, Carlsson-Kanyama and Börjesson (2015).

Healthy diets (such as the Mediterranean diet, or those based on national dietary guidelines), diets with lower meat content, and meat-free diets also show the potential to reduce land-use requirements. This is important, given increasing pressures on available land to produce food (see Chapter 5 for more on land-use and biodiversity loss).

9.2.3 GHG emissions of real life diets

Real life non-meat diets have been found to have lower GHGs than various meat-based diets

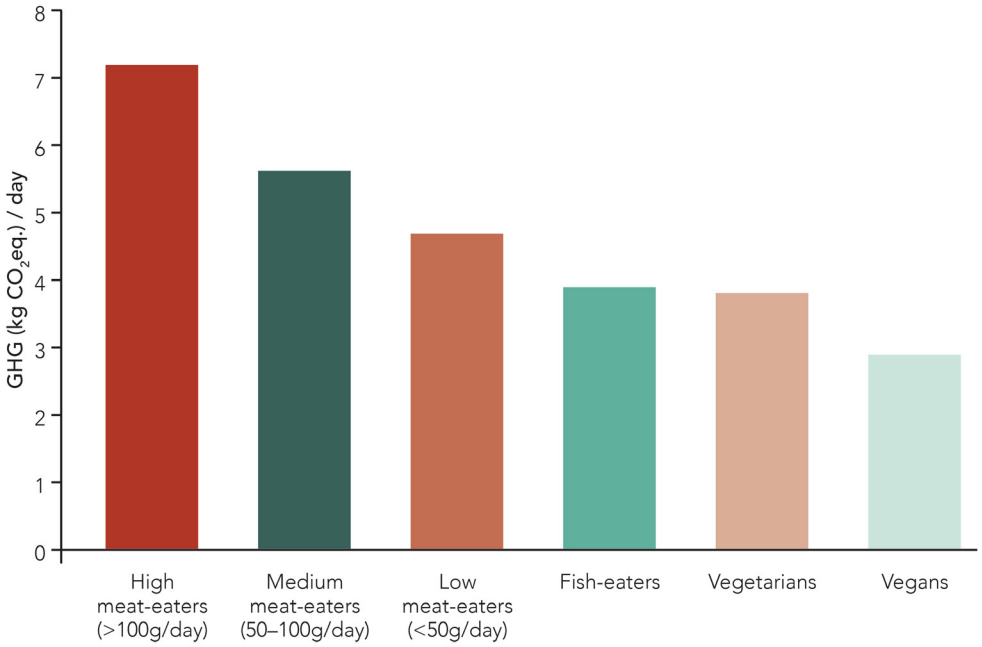

Figure 3: Greenhouse gas emissions associated with real dietary patterns of people living in the UK.

Source: Scarborough, *et al.* (2014).

This research was based on real-life diets, from consumer data of over 55,000 people in the United Kingdom. Error bars represent 95% confidence intervals.

Vegan and vegetarian diets were found to have lower GHGs than all meat-based diets.

A vegan diet was found to have 50% of the GHG emissions of a meat-eater's diet.

A pescetarian diet (fish-based, but no meat) also has lower GHG emissions compared to all types of meat-eater diets. However the difference is not as great between vegetarians, fish eaters and low meat eaters, and the consumption of fish gives rise to a different set of environmental issues concerning fish stocks and marine ecosystems (see Chapter 5).

Other studies have found similar results, with vegetarian and lower-meat diets having lower GHGs emissions, for example Soret et al., 2014.

Note that the study does not factor in any possible carbon sequestering effects of grazing management. The potential that well managed grazing can promote soil carbon sequestration is still an under researched area, would apply (if borne out by evidence) only to ruminant rearing systems, and is discussed briefly in Chapter 8.

9.3 Do recommended healthier diets contribute to lower environmental impacts and vice versa?

9.3.1 Comparing GHG emissions and land use of idealised diets with 'average' diets: the Netherlands

'Recommended' diets have lower GHGs than 'average' Dutch diets, but higher GHGs than nutritionally balanced vegetarian, vegan or 'Mediterranean' diets

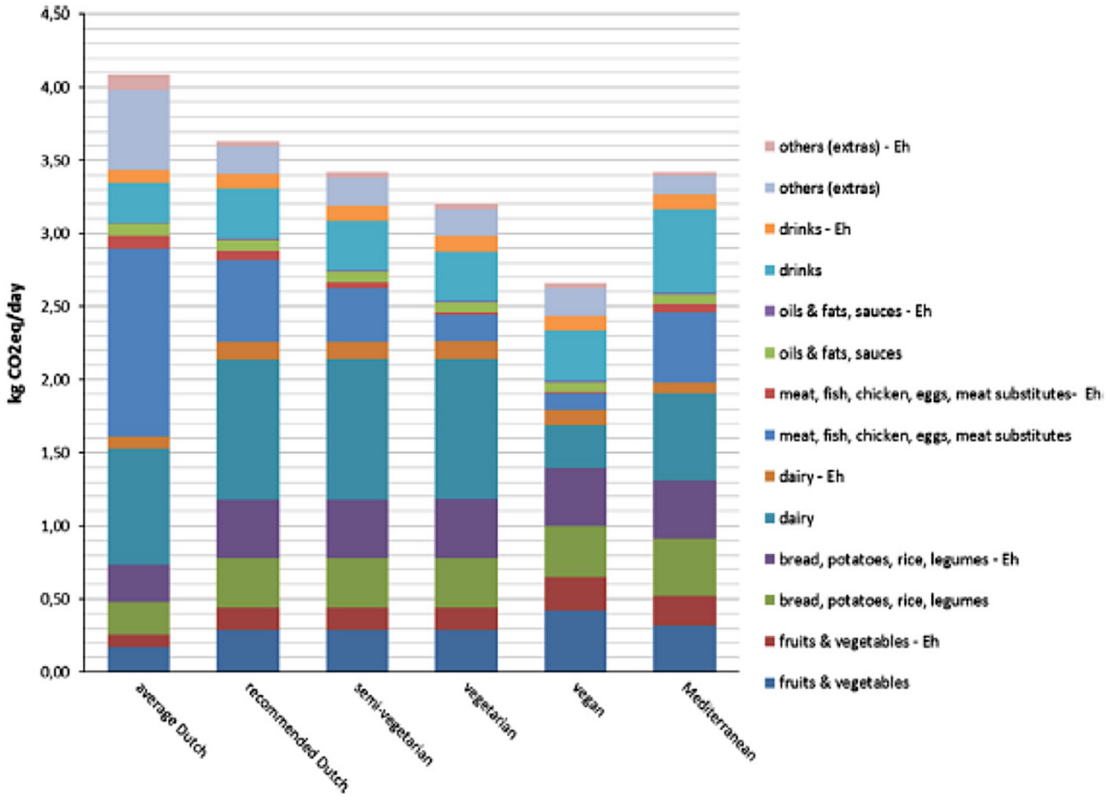

Figure 4: Greenhouse gas emissions of different dietary patterns compared to the average and recommended Dutch diets.

Source: van Dooren *et al.* (2014).

Government-approved food based dietary guidelines may recommend that meat intakes are moderate rather than high (for example stipulating a maximum of 500g red and processed meat per person, per week), and that energy intakes are in line with energy requirements.

This study compared a range of idealised diets with the average Dutch diet – the official Dutch 'recommended diet', a Mediterranean diet and nutritionally balanced semi-vegetarian, vegetarian and vegan diets. (Link to text explaining a Mediterranean diet here).

These were based on modelled, rather than real-life diets. In reality, people may not always eat in a nutritionally balanced way, an important point to take into account.

The recommended Dutch diet did have a lower GHG than the average Dutch diet, but other diets had lower emissions still.

The GHGs of the nutritionally balanced vegan diet were 34% lower than that of the average nutritionally balanced Dutch diet.

The study did not take into account any possible carbon sequestering effects arising from ruminant production. The potential that well managed grazing can promote soil carbon sequestration is still an under researched area, would apply (if borne out by evidence) only to ruminant rearing systems, and is discussed briefly in Chapter 8.

The same pattern is found for land-use requirements from different diets

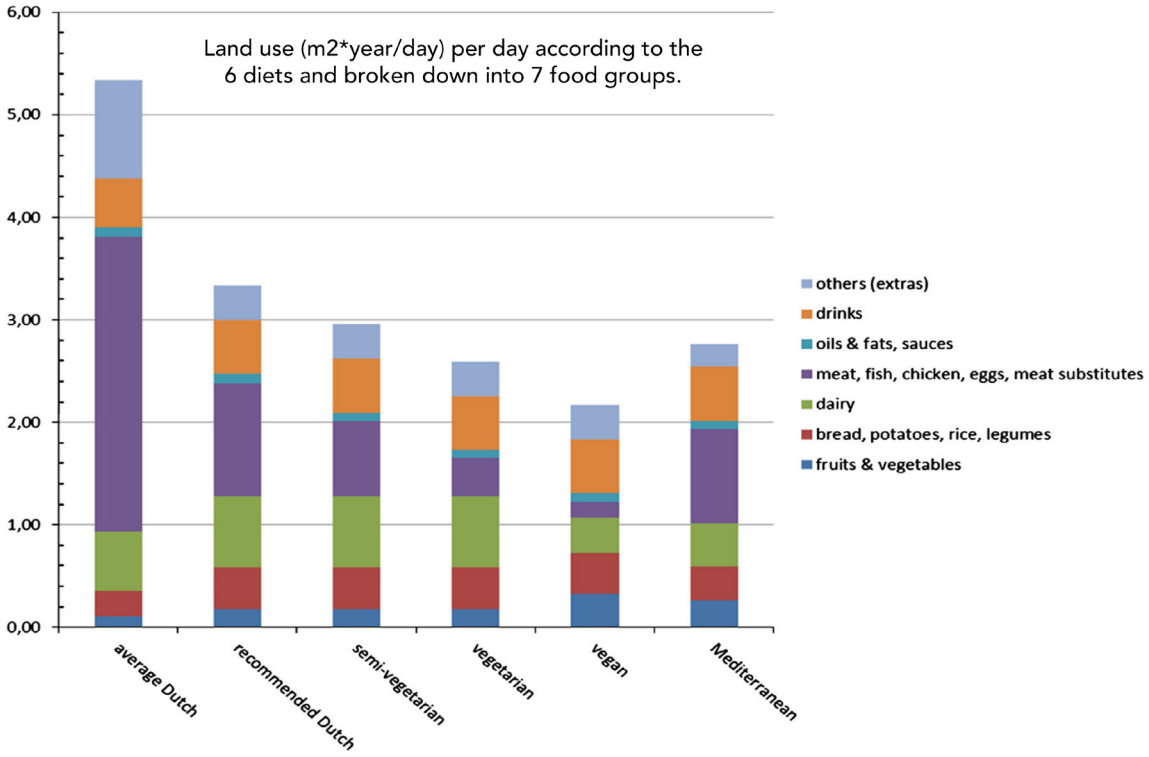

Figure 5: Land use of different dietary patterns compared to the average and recommended Dutch diets.

Source: van Dooren *et al.* (2014).

The same trends are evident for land-use requirements.

9.3.2 Comparing GHG emissions, land use and biodiversity impacts of a variety of diets: Sweden

Recommended healthy diets can have lower GHG, land-use and biodiversity impacts than 'average' diets and Paleo diets: the example of Sweden

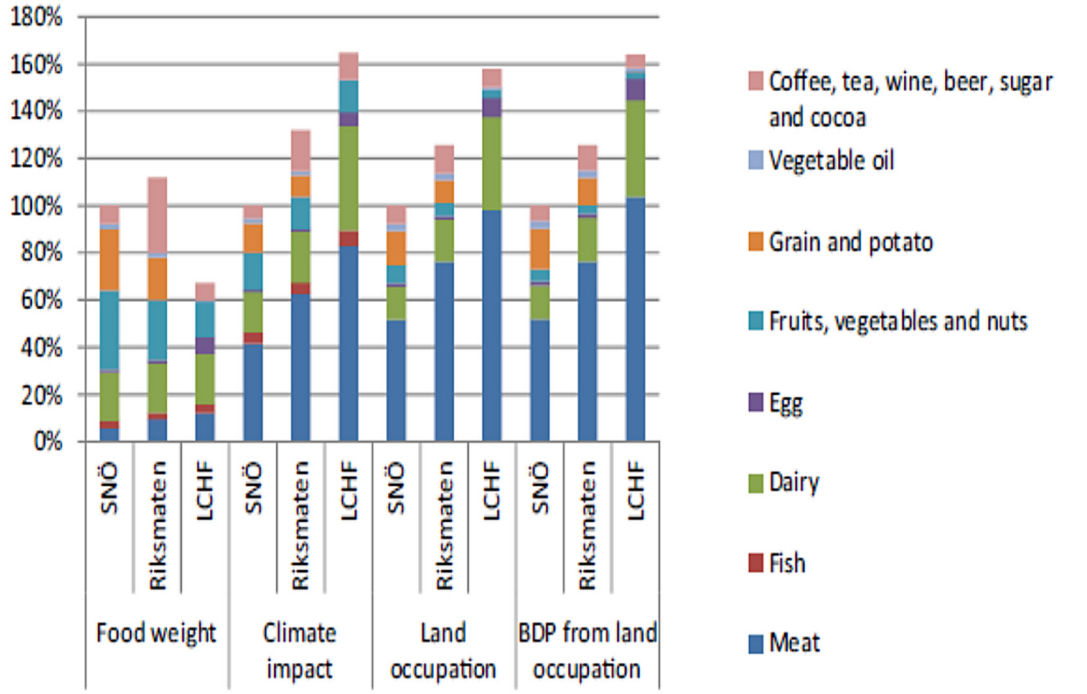

Figure 6: Comparison of climate, land occupation, food weight and BDP.

Source: Röös, *et al.* (2015).

This study compared the impacts of the average Swedish diet with a diet following Swedish government recommendations and a popular fad eating pattern, the 'Paleo' (Palaeolithic) diet. (Followers of the Paleo diets consume a great deal of animal protein and avoid carbohydrates – an interpretation of the 'Paleo' diet is explained here).

The research showed that the Swedish recommended diet had 30% lower GHG emissions than the average Swedish diet, due to lower impacts from meat and certain beverages.

The recommended diet also had lower land-use requirements and lower impacts on biodiversity (Biodiversity Damage Potential or BDP, based on land occupied).

The Paleo diet had considerably higher impacts across all metrics.

The study did not take into account any possible carbon sequestering effects arising from ruminant production. The potential that well managed grazing can promote soil carbon sequestration is still an under researched area, would apply (if borne out by evidence) only to ruminant rearing systems, and is discussed briefly in Chapter 8.

9.3.3 Possible environmental impact increases resulting from average to recommended diet shift: USA

Models have not always shown environmental benefits from a shift from "average" diets towards recommended diets. This study modelled current USA diets compared to diets based on USDA recommendations under the following scenarios:

A shift from average to recommended diets might increase environmental impacts, depending on the recommendations: USA as an example

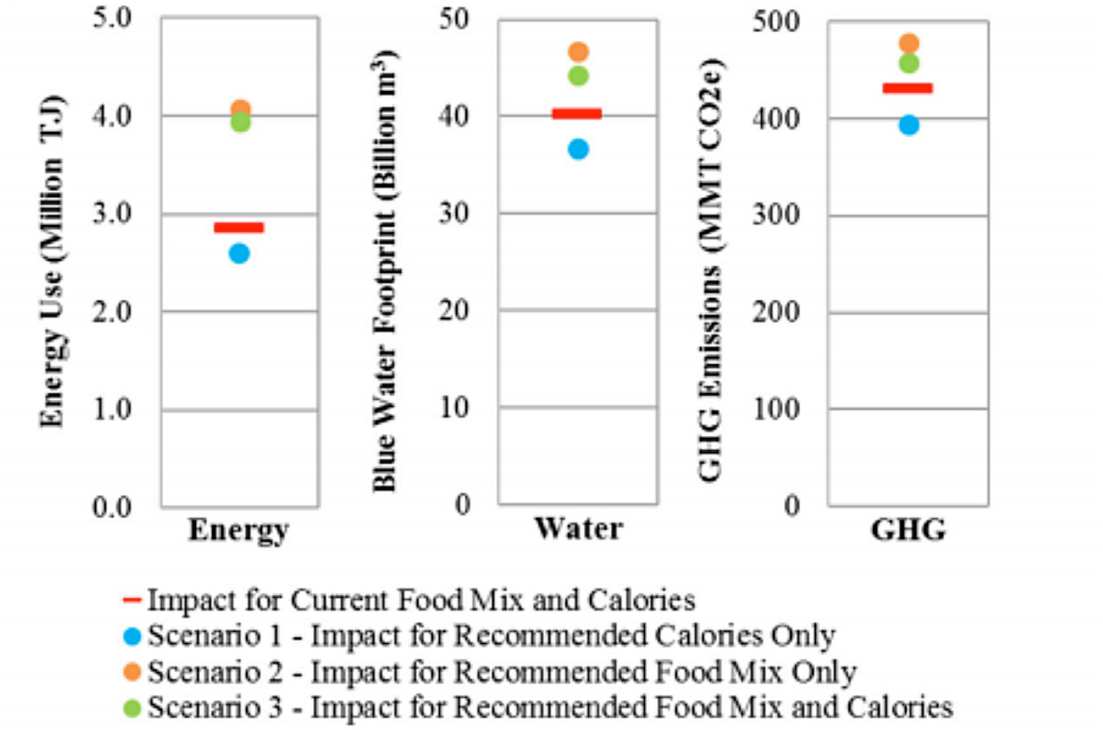

Figure 7: A modelled comparison of energy use, water use, and greenhouse gas emissions across four dietary scenarios including the current US diet, and scenarios based on government recommendations for calories and food mix.

Source: Tom, Fischbeck and Hendrickson (2015).

Modelled comparisons between current USA diets and diets based on USDA recommendations show increases in GHG, energy use and irrigation water use.

This is due to USDA recommendations for high fruit intake leading higher energy and water use, and high dairy intakes, leading to an increase in GHGs, as well as recommendations to eat more fish.

1. Recommended calorie intake (the "average" diet in terms of nutrient balance, but with fewer calories consumed).

2. Recommended food mix (shift to the recommended diet, but no reduction in calorie intake).

3. Both (fewer calories and shift to the recommended diet).

Only scenario 1 resulted in lower environmental impacts (the same food, but fewer calories consumed), whereas the recommended diet was determined to have higher GHG, energy use and blue water footprint than current USA diets for both scenarios 2 and 3. In other words, a shift towards the USDA recommended diet might be considered healthier, but could result in increased environmental impacts even with reduced total calorie intake.

The reasons for this were considered to be the very high levels of dairy and fruit in the recommended diet (the USA has the highest recommended dairy intakes in the world), which tend towards high GHGs (especially dairy) and energy and water-use (especially fruits). This demonstrates two key points:

- The food that is substituted can critically influence the environmental outcome, especially where energy-dense sugary foods (which have relatively low GHGs) are replaced. This substitution effect is discussed in more detail below.
- Not all recommended diets align with sustainability. For more on interventions, government policy and transitions towards SHEPs, see Chapter 10.

9.3.4 GHG emissions of real-life healthier diets higher than average diets: France

Healthier diets do not always lead to lower environmental impacts for several reasons. The substitution effect is an important consideration – this is where swapping one food for another may be healthier, but can also have negative environmental impacts (in this case GHG). This study compared real life French diets and clustered them into a range of nutritional classes, ranging from high to low.

This French study on real-life diets shows that some healthier diets can have higher GHGs than unhealthy diets

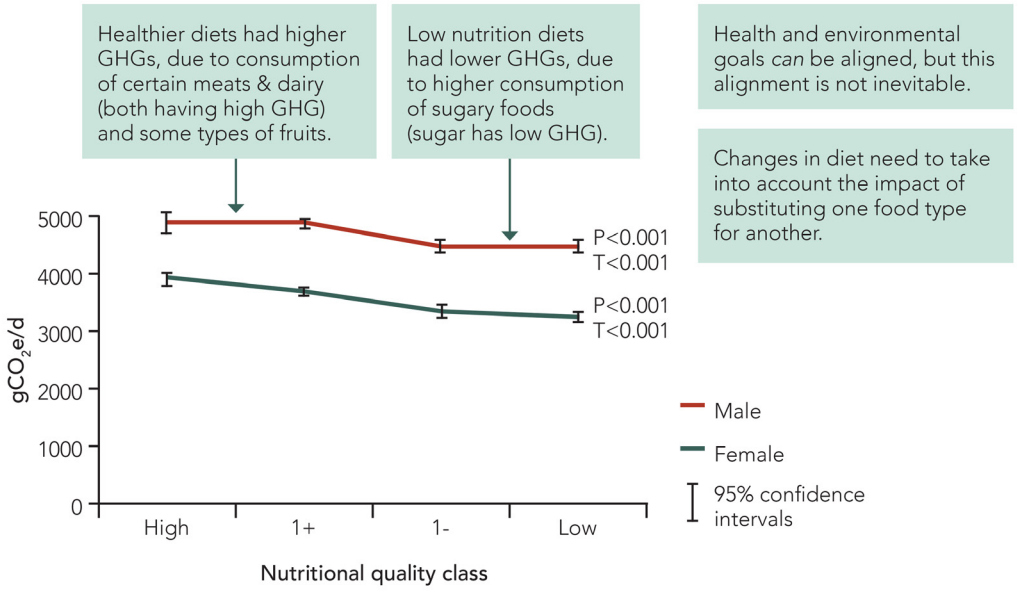

Figure 8: The association between dietary quality and associated greenhouse gas emissions in French adults.

Source: Vieux, *et al.* (2013).

It found that the reported healthiest diets had a higher GHG impact than the unhealthiest diets. This was for several reasons:

- The healthiest diets did contain lower quantities of ruminant meat, but quantities of pork, poultry and egg consumed did not differ much from less healthy diet.
- The reported healthier diets were also higher in dairy products than the unhealthy diets – these are animal source foods of ruminant origin and so are associated with high GHG impacts.
- The healthier diets were rich in fruit and vegetables and lower in sugary foods; the unhealthy diets had the reverse characteristics. Sugar has a relatively low GHG profile (which is why it is cultivated as a biofuel), so can be part of an unhealthy eating pattern that has a relatively low GHG impact. There are however other environmental concerns that arise from sugar cultivation.

So, in terms of the substitution effect, replacing sugary foods with fruits and vegetables (especially if grown unseasonally, in heated greenhouses) can result in an increase in GHGs. Interventions designed to encourage changes in eating patterns need to be aware of these effects (see Chapter 10 for more on interventions and potential substitution effects and trade-offs).

9.3.5 Substitution effect

Shifting consumption towards healthier diets does not always or necessarily result in lower environmental impact.

If a shift towards a healthier diet results in eating high levels of dairy and fruits (that are grown in greenhouses or airfreighted, see Chapter 3), this can result in higher GHGs and potentially increase other impacts such as water stress.

Potential substitution effects from changes in eating patterns can therefore have important consequences

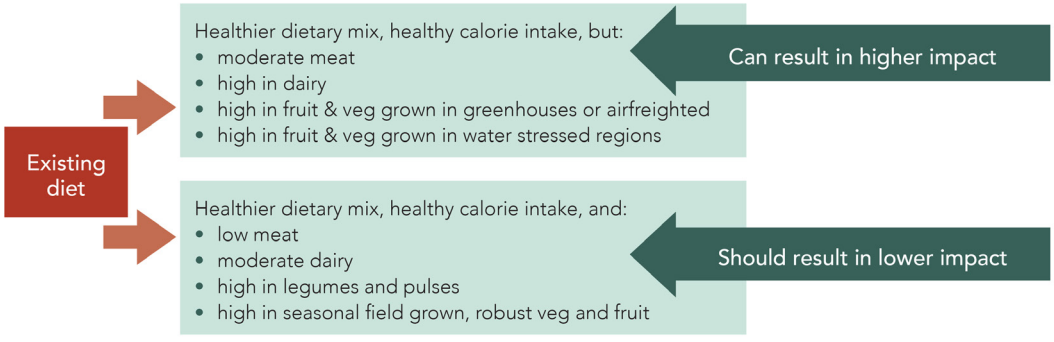

Figure 9: Dietary substitutions that improve health can increase or decrease the environmental impact of diets.

Source: FCRN. (2016).

9.4 What are the synergies and trade offs and overall implications for health?

Current diets generate high environmental impacts and are often not healthy. There is a need to identify diets that are good for health but have low environmental impacts. Is it possible to define diets that deliver both health and environment benefits?

9.4.1 'Win-wins' are possible, if not inevitable

Win-wins are possible, if not inevitable

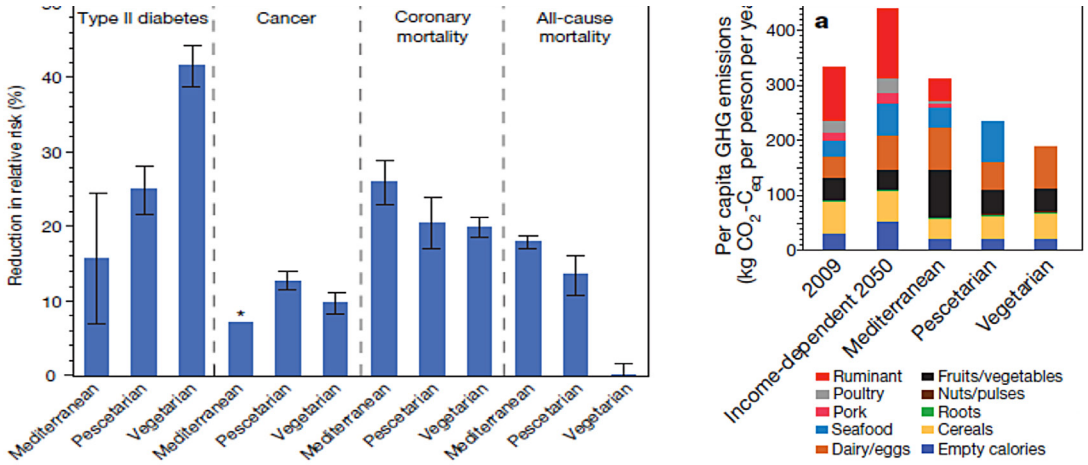

Figure 10: Diet associated reductions in the relative risk of Type II diabetes, cancer, coronary mortality, and all-cause mortality, alongside associated reductions in greenhouse gas emissions.

Source: Tilman and Clark (2014).

Non-meat and lower-meat diets generally have lower GHG and land use impacts and are associated with reduced incidence of some important chronic diseases

Chapter 7 discusses the links between eating patterns and health, including the links between higher consumption of red and processed meats and sugars, and obesity, Type II diabetes, coronary heart disease and other non-communicable diseases.

This study identified associations between lower GHG-emitting diets such as a Mediterranean diet, pescetarian diets, and vegetarian diets and reductions in the incidence of such non-communicable diseases. It is important to note that there are also other important non-diet related lifestyle and socio-economic influences on the incidence of such diseases (see Chapter 7).

The study does, however, highlight the potential for eating patterns to achieve win-wins – to contribute to both good health and lower environmental impacts.

Lower impact eating patterns can be consistent with good health

As the studies in this chapter show, diets consisting of less food from livestock and more of the appropriate fruit and vegetables have lower environmental impacts and are consistent with good health. These diets have also been associated with reduced risk of certain negative health outcomes.

More research is needed to understand the characteristics of SHEPs for environmental impacts other than GHGs, such as the sustainability of water use, impact on biodiversity and so forth.

Given the caveats already discussed, a lower environmental impact diet that is also healthy might look like this:

- Sufficient calories to meet energy needs and nutrient diversity.
- Based around tubers, whole grains, fruit and vegetables (mainly field grown, resistance to spoilage, and not requiring energy-intensive transport).
- Meat eaten sparingly, if at all, and all parts consumed:
    - Includes offal (which is generally nutrient rich) but may also include fattier cuts – since overall meat intakes are very reduced overall dietary quality does not suffer unduly.
- Dairy products in moderation or replaced with fortified plant-based alternatives.
- Unsalted seeds and nuts.
- Small quantities of fish, from certified sources.
- Very limited quantities of processed foods high in fats, sugars and salt.

These general principles may not be applicable to all individuals in all parts of the world. In that sense, while we understand what SHEPs might look like, there is no single 'ideal' SHEP.

9.4.2 Sustainable healthy eating patterns are context specific

Sustainable, healthy eating patterns (SHEPs) are context specific – there is no single 'ideal' SHEP

- As shown above, synergies are possible for healthy and low impact eating patterns. Our understanding of diets that are healthy, less GHG-intensive and place less stress on water and land use is growing.
- But we have less understanding of the relationship among the environmental, societal and economic dimensions of sustainability.
- There is no ideal SHEP – the 'ideal' is contextual.
    - Different age-groups and social groups have different nutritional needs.
    - Important differences in nutritional requirements exist between high and low income countries and among populations within countries.
- 'Sustainable' depends on which aspect we focus on, for example:
    - GHG emissions;
    - Water stress;
    - Land-use;
    - Animal welfare;
    - Human welfare (for example farmers' livelihoods);
    - Other socio-economic and cultural factors.

9.4.3 There are trade-offs between health, environmental and socio-economic considerations

Trade-offs between health, environment and socio-economic aspects exist

Trade offs can exist **between health and the environment**. For example:

- Shifts in eating patterns towards certain fruit and vegetables might increase nutritional quality but also increase water stress if this increases production requirements in water scarce areas.
- Food processing can be a way of improving resource efficiency (e.g. sausages make use of less appealing body parts) but at a cost to health (e.g. due to the addition of salt).

Trade-offs can exist **between environmental impacts**. For example:

- Some fish have a lower GHGs than meat but increased fish consumption could put extra pressure on fish stocks and marine biodiversity.
- Most fruits and vegetables have lower GHGs than meat, but increased consumption of fruits that are grown in warm but water scarce regions could exacerbate water stress – or there may be pesticide issues to consider.

Trade-offs can exist **between environmental impacts and social and economic aspects** of sustainability. For example:

- Changes in livestock farming practices that lead to reduced GHGs might have negative consequences for animal welfare.
- A reduction in livestock production may negatively impact jobs and livelihoods or may undermine food security or local food cultures and traditions.

Win-wins are possible if not inevitable. It is possible to define diets that deliver both health and environment benefits, but there are many possible trade-offs that must be considered.

Care and planning is needed to ensure micronutrient adequacy (e.g. iron, calcium, vitamin B12, zinc) – otherwise there is a risk of deficiency.

Animal products are important sources of protein and essential micronutrients both in high and low income contexts. Removing them completely from the diet without care could increase the risk of deficiency.

However, well-planned and diverse plant-based diets can have lower environmental impacts than those containing meat. They can also be nutritionally adequate, containing the full range and quantity of essential micro- and macro-nutrients.

In summary, diets lower in animal products can be nutritionally adequate and carry lower environmental impacts.

The 'need' for animal products depends on the context of consumption (see later in the chapter).

9.4.4 Possible outcomes

Towards sustainable and healthy diets

Figure 11: A four part typology and description of diets, according to dimensions of health and environmental impact.

Source: FCRN. (2016).

Diets can be seen as:

- "lose-lose": high impact / unhealthy (more common in rich and emerging countries);
- "win-lose": low impact / unhealthy (more common in poor countries);
- "lose-win": high impact / healthy (mainly in rich countries);
- "win-win": the "ideal" that is low impact and healthy.

As this chapter has shown there is an acknowledgement that, in high income countries at least, this would include lower levels of animal products and higher levels of appropriate fruit and vegetables (see Chapter 3 for more on the relative GHGs of food types). Proteins can be obtained from other sources, not just from animal products, especially legumes and pulses. Fish should be limited to certified sustainable stocks (see Chapter 5) and food waste should be minimised.

9.5 Can we define SHEPs relevant to different global, regional and national contexts?

9.5.1 Effectiveness and plausibility of shifting eating patterns in developed countries

Shifts in eating patterns can make an important difference to global environmental impacts

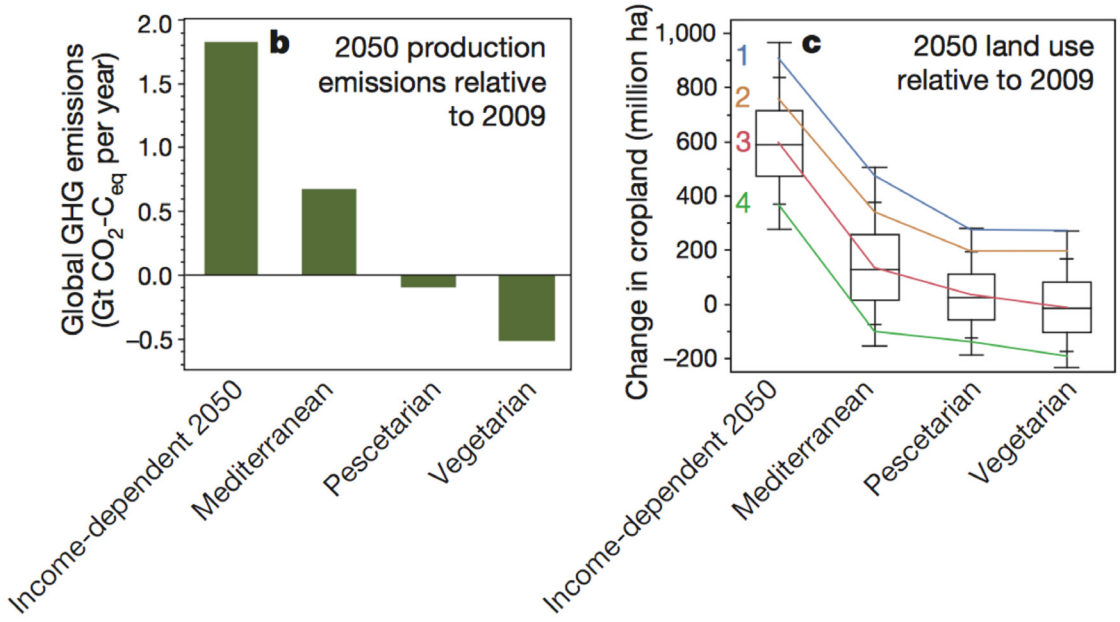

Figure 12: The potential effect of a change in dietary patterns on global greenhouse gas emissions (left) and land use (right).

Source: Tilman and Clark (2014).

Adoption of Mediterranean, pescetarian and vegetarian diets has been modelled to have environmental benefits in terms of both lower GHG emissions and reduced land-use requirements, compared to both a 2009 "average" global diet, and an income-dependent predicted diet based on the 2009 average.

In high income countries, significant reductions in GHG emissions are possible without radical changes in eating patterns, although the role of meat in the diet does decline significantly. But above a certain level of emission reduction, it can be difficult for diets to meet nutritional needs and conform with current norms of acceptability.

In high income countries, significant reductions without being too radical are possible

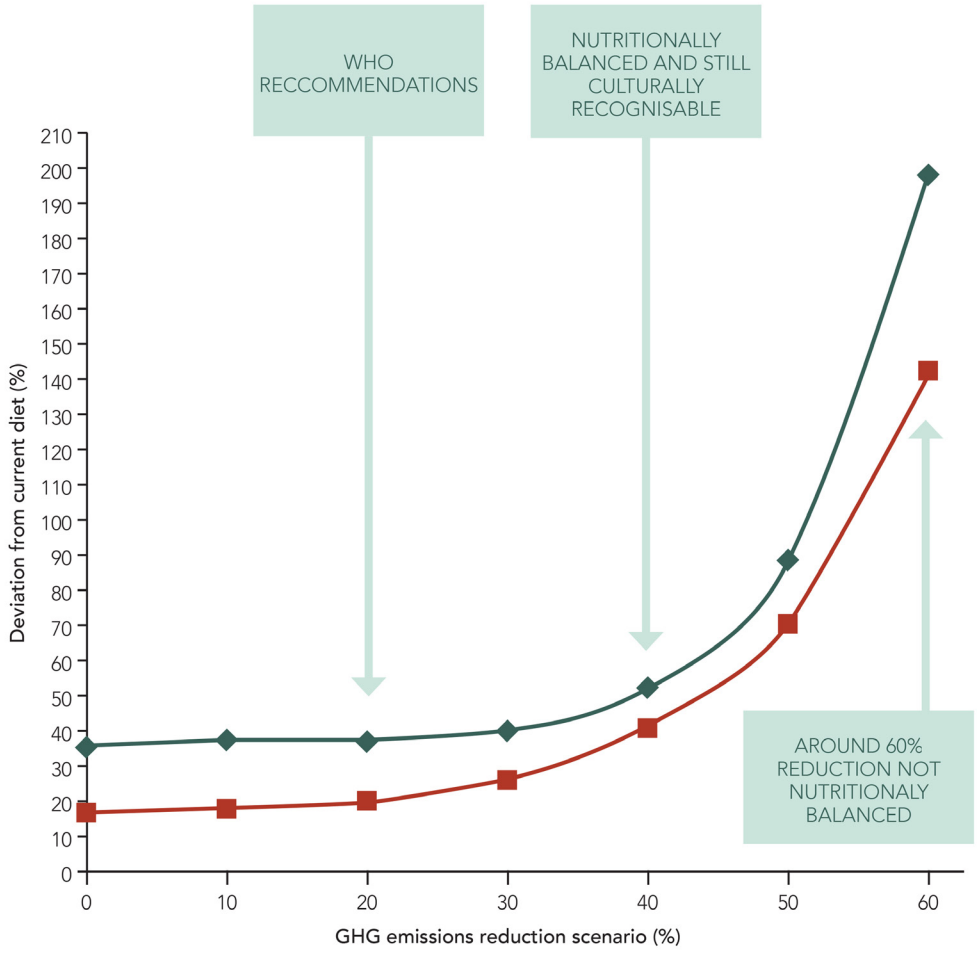

Figure 13: Difference from current average UK diet required, according to level of reduction in greenhouse gas emissions achieved.

Source: Adapted from Green, *et al.* (2015).

This study showed that if UK diets met WHO recommendations then associated GHGs would be reduced by 17%.

Further GHG reductions of up to about 40% would be possible via "realistic modifications to diets so that they contain fewer animal products and processed snacks and more fruit, vegetables and cereals".

However, deeper cuts in emissions (e.g. beyond about 60%) would require acceptance of diets that are culturally very different from what we consume today – and beyond this level of reduction, our nutritional needs would not be met.

This observation illustrates the need for production-side changes (improving agricultural production, distribution and storage – see Chapter 4) and measures to address food waste, as well as for changes in consumption.

In high income countries, shifts towards national dietary guidelines can reduce GHG emissions, but per capita food-related emissions still remain high

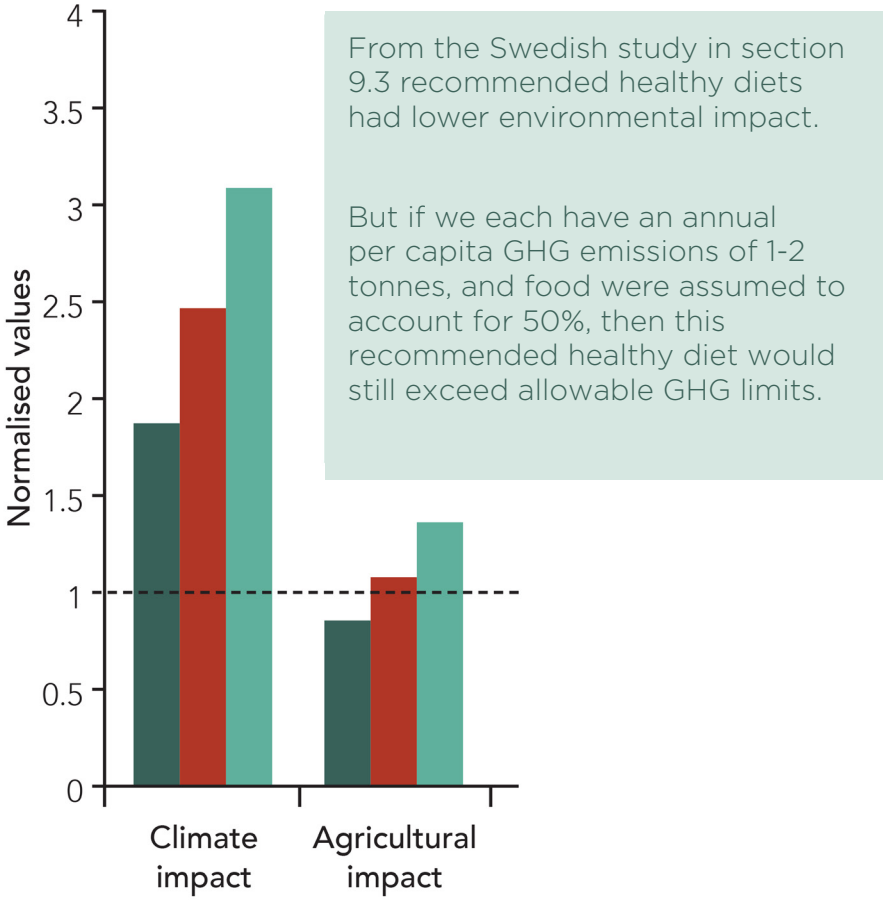

Figure 14: Impact of recommended Swedish diet (dark green) compared to the current average diet (red) and a low carbohydrate high fat diet (light green).

Source: Röös, *et al.* (2015).

The study on Swedish recommended healthy diets (see section 9.3) assumed that we each have a per capita emission space of approximately 1-2 tonnes CO2eq. as defined by IPCC – it also assumed that food consumption would take up 50% of these 'allowable' emissions.

All of the diets modelled here (a recommended Swedish diet (dark grey bar), an average Swedish diet (light grey bar), and a 'paleo' diet (middle grey bar)) would exceed this allowable GHG emissions per capita.

This again suggests that existing dietary recommendations may not yet be aligned with environmental sustainability, and that more needs to be done to reduce the environmental impacts of production (see Chapter 4).

9.5.2 Addressing nutritional challenges for rich and poor

The nutrition challenge is different for rich and poor people

The nutrition challenge is different for rich and poor countries. Many people in poorer countries need to increase their energy intake and food (and nutrient) diversity; people in richer countries need to decrease their energy intake and realign food diversity.

High consuming / overweight / rich people:

- The main issues are overconsumption:
    - Lower meat diets are likely to do no harm / could yield health benefits.
    - Potential win-wins possible for health and the environment.

Poor / hungry / malnourished people:

- The main issues are undernutrition, micronutrient deficiency, and livelihoods:
    - Animal products are nutrient rich while livestock keeping can contribute to livelihoods and income.
    - We need to develop food production systems that maximise nutrition at minimum environmental cost.

Rich and poor people alike in developed countries may often consume high quantities of meat and dairy, as do many rich people in developing countries. These groups will need to reduce or moderate their meat and dairy consumption.

There is a need to integrate nutrition, climate change and environmental policy, a view which is largely consistent with the contraction and convergence concept introduced in Chapter 4.

9.5.3 Important uncertainties remaining

Important uncertainties remain

Important uncertainties remain in our understanding of SHEPs.

Production-consumption interactions are complex. Production methods influence environmental and/or nutritional profile and affect cost and availability, which influences consumption (see Chapter 4).

Rebounds and leakages can influence consumption: changes in production or consumption in Country A can trigger changes in consumption or production in Country B.

Climate change models predict disruptions to food supply, but greater understanding is needed into how these will impact consumption (see Chapter 5).

Currently GHGs are often used as a proxy for environmental impact. We only have a limited understanding of how water issues, different qualities of land use, impacts of food production on biodiversity, and resilience & adaptability – and the interactions among all these concerns – would shape a more complete understanding of SHEPs. We also lack understanding about the cultural and livelihoods dimensions of sustainability.

Most of the research on SHEPs has focused on developed countries, whereas significant consumption changes are occurring in low-middle income countries. It is important to understand these changes and explore how evolving dietary pathways might be reoriented in more sustainable directions.

Remaining questions:

- How might future changes in production methods influence demand? (see Chapter 4)
- How might different assumptions about the role of grazing livestock in sequestering soil carbon alter our conclusions about the role of ruminant meat in SHEPS?
- How might changes in production or consumption in one country trigger changes in consumption or production in another (via imports and exports)?
- How will climate change itself impact upon food production – not just yields but also nutritional quality? (see Chapter 6)
- What about sustainability metrics that go beyond GHGs, water and land use?
- What sustainable and nutritionally adequate dietary pathways might be appropriate for low income countries?

9.6 Conclusions

- SHEPs are difficult to define in a meaningful way; the FAO provides a definition of a SHEP encompassing environmental, socio-economic and cultural aspects of sustainability, but does not provide guidance on what this looks like "on a plate".
- Diets containing fewer animal products have been shown to generate lower GHG emissions and to be associated with lower land use requirements.
- While adherence to government dietary recommendations can also lead to reductions in GHGs in high income countries, this is not always the case. Where dairy intakes are increased, or high impact fruits and vegetables consumed, the consequence can be higher GHGs than the current average. The substitution effect is critical.
- In high-income countries, significant reductions in GHG emissions can be achieved by changing diets, but achieving really deep cuts in emissions may require changes in diets that are not considered to be culturally acceptable.
- Identifying SHEPs requires particular consideration of regional and national contexts, as nutrition issues differ between, for example, rich and poor countries.
- A focus on dietary change needs to be seen in the context of approaches aimed at reducing the environmental impacts of production and distribution and reducing food waste – i.e. all these approaches go together.

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