PBL Netherlands Environmental
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OUR DAILY DIET

HOW GOVERNMENTS, BUSINESSES AND CONSUMERS CAN CONTRIBUTE TO A SUSTAINABLE FOOD SYSTEM

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Our Daily Diet. How governments, businesses and consumers can contribute to a sustainable food system

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Summary

Food production is indispensable. It provides a basic necessity of life, is a source of income for many and contributes to quality of life. However, the production of the food that is consumed within the Netherlands also has a downside for the physical environment, as it can result in biodiversity loss and greenhouse gas emissions. Solutions for reducing this environmental burden are often sought in relation to agricultural production. But there are also other areas in which food production can be made more sustainable.
If government authorities would pursue a food policy that includes the entire food system, new opportunities to reduce the adverse effects on the living environment would present themselves. Other stakeholders within the food system, such as the food processing industry, supermarkets, the hospitality sector and consumers, can also contribute to sustainability — for example, by eating more sustainably, reducing food waste, and supporting more sustainable production methods for farmers and fishermen.
This report focuses on Dutch food consumption and the Dutch food system. However, the lessons it draws for government authorities, businesses and consumers could also be applied to create more sustainable food consumption in other countries.

Food production has a negative impact on the physical environment
The production of the food that is consumed in the Netherlands has a number of effects on the physical environment in both the Netherlands and around the world. Most of these effects occur during primary production processes on farms and in fisheries, here and abroad. Biodiversity, climate, soil, air and water quality, landscape and animal welfare are all negatively affected by food production. Some of these negative effects on the physical environment are expressed in a footprint, which shows how much space is used or how many greenhouse gases are emitted to make consumption possible. The total Dutch consumption footprint is constructed from various areas of consumption. Food consumption is responsible for almost 40% of the total land footprint of Dutch consumption; and for about 13% of the total greenhouse gas footprint of Dutch consumption. Reducing these effects can therefore make an important contribution to achieving international and national environmental targets.

Not only farmers, but also consumers, businesses and government authorities can reduce the burden on the physical environment
Solutions for reducing the burden on the physical environment are often sought in the agricultural and fishery sectors. But there are also other areas in which food production can be made more sustainable. It is therefore important to look at the entire food system — 'from farm to fork' — and include all stakeholders and their mutual relationships. Consumers and businesses can bring about a change in the food system. After all, the demand from consumers and parties in the food supply chain influences the type of food produced and food production methods. In addition, national governments, the European Union and local and regional government authorities can all play key roles in making the agricultural and food systems more sustainable. They set the preconditions and rules within

which companies and consumers produce and consume food, and record them in international trade agreements and legislation and regulations.
When pursuing sustainability policies on the food system, it is important that the various ideas, perspectives and wishes that exist in society regarding sustainable food are taken into account. In other words, 'sustainable food' is a value-laden concept. For some people, sustainability has to do with fair trade and the quality of countryside living, while for others, it may have to do with food safety and animal welfare. Not all of such values can be fully achieved at the same time; there are certain trade-offs. Increasing animal welfare or increased space for nature in meadows and fields, for example, can have a negative impact on production efficiency and may, thus, lead to higher greenhouse gas emission levels and more land being used.

Four starting points to increase sustainability of the food system
If all stakeholders would focus on the entire food system, this would reveal new possibilities for reducing the impact on the physical environment. We identified four starting point for food policy to focus on:

- Eating more sustainably;
- Less food waste;
- More efficient production (using fewer resources and raw materials during the production process);
- More careful production (changing production methods to reduce the negative impact on animal welfare and the local environment).

These starting points belong to food policy and, partly, also to agricultural policy. Agricultural policy focuses on the primary food production by Dutch farmers, while food policy is aimed at consumers and national and international food supply chains. In order to increase the level of sustainability of the agricultural and food systems, both policy fields should be involved.
To show what could be achieved through food policy, we used land and greenhouse gas footprints in our calculations. A combination of these starting points may significantly reduce the burden on the physical environment; both these footprints related to Dutch food consumption can be reduced by about a third. The calculations assume that consumers will adopt a diet with less meat and dairy products, that they will waste less food, and that producers will improve animal welfare (although this will result in a slight increase in the footprint) and increase the efficiency of crop yields and animal production.

Consumers will not be able to achieve more sustainable diets and less food waste by themselves
For consumers, achieving a more sustainable diet and less food waste means they have to change their everyday routines, including which groceries they get, what and how they cook and which restaurants they visit. Changing these routines may appear an individual choice, but this is only partly true.
Food consumption routines are influenced by the cultural significance of these activities, such as which food is considered 'normal' (e.g. the Dutch eat potatoes, vegetables and meat, rather than insects), by the acquired food skills (e.g. the ability to cook with various

basic products), and by food availability (e.g. the supply of products at certain locations, such as railway stations).
These elements make it difficult for individual consumers to change their routines.
An important role in achieving those changes can be played by supermarkets, the hospitality industry and food processing industry. Consumers are most likely to change to more sustainable diets if the above three elements are addressed simultaneously. This includes, for example, the location of the sustainable products in supermarkets and the price of those products; the level of food literacy regarding the preparation of sustainable meals; and whether or not meat is considered a necessary element of a 'full meal'?

Businesses within the food supply chain take initiatives to increase sustainability, but they are not the only solution

Various companies, such as those in the food processing industry and supermarkets, are developing initiatives to make food production more sustainable. They impose sustainability requirements on food production that go beyond what is required by law. For example, they encourage farmers to make their production methods more sustainable, sometimes by offering compensation. These parties within the food supply chain take initiatives above and beyond their legal obligations, mainly for economic reasons; namely reputation management, securing their raw material supply and cashing in on earning opportunities. The influence of public pressure and questions may also lead these stakeholders to making the effort to increase the sustainability of their practices beyond what is required by law.
The non-statutory sustainability requirements mainly focus on 'more careful production', particularly with respect to animal welfare and fair trade. Certified pork and certified coffee and chocolate are now largely the standard choice in supermarkets.
Sustainability initiatives by businesses are not the solution to all problems. Subjects that are more difficult to communicate to the general public or difficult to measure (e.g. sustainable soil management) are less likely to get off the ground. Evaluation of certification schemes has shown that the actual reduction in negative effects on the physical environment (and other improvements such as in working conditions) lags behind expectations and public perception around certification labels.

Government authorities move towards a system-sensitive food policy with a clear vision and specific objectives

If government authorities want to make and implement more sustainable food policy, they should also take the characteristics of the food system into account. This requires a food policy that is sensitive to the international and complex nature of the food system, also taking into account the inherent conflicting values.
System-sensitive food policy requires a vision and objectives that are both clearly understood, to be able to influence and change the preconditions and rules of play in the food system. This vision and these objectives are not based on one set of wishes and values regarding sustainable food, but rather offer room for experiments that arise from the various perspectives within society with respect to a sustainable future for food.

A clear vision and specifically formulated objectives may stimulate and guide citizens and businesses to become more sustainable. The effects of measures, experiments and initiatives are difficult to predict, because of the complexity of the food system. By monitoring the effects, it is possible to make continual adjustments and learn more about how to shape a broadly supported and sustainable food system.

Dutch government authorities, both national and local, are already pursuing policies that contribute to a more sustainable food system. Current policy aimed at reducing food waste and influencing consumers' dietary patterns could be intensified, for example through education about food, raising awareness of food waste and supporting companies that offer sustainable products. This policy could be complemented by other measures, such as regulating the food environment (e.g. banning the sale of certain food products near schools), and pricing emissions through pricing policies or fiscal policies.

In addition, government authorities — the European Union and the Dutch Government — may consider amending legislation and regulations that impede the sustainability of the agricultural and food systems. Examples include stricter requirements in plant protection products, animal welfare, greenhouse gas emissions and showing negative external effects of food production through pricing. It would be sensible to align these types of policy so that different actors in the food system can be called to account — farmers, businesses, consumers — and to encourage them to change. Eating more sustainably, wasting less food and producing more sustainably could then become the new standard.

Introduction

Food is abundantly available in the Netherlands, every day and at reasonable prices. This situation is not self-evident and not without consequences for the physical environment; food production has negative effects on the physical environment. The question, therefore, is how people in the Netherlands can continue to eat enough and well, and how, at the same time, they can reduce these effects and make the food system more sustainable.

Food is valuable

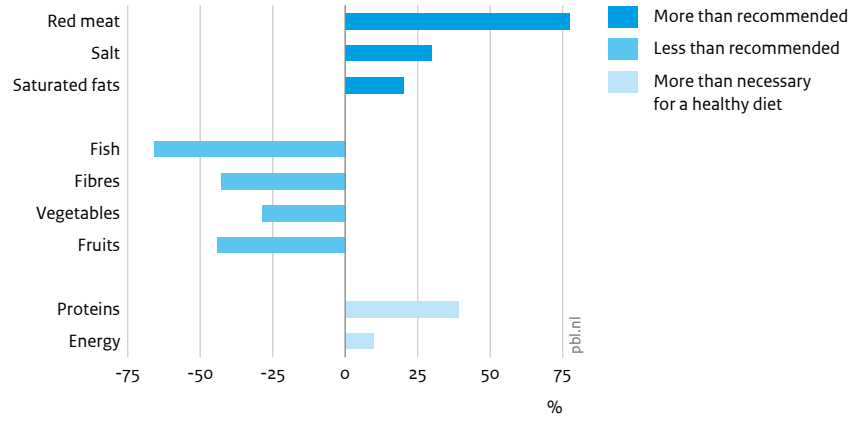
The subject of 'food' is already receiving a large amount of attention in society. This makes sense, as people need to eat every day. Moreover, food is more than just energy and nutrients — taste, tradition, social aspects and status are also important cultural elements. Food consumption and production touches on many aspects: health, food safety, animal welfare, the environment, quality of life in the countryside, and livelihood security. People differ in what they eat and what they find important about their food. Society, therefore, has many different images of sustainable and healthy food and how food should be produced in the future.

Eating patterns in the Netherlands, on average, are not sustainable and not healthy

The average diet of the Dutch is not sustainable; eating too much — and especially too much meat — exerts enormous pressure on the environment. A more sustainable diet (including less meat and fewer beverages and more fruits and vegetables) is also a healthier diet, for the average person (Ocké et al., 2017). The RIVM estimates that unhealthy dietary habits are responsible for more than 8% of the disease burden in the Netherlands, leading to 6 billion euros in healthcare costs, each year (RIVM, 2018b). Approximately half of the Dutch adult population is overweight (CBS, 2018e). The Dutch consume insufficient amounts of fruits and vegetables and too much red meat, salt and saturated fats (Figure 1) (RIVM, 2018c).

Figure 1

Dutch food intake compared to dietary guidelines, 2012 – 2016



Source: RIVM; Voedingscentrum

Dutch people, on average, do not eat according to nutritional guidelines.

Sustainable food plays a role in various policy dossiers at various policy levels

The aim for sustainable and healthy food is already playing a role in various types of policies and at various levels and scales. The text box 'Food policy at various levels and scales' below provides an overview of food policy at international, national, regional and local levels.

Food policy at various levels and scales

International food policy

In an international context, the Sustainable Development Goals (SDGs) are important. Two of these goals focus explicitly on food; SDG 2, 'Zero Hunger', and SDG 12, 'Responsible Consumption and Production', of which SDG 12.3 is to halve food waste by 2030. The other Sustainable Development Goals are also related to food and can be divided into three categories: the biosphere, society and the economy. These three categories, or 'layers', refer to the well-known 'People, Planet, Profit' concept of sustainability (EAT Stockholm Food Forum, 2016). The objectives from the 'Planet' layer, or biosphere, form the preconditions from which the objectives in the other two layers (People, Profit) can be derived. The production of food largely depends on processes in the biosphere (e.g. soils and water) and vice versa, food production leads to changes in the biosphere, worldwide. In this way, food production and consumption are connected to all the Sustainable Development Goals.

European trade, environment and food safety policies

The food production in and for the Netherlands also greatly depends on EU policy, and, therefore, so is Dutch food consumption. This mainly concerns policy on the internal EU market, food safety policy and environmental policy (in descending order of importance). EU agricultural policy mainly affects farm incomes and the price of agricultural products, which is why it has less of an impact on food consumption. European policy often includes cross-compliance preconditions, which are then fleshed out at the national level. The European internal market means that products produced anywhere in the European Union can be sold on the Dutch market without restrictions. This means that any legal requirements on sustainable production are set at EU level. The same applies to food safety requirements. Among other things, the European Union has legal requirements on authorisations in the fields of pesticides, animal welfare (e.g. the ban on battery cages) and animal health. It has been agreed that all EU Member States must draw up policies to reduce emissions, including from the agricultural sector. Guidelines have been set for climate policy, as well as for nitrogen emissions (Nitrate Directive, NEC), water quality (Water Framework Directive) and biodiversity (Birds and Habitats Directives). These directives have consequences for agriculture, in the sense that the volume of agricultural production is limited in some sectors, and also for production methods (e.g. with fewer emissions of pesticides, nitrogen and phosphate).

National food policy

The Netherlands has national agricultural policy, about which the Minister of Agriculture, Nature and Food Quality, in her vision document of September 2018, states that, instead of 'a continuous reduction in cost price, there should be a continuous reduction in raw material consumption' (LNV, 2018). Furthermore, the Netherlands has had food policy in place since 2009, which takes consumers and supply chains as its starting point. This policy was given a new impetus in 2015 with the national 'Food Agenda' published at that time. Since then, the Food Agenda has been followed up. The current Minister of Agriculture, Nature and Food Quality has indicated that she wishes to continue the policy laid down by her predecessors between 2015 and 2017 (LNV, 2018a, 2019). She has committed herself to Sustainable Development Goal 12.3, which is to halve the amount of food waste by 2030. In addition, policy attention is being awarded to new revenue models (enabling more sustainable production), transparency and consumer confidence, and the prevention of chronic diseases through nutrition. No concrete targets have been set for these 'lines of action', but what has been formulated is stimulating and supporting policy.

Food and agriculture also feature as themes in Dutch policy on climate and circular economy. The Climate Agreement includes a section on food consumption. It contains the following goal concerning the dietary patterns: to bring consumption of animal protein in line with recommendations by the Netherlands Nutrition Centre, which would mean a protein reduction of 10% to 15% and a 50:50 ratio between animal and vegetable protein in the human diet. The Transition Agenda for Biomass and Food, in the context of policy on the circular economy, states a similar goal: to reverse the ratio between animal and vegetable protein in the human diet from 60:40 to 40:60 and reduce protein by 10% to 15%.

Urban food policy
Food policy is also formulated on a municipal level. In this context, developments in the Netherlands are in line with the Milan Urban Food Pact (2015), the FAO's Food for the Cities Programme (2001) and the UN Habitat II New Urban Agenda (2016). In 2017, 12 municipalities, 1 province and 3 ministries signed the City Deal 'Food on the Urban Agenda' (Government Gazette, 2017). This City Deal is intended to further elaborate the national food policy and translate it to the local context. The starting point, as on a national level, is integrated policy which links food production and consumption in three themes: 1) increase ecological and economic sustainability and innovation; 2) strengthening regional food systems and food supply chains around the city; and 3) promoting healthy and sustainable food consumption among all sections of the population.

Food, therefore, receives attention in various policy dossiers, at various policy levels, but this is causing a food policy that is highly fragmented. In addition, a range of private parties are making the food system more sustainable, each with their own motivations and in their own way (see the text box 'Sustainable initiatives over the past five years').

Sustainable initiatives over the past five years

Over the past five years, many different initiatives have been started and realised in the Netherlands by food companies, with or without government support. A brief overview is provided below.

Realisation
For some product types, the more sustainable version became the standard choice in the supermarket:
- more animal-friendly meat: 1* Better Life label for pork and 'concept chicken' for chicken;
- a large share of the coffee and chocolate on the Dutch consumer market has a Fair Trade or UTZ/Rainforest Alliance certified seal.

New companies were set up, whose products focus on the following sustainable themes:
- short, local or regional supply chains;
- the prevention of food waste;
- meat substitutes.

In addition to certified products and new companies, there are also initiatives that focus on disseminating information through education and transparency, such as through apps.

Plans and ambitions
Over the past five years, various initiatives have also been launched that have not yet yielded tangible results, although ambitions and plans have been formulated. These ambitions are often widely supported by many different parties (companies and government authorities) in the food system:
- Green Protein Alliance (aims to reduce the percentage of animal protein in the human diet);
- Transition Agenda Netherlands Circular (aims at halving food waste and reducing the percentage of animal protein in the human diet);
- Taskforce Circular Economy in Food, and Foundation Together to Combat Food Waste (aims to halve food waste and useful application of unavoidable residual flows);
- City-deal 'Food on the urban agenda' (strives for healthy and sustainable food in cities and municipalities);
- Transition Coalition Food (aims for an alternative food system in which sustainability, circularity, health, transparency and true cost/true price are central elements).

Slow progress in making food more sustainable
Progress in making Dutch food consumption more sustainable has been slow, over the past decade. There is no measurable trend showing a decrease in the extent of food waste (PBL, 2018). After several years of decline, meat consumption seems to have stabilised again (Dagevos et al., 2018; RIVM, 2018a; Terluin et al., 2017). As a result, the policy goal of halving food waste by 2030 and the ambition in the Biomass and Food Transition Agenda to reduce the share of animal protein in the human diet seem currently out of reach. The ambition to increase pork and chicken market shares to 100%, by 2020, at a level above the statutory level of animal welfare, seems likely to be achieved (PBL, 2018).

Reader
'How can the pressure on the physical environment associated with Dutch food consumption be reduced?' This is the central question in this report. To answer this question, it investigates which role government authorities, companies in the food supply chain, and consumers can play in making the food system more sustainable.

It first examines the negative effects of food production on the physical environment. Subsequently, it shows that, in the current agricultural and food system, government authorities play a key role in making the food system more sustainable and explore the potential of food policy to reduce the effects of food production on the physical environment. The report then discusses how the agricultural and food system can change and what this means for parties in the food supply chain and consumers.

About this report

This report is an edited translation of the findings of the PBL report '*Dagelijkse kost. Hoe overheden, bedrijven en consumenten kunnen bijdragen aan een duurzaam voedselsysteem*'. The report is a synthesis of several recent PBL studies on Dutch food consumption and the agricultural and food system. It connects the results of the various sub-studies; thus, sketching the big picture of possibilities for change in the Dutch food system.

Food production has negative effects on the physical environment

Behind the food served at the table, an international agricultural and food system is hiding

Behind the food that is being served at the table, there is a chain of shopkeepers, food manufacturers, traders, transporters, farmers and fishermen (see Figure 2). The entire chain 'from farm to fork', and all parties involved in it, such as banks, government authorities, knowledge institutes and stakeholders, and their mutual relationships, together form the food system.

Much of the food consumed in the Netherlands is imported, most of it from Europe. Much of the food produced in the Netherlands is exported, most of it to other European countries. Almost three quarters of the agricultural land used for Dutch food consumption is located abroad; at the same time, the Netherlands also exports about three quarters of the agricultural products produced in the Netherlands (see the text box 'Often, the food consumed in the Netherlands has not been produced by Dutch agriculture').

The agricultural and food system is largely made up of private companies, both in the Netherlands and abroad, which operate within the framework of international treaties and laws and regulations of the European Union and the Dutch Government. For these parties, such as farmers, supermarkets, food producers and the national government, economic considerations usually guide their actions. In addition to profit maximisation, factors such as consumer and business-to-business trust, the prevention of reputational damage and security of supply of raw materials play a role in their decisions.

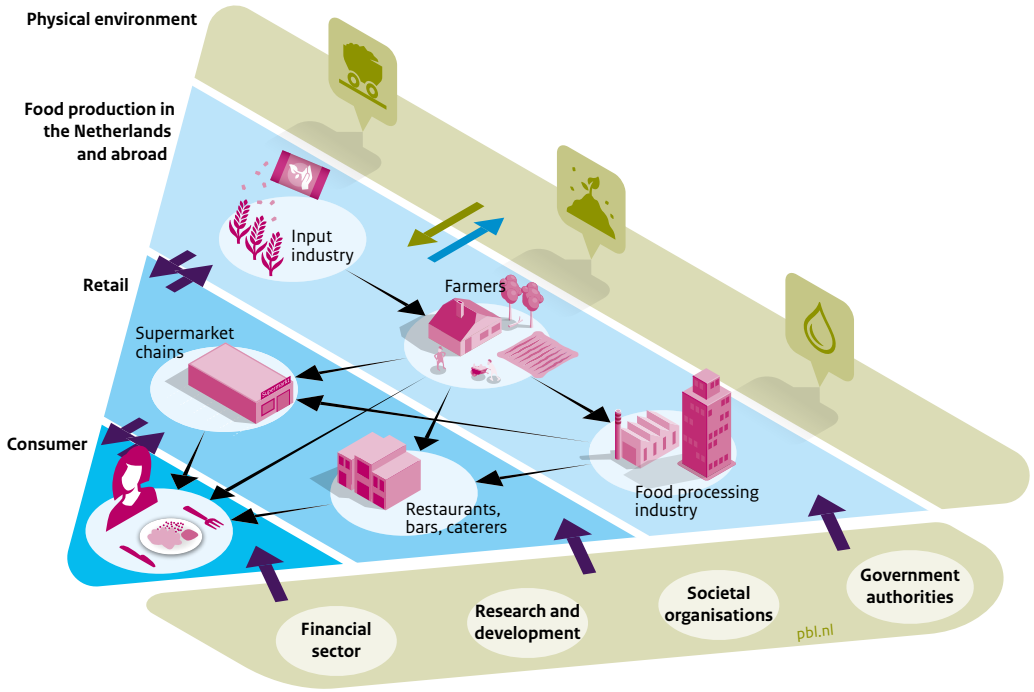
Production of food has a major impact on the physical environment

The production of food has many different effects on the physical environment, both in the Netherlands and abroad; ranging from global problems such as biodiversity loss and climate change, to local problems such as odour nuisance, air and water pollution, agricultural land degradation and animal welfare. Looking at the chain from farm to fork, for most products, most of the effects on the physical environment occur during the on-farm primary production process, regardless of whether farms are located in the Netherlands or abroad.

Food production around the world is a major contributor to biodiversity loss (it is responsible for about 60% of total current and historical losses in land biodiversity loss, worldwide), nitrogen emissions (globally, more than 50% of global nitrogen emissions), the amount of land use (about 35% of the world's land surface is used for food production) and

Figure 2

Dutch food system, from fork to farm



Source: PBL

Behind the Dutch food consumption lies an international agricultural and food system of import and export. Governments — national, European and international — determine the preconditions for other parties to produce food. Consumers and companies in the food supply chain influence primary food production (i.e. on farms). Parties outside the direct food supply chain, such as financiers, knowledge institutions and civil society organisations, together with consumers and parties in the food supply chain, influence the scale and manner of food production.

Often, the food consumed in the Netherlands has not been produced by Dutch agriculture

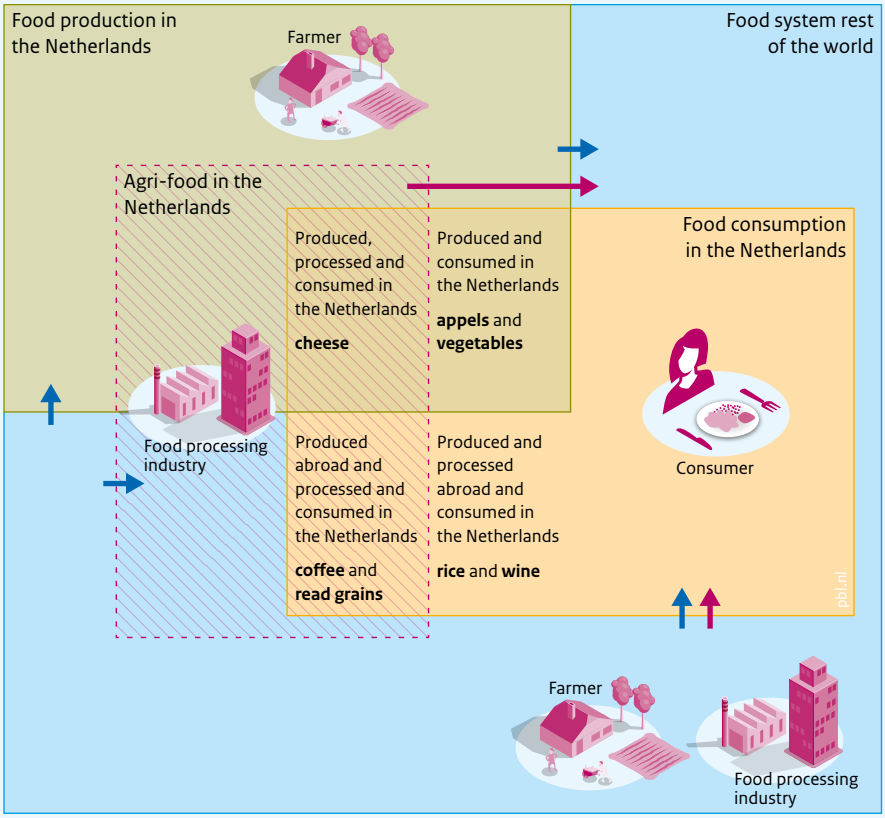
An important part of the food consumed in the Netherlands comes from abroad. Conversely, almost three quarters of the food produced by Dutch agriculture is exported (Verhoog, 2016). After the United States, the Netherlands is the second largest agricultural exporter in the world, expressed in euros (CBS and WUR, 2018). In 2017, agricultural exports amounted to 91.7 billion euros. Approximately 72% of all exported products were produced in the Netherlands; the rest was imported, processed to a certain amount and re-exported (CBS and WUR, 2018). It, therefore, makes sense to distinguish between three components of the agricultural and food system: Dutch agriculture, the Dutch agri-food sector and Dutch food consumption (see Figure 3). Some of the products of Dutch agriculture, such as apples and vegetables, are consumed in the Netherlands. For a product such as cheese, there is another intermediate step in the agri-food sector, where milk is processed into cheese. Other products, such as rice, bananas and wine, are produced abroad, (processed) and consumed in the Netherlands. Products that are produced abroad, such as cocoa and coffee beans, then processed into chocolate and coffee and consumed in the Netherlands form a third important category.

greenhouse gas emissions (contribution related to food production is about 25% of total greenhouse gas emissions, worldwide) (Van der Esch et al., 2017; PBL, 2014; Sutton et al., 2013; UNEP, 2016). As a result of a growing world population and a shift towards dietary patterns that include more animal products due to increasing prosperity, the pressure on the global physical environment is expected to increase over the coming decades.
Of the total Dutch consumption footprint, food consumption is responsible for almost 40% of the country's land-use footprint and about 13% of the greenhouse gas footprint (Van Eerdt and Westhoek, 2019, Wilting et al., 2015; Wilting et al., 2017; CBS et al., 2018b). Reducing the impact of food production, therefore, can make an important contribution to achieving international and national environmental goals, such as those in the Paris Agreement and the Convention on Biodiversity. It is important to realise that there will always be land use — and thus impact on the physical environment — through food production, because food is a basic necessity of life. Therefore, bringing the impact of food on the physical environment down to zero will never be possible.

Production of food has a major impact on the physical environment
The production of food has many different effects on the physical environment, both in the Netherlands and abroad; ranging from global problems such as biodiversity loss and climate change, to local problems such as odour nuisance, air and water pollution, agricultural land degradation and animal welfare. Looking at the chain from farm to fork, for most products, most of the effects on the physical environment occur during the on-farm primary production process, regardless of whether farms are located in the Netherlands or abroad.

Figure 3

Overlap Dutch food production and food consumption



Source: PBL

There is a certain overlap in Dutch agricultural production, Dutch food consumption and the Dutch agri-food sector.

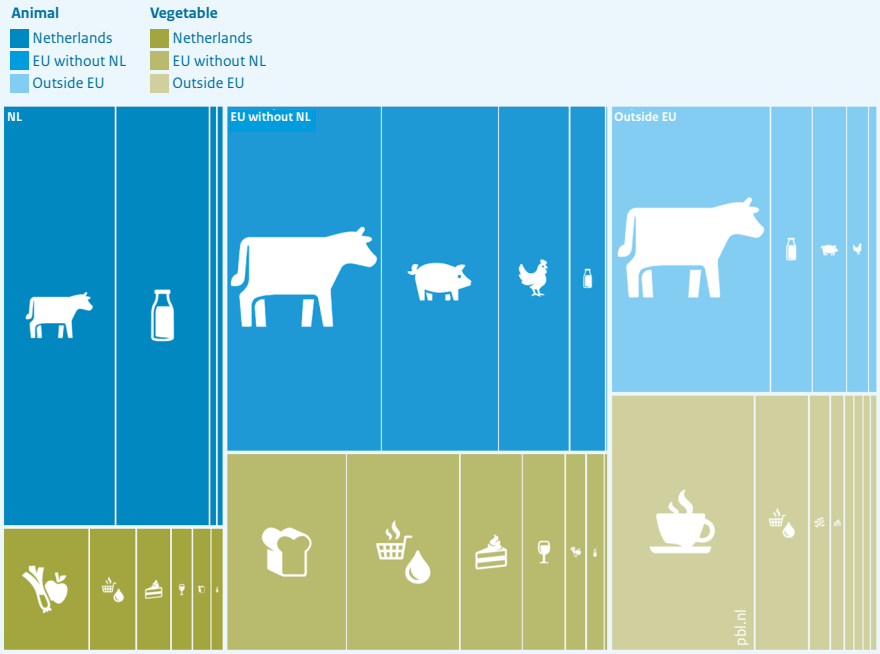
Food production around the world is a major contributor to biodiversity loss (it is responsible for about 60% of total current and historical losses in land biodiversity loss, worldwide), nitrogen emissions (globally, more than 50% of global nitrogen emissions), the amount of land use (about 35% of the world's land surface is used for food production) and greenhouse gas emissions (contribution related to food production is about 25% of total greenhouse gas emissions, worldwide) (Van der Esch et al., 2017; PBL, 2014; Sutton et al., 2013; UNEP, 2016). As a result of a growing world population and a shift towards dietary patterns that include more animal products due to increasing prosperity, the pressure on food consumption is responsible

Agricultural land used for Dutch food consumption for three quarters outside the Netherlands

Most of the products consumed in the Netherlands are produced (and sometimes processed) abroad. Of the agricultural land used for Dutch food consumption, 74% is located abroad, 44% of which in Europe (see Figure 4). This represents approximately 3 million hectares of farmland used for growing food and animal feed for Dutch consumption. On a European level, the overlap between food consumption and agricultural production is much greater. Food consumed in Europe, such as grain, fruits and vegetables, meat and dairy products, is also produced in the European Union, in addition to part of the production of exotic products and animal feed.

Figure 4

Land use magnitude at current diet Dutch population, 2010



Source: PBL

A large part of the land used for Dutch food consumption lies outside the Netherlands, but within Europe. This applies, for example, to food that requires a large amount of land to produce, such as pork, chicken and bread. For coffee, land use lies entirely outside Europe.

for almost 40% of the country's land-use footprint and about 13% of the greenhouse gas footprint (Van Eerdt and Westhoek, 2019, Wilting et al., 2015; Wilting et al., 2017; CBS et al., 2018b). Reducing the impact of food production, therefore, can make an important contribution to achieving international and national environmental goals, such as those in the Paris Agreement and the Convention on Biodiversity. It is important to realise that there will always be land use — and thus impact on the physical environment — through food production, because food is a basic necessity of life. Therefore, bringing the impact of food on the physical environment down to zero will never be possible.

Change not only in agriculture, but also by other businesses and consumers

Although most of the effects on the physical environment occur during on-farm primary production, this does not mean that food production could only be made more sustainable by farmers and fishermen. Farmers, in the Netherlands and abroad, often have limited financial opportunities to opt for different production methods. This is partly due to past investments and choices aimed at producing large volumes at low prices. It is also difficult to recoup any additional costs incurred by more careful production, such as the costs of greater animal welfare, fewer plant protection products or more space for biodiversity due to flowering field margins, for example. This is because there is strong competition at the lowest price and only a limited proportion of consumers are prepared to pay more for food products with a sustainability label.

There is a certain interplay between the consumption and production of food, with consumers buying what is on offer, and producers delivering according to the demand from consumers and parties in the food supply chain. Looking at the relationship between production and consumption will reveal these parties (consumers, retailers and food manufacturers) and activities (consuming, selling) and, thus, also shows other possibilities for change.

Less food waste, more sustainable consumption and more careful production are the starting points for a more sustainable food system

Not only agricultural producers, but also consumers and other parties in the food supply chain (food processing plants, retailers and the hospitality industry) can influence food production volumes and the way in which food is produced, as producers often attune their supply to the demand from customers and consumers. Food policy centres around the dynamics between demand and supply.

We distinguish four starting points for food policy to reduce the impact of food production on the physical environment:

- eating more sustainably (opting for a diet with a lower environmental impact);
- less food waste;
- more efficient production (using fewer resources and raw materials in food production);
- more careful production (changing production processes to reduce negative effects on the local environment).

This report focuses on three of the four starting points — eating more sustainably, wasting less food, and producing more carefully, as much attention is already being paid, elsewhere, to producing more efficiently. Food production in north-western Europe (from where most food in the Netherlands originates) is already very efficient, in some respects, with high crop yields in arable farming and feed conversions in livestock farming. The environmental gains that can be achieved through increasing production efficiency, in the Netherlands and north-western Europe, are declining. Forced increases in efficiency, moreover, would lead to increasingly pronounced trade-offs (i.e. negative effects on other aspects, such as increased use of plant protection products, less room for local nature, or a decline in animal welfare. Furthermore, efficiency increases are already receiving attention in agricultural policy.

The big question for government, the business community and society is: if a more sustainable food system would be desired, then how could the required change be achieved? Here, we discuss these three starting points from the perspective of governments, consumers and businesses.

Key role for government in making the food system more sustainable

The food system behind the food on our plate can be typified as an international and complex system of largely private companies that operate within the preconditions set by government authorities and within their own business economics rationality.

Building blocks for food policy

Various values and wishes behind 'sustainable food'
Sustainability is understood differently by different people; behind this concept lies a variety of wishes and values. Society has many different ideas about what constitutes sustainable food and how this could be produced. For some, this means that farmer and consumer encounter each other in short supply chains, while others aim to achieve sustainability by eating cultured meat produced in a hyper-efficient laboratory. The text box 'Five perspectives on sustainable food from Dutch political and public debate' provides an overview of five perspectives on sustainable food that play a central role in the Dutch debate on making the food system more sustainable (see also De Krom & Muilwijk 2019).

The different wishes and values contained in these perspectives on sustainable food are sometimes in conflict with each other. The national government's ambition to make the Netherlands a 'front runner in sustainable food production' seems to suggest that the definition of sustainability in relation to food is self-evident. Not recognising and acknowledging the pluriformity of wishes and values that underlie the concept of 'sustainable food', would mean that opportunities to use the energy in society and the willingness to become more sustainable are missed. Making room in policy for initiatives and experiments from various perspectives may increase public support for the policy. It also makes it less likely that blind spots occur and that new solutions are overlooked.

Five perspectives on sustainable food from Dutch political and public debate

1. Sufficient and affordable food on the world market
From this perspective, today's global food system provides sufficient and affordable food, but also brings with it environmental and health problems. These problems do not have a structural character, and could largely be solved through international market mechanisms. In cases where the free market cannot solve a particular problem while society does demand a solution, government intervention is a legitimate option. Government intervention, from this perspective, should disrupt the market as little as possible. Options include the pricing of 'external costs' and implementing minimum standards for production processes. Consumers opt for tasty, easy and cheap food products and are not or hardly willing to pay more for sustainable food.

2. Technological optimism
From this perspective, the current food system should continue to produce sufficient food for a growing and increasingly prosperous world population. In the past, agricultural research has contributed significantly to increasing food security and, to date, science and technology continue to be the key to future-proof food production. Radical changes in the organisation of the food system are unnecessary, according to this perspective. Scientists and engineers continue to develop innovative products and production methods. Government authorities and the business community are creating an effective innovation climate through which innovative products and methods enter the market. Consumers are content with the nutritious and safe food products on offer.

3. Alternative food networks
From this perspective, farmers and consumers together identify several fundamental problems with the current food system, such as environmental pollution, reduced animal welfare and a marginal role of farmers in the food chain. These problems can be traced back to the large-scale, global food system that produces anonymous, 'placeless' food. The connection between farmer and consumer has been severed and needs to be restored, according to this perspective. By forming local or regional food networks, farmers and consumers are given the opportunity to produce and consume in a way that suits their personal and public values. Government authorities pursue policies that will increase food sovereignty and local or regional self-sufficiency.

4. The consumer at the wheel
From this perspective, consumers have become aware of the downsides of the conventional food system, partly caused by food scandals. Consumers are no longer satisfied with the food on offer, and are beginning to impose additional requirements on products. As a result, consumers (and their concerns represented

by NGOs) are influencing food production. Transparency about the origins and production methods of products plays a central role. Certification allows consumers to buy products that meet their specific concerns and wishes. New ICT applications facilitate providing such transparency and contribute to a fragmentation of themes and labels, which adds to the importance of niche products. Government can play a role in ensuring the accuracy of consumer information.

5. *Integral food politics*
From this perspective, the current food system has a wide range of problems, from local and global environmental problems to 'unfair' trade and an unhealthy diet. These problems can only be understood and solved in conjunction. Such an integrated approach requires the involvement of all parties in the food system, so that they can jointly seek chain-wide and cross-sectoral solutions. Agreements and round tables are standard policy instruments for this purpose. Governments have a key role. They can adapt the preconditions of the food system, thereby reversing unsustainable practices and making the entire system more sustainable. In order to govern effectively, governments need to be active at various levels and scales in drawing up and implementing food policy.

Source: De Krom & Muilwijk 2018

Food policy and agricultural policy complement each other
Food policy is an emerging policy area in the Netherlands that encompasses various policy objectives; with it, the government aims to contribute to 'safe, healthy, and sustainable' food, thus linking food safety, public health, and sustainability. The food policy gives substance to the commitment to promote public health and a clean environment, which is laid down in the Dutch constitution (Articles 21 and 22).
Food policy places consumers and food supply chains at the centre, thus highlighting the link between food consumption and food production. After all, Dutch food consumption does not coincide geographically with its production. Food and agricultural policy complement each other, with the latter focusing primarily on farmers, the agricultural sector in the Netherlands and the method of production ('more efficient and careful production').
More sustainable diets and less food waste are starting points that are explicitly highlighted in food policy, as is the support for sustainable production from within the food supply chain (more careful production). Food policy as an independent policy area, is relatively young.
From a broader perspective, food policy historically has been a mosaic of policy areas, such as agriculture and fisheries, trade, public health, environment, food safety and knowledge and innovation. Moreover, both the national government and the European Union have an important role to play in this respect.

Governments determine the regulations on food production and consumption

In today's agricultural and food system, the most important role for government is to regulate and monitor, and to facilitate food producers and sellers. These regulations are largely agreed on national or EU level. Important EU regulations, frameworks and directives are the Common Agricultural Policy (CAP), food safety policy, agreements on the internal market and environmental directives. In the Netherlands, the environmental directives (such as the Water Framework Directive, the Nitrates Directive and the Birds and Habitats Directives) have been drawn up at national and regional levels, and the Dutch Government also pursues additional agricultural and food policy.

The position of the Dutch Government and the European Union in the agricultural and food system is unique; they are able to adapt rules and regulations other parties have to comply with. On the one hand, the Dutch Government is bound by EU agreements, but it also has a voice in the making and changing of these agreements. Food production and consumption can be made more sustainable by changing the rules of the game — such as those concerning product pricing and the availability of information about the effects of food production on sustainability issues.

System-sensitive food policy is a step-wise policy with vision

The Dutch agricultural and food system is a complex network with product, money and knowledge flows all over the world. The complexity of this network is reflected in the interaction and feedback between the biophysical, social and economic components of the agricultural and food system. This interaction becomes especially visible during shocks to the system, such as food security crises and trade boycotts. Feedback loops make the system unpredictable. They make it impossible to predict the exact impact on the system by a particular action or measure.

Food policy must therefore be system-sensitive and geared to this complexity. System-sensitive food policy is one that is aimed at influencing the preconditions and behaviour of all stakeholders, on the basis of a clear vision and specifically formulated objectives. These are not necessarily based on a single set of values and wishes regarding sustainable food, but may instead offer scope for initiatives that arise from various societal perspectives on a sustainable food future.

Such a vision and objectives can be used to concretise the willingness and energy within society to work towards a more sustainable food system. Regular monitoring makes it possible to anticipate the unintended effects of measures and initiatives which, due to the complexity of the agricultural and food system, are difficult to predict. System-sensitive food policy is a step-by-step policy with a vision; consecutive, small steps aimed at connecting the short and the long term, will move the process slowly but surely towards a healthier and more sustainable food system.

Promoting sustainability in the short term, under current preconditions

Changing regulations and preconditions of the agricultural and food system (legislation, trade treaties) and informal rules ('unwritten' rules as expressed, for example, in consumption routines) cannot happen overnight. It is therefore important to distinguish between long-term and short-term policy.

In the short term, sustainable production and consumption can be pursued within rules and regulations. The government has various types of policy at its disposal, ranging from more legislation and taxation ('hard' policy) to information and facilitation ('soft' policy). Under current Dutch food policy, the focus is on 'soft' policy, the effects of which are not always easy to measure, but implementation costs are relatively low. In the socio-cultural field, this may concern more policy to influence dietary routines, such as through food education, regulation of the food environment (intervening in the physical supply of food), raising awareness of food waste and supporting innovative sustainable products and supply chains. In this way, more sustainable and healthier diets and less food waste can be achieved. Short-term policy can be implemented by both local and national government and requires continuity in order to be effective.

Pursue long-term strategic policy to change international regulations and socio-cultural ground rules
Changing socio-cultural patterns, such as consumption routines, which may contribute to more sustainable diets and less food waste, is often a long-term process and requires long-term policy commitment. In the longer term, it is also conceivable that the main preconditions that are currently hampering the sustainability of the agricultural and food system could be adjusted.
In the current food system, international trade agreements and the internal European market make it difficult to impose additional sustainability-related requirements on food products. However, adjusting these treaties is not impossible, especially in the long term. Legislation and regulations on food production and consumption can also be amended on EU level. For example, stricter requirements in the area of plant protection products, animal welfare and greenhouse gas emissions could be considered. Adjusting rules and regulations and trade agreements will have an impact on all stakeholders in the food system, from farmers and fishermen to food producers, retailers and consumers. The Dutch Government, therefore, would need to make an effort on EU and international levels, to ensure sustainable food production and consumption becomes the starting point of the food system, so that consequences for the physical environment and public health are no longer 'external effects'.

Various options for revealing the negative effects of food production through pricing
The fact that negative external effects on public health and the physical environment are not addressed via pricing (i.e. incorporated into food prices) is an economic barrier to making the current food system more sustainable. In particular, measures aimed at more careful production (e.g. improved animal welfare or flowering field margins) often lead to additional costs, compared to conventional products. This added value is usually not reflected in product prices, or, put differently, the negative impacts of conventionally produced products are not reflected in product prices.
There are various types of policies conceivable aimed at revealing external effects through pricing. The first option is that of legislation and regulations in which certain production methods are banned which will cause the price of some food products to increase. Examples are the European ban on battery cages for laying hens and the ban on certain plant protection products. The government can also use pricing policies (such as setting a fixed

price for books) or fiscal policy to price emissions or the use of natural resources, such as with a tax on raw materials or food products. From the point of view of reducing external effects, it is often more effective to price raw materials, resources or emissions, rather than to price end products (the food product) (Drissen and Vollebergh, 2018). A meat tax, from that perspective, is less obvious than, for example, a carbon tax (CPB and PBL, 2012).
In addition to forms of 'hard' policy, the government can also focus on supporting chain stakeholders that set above-statutory sustainable requirements for food production. In this way, too, external effects will be reduced. Examples include meat with an animal welfare certificate or organic products. Finally, the government can encourage consumers and stakeholders in the chain to be informed about the actual costs of a food product, for example with a 'shadow price' on the price tag. This could convince businesses and consumers to opt for a more sustainable product or resource.

Regular monitoring provides insight into progress and direction of sustainability
In order to assess whether the food system is becoming more sustainable, it is necessary to have good monitoring information and indicators. Regular monitoring reveals both intended and unintended effects early and enables timely adjustments. At present, there is a lack of good monitoring information that provides insight into the progress and direction of sustainability. This lack of information is partly due to the scale and complexity of food imports and exports in the Netherlands. Examples of this are the disrupted nutrient cycle and the largely lacking direct or transparent link between farmer and consumer. In addition, the direction and progress of sustainability is not clear either because they are simply not kept up to date, indicators are lacking, information is fragmented or is only temporarily monitored as part of a social initiative. National government can play a role in making good monitoring information available.

When monitoring, take into account the various wishes and values regarding sustainable food
The choice of monitoring indicators reflects what government or other parties consider to be 'sustainability'. When setting up a monitoring system, it is therefore advisable to take account of the various wishes and values around sustainable food in society. This could include indicators on regional products and animal welfare, for example, as well as those focused on land use and greenhouse gases, which have already been further developed.
The choice of indicator determines the focus of both government and business efforts. Measurements themselves are not leading — it is *what* is measured that determines where attention and efforts are being directed.

Potential of food policy to reduce the impact of food production on the physical environment

Footprint of food consumption shows the potential of food policy

What is the potential of a food policy that takes consumers and food supply chains as its starting point to reduce the effects of food production on the physical environment? To answer this question, we based our calculations on the land footprint and greenhouse gas footprint of Dutch food consumption, using the average Dutch diet of 2010 (Westhoek, 2019).

We opted for the land footprint and greenhouse gas footprint because these indicators provide insight into important food production effects on the physical environment (i.e. the amount of land used and the magnitude of greenhouse gas emissions) and because they are available and well-developed indicators. Calculation results should be regarded as an order-of-magnitude estimation, providing insight into the possible impact of food policy on the physical environment.

In calculating a footprint, a single effect on the physical environment (e.g. land use) is determined and added up across all links in the food supply chain; together, this gives the footprint of food consumption. The calculations show that many of the options would reduce the land footprint. A large number of studies show that a reduction in land use, on a global level, would lead to a reduction in global greenhouse gas emissions, as this is associated with less deforestation. In order to keep the calculation method as transparent as possible, this effect was not included in the greenhouse gas emission reductions presented here.

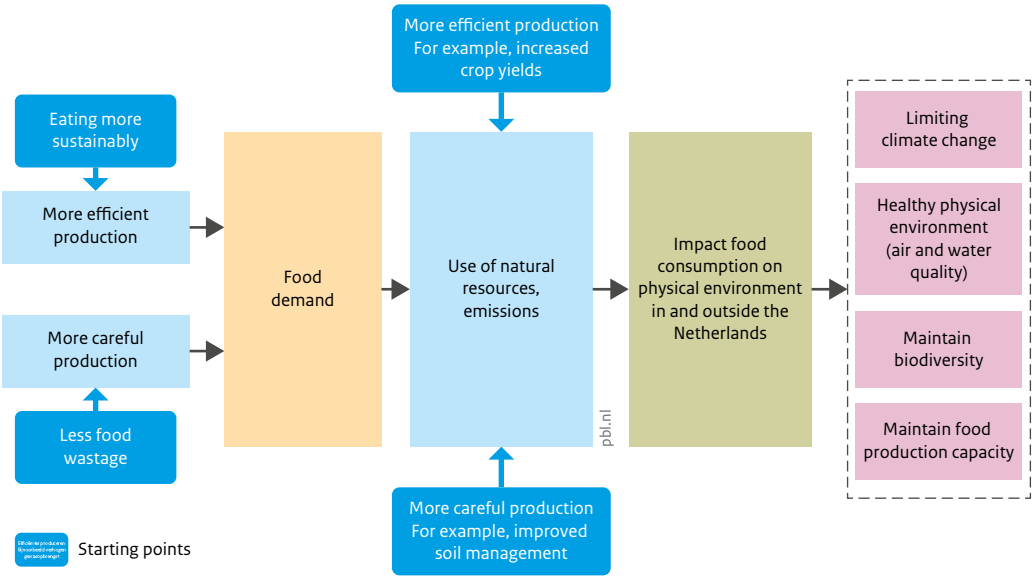
Four starting points for reducing the impact of food production on the physical environment

In order to reduce the impact of food production on the physical environment, four points of departure for food policy can be distinguished: 1) eating more sustainably, 2) less food waste, 3) more efficient production, and 4) more careful production (see Figure 5). In order to make calculations using the land footprint and greenhouse gas footprint, we translated these starting points into concrete changes in consumption and production, such as a reduction in meat consumption, higher crop yields and improved animal welfare.

The starting points and their translation into changes to the food system not yet represent concrete policy measures; they can still be implemented in many different ways and using various policy instruments. They do, however, provide insight into the potential of particular policy measures aimed at a certain starting point. An example of this is that of less food waste; in the calculations with the footprints we translated this starting point into 50% physical reduction in food waste in distribution and retail and at consumers. This shows the possible effect of such a reduction on the physical environment, in terms of land footprint and greenhouse gas footprint. Policies aimed at reducing food waste can be formulated in a variety of ways and using a variety of instruments.

Figure 5

Effects of food on the physical environment



Source: PBL

We identified four starting points for food policy to reduce the impact of food production on the physical environment, namely eating more sustainably, less food waste, more efficient production and more careful production.

Policies aimed at more sustainable diets are relatively the most beneficial for the physical environment

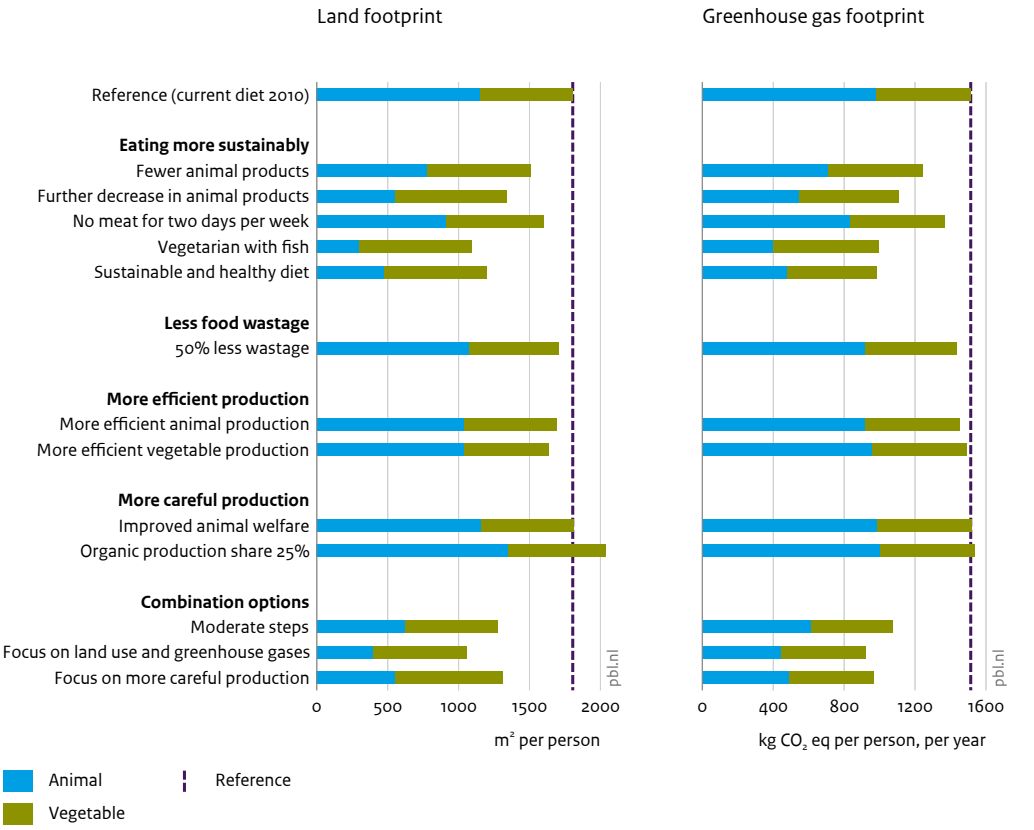
The footprint of Dutch food consumption, measured in terms of greenhouse gas emissions and land use, can be reduced by taking action on the four points mentioned above (Figure 5). The current land footprint of Dutch food consumption is approximately 1,800 m^2 per person and approximately 1,500 kg of CO_2 eq per person, per year. Relatively speaking, calculations show that measures that reduce meat consumption and, thus, change eating patterns reduce the footprint the most (Figure 6). Measures aimed at more efficient production (assuming the possibilities up to about 2030) and less food waste result in a smaller reduction in the land footprint and greenhouse gas footprint of Dutch food consumption.

Potential positive local effects from more careful production, but increase in land and greenhouse gas footprints

Measures aimed at more careful production methods would result in an increase in the land footprint and greenhouse gas footprint of food consumption (see Figure 6, 'Animal welfare improved' and 'Biological share 25%'). Organic farming achieves lower crop yields per hectare, which means more land is needed to grow the same amount of food, and if livestock grows less quickly, they eat more during their lifetime. Any positive effects of improved animal welfare or organic farming (e.g. more local biodiversity) were not included in these calculations, as they are not included in the used indicators of the land footprint and greenhouse gas footprint.

Figure 6

Footprint of Dutch food consumption



Source: PBL

A combination of options could achieve a 25% to 40% reduction in the food-related land footprint and a 30% to 40% reduction in the food-related greenhouse gas footprint. For an explanation of the various interventions, see Appendix A.

The greenhouse gas footprint of food consumption can also be reduced with targeted technical measures; for example, by reducing methane emissions from cattle farming (keeping cows in closed housing systems or feeding them modified feed) and reducing the use of fossil fuels in food production. However, too strong a focus on reducing greenhouse gases in agriculture can have negative consequences for, for example, animal welfare and local biodiversity in meadows and fields.

A combination of starting points may reduce the food consumption footprint by around one third

The land footprint of Dutch food consumption can be reduced by about a third, depending on the combination of measures (see 'Combination options' in Figure 6). This corresponds to around 15% of the land footprint of total Dutch consumption. The combinations of measures differ in emphasis;

Reducing footprint with more sustainable food

The footprint of Dutch food consumption may be reduced through less food waste and more efficient production, but also through 'eating more sustainably'. In this last case, our main focus was on reducing the consumption of animal products, because animal products place a heavier burden on the environment compared to vegetable products. All kinds of diets are possible with fewer animal products; we worked out five, set against the current average Dutch diet:

	Protein composition	
Diet	**Animal**	**Vegetable**
Current diet (2010)	60%	40%
Fewer animal products	50%	50%
Further decrease in animal products	40%	60%
Two days without meat	57%	43%
Vegetarian with fish	37%	63%
Sustainable and healthy diet	37%	63%

All these diets are based on the same energy intake. Most diets, like the current one, do not meet the general recommendations by the Netherlands Nutrition Centre. The 'sustainable and healthy diet' is the only one in the table above that is according to these dietary guidelines.
Of the five alternative diets, the largest footprint reductions are achieved by the 'sustainable and healthy diet' and 'vegetarian with fish', with a 35% to 40% reduction in the land footprint and more than 30% in the greenhouse gas footprint (Figure 6). The 'two days without meat' option has the least impact, as it most closely resembles the current diet. For more detailed information, see Appendix A.

the combination 'moderate steps' includes around 25% fewer animal products on the menu, 25% less food waste, a trend increase in the efficiency of plant and animal production and improved animal welfare to the level of Better Life certificate 1* (pigs) or 'concept chicken' (chickens). The combination 'focus on land use and greenhouse gases' pays less attention to careful production methods, but places greater emphasis on more efficient production and more sustainable diets (diet 'further decrease in animal products'). In the combination 'focus on more careful production', the choice was made for a focus on improved animal welfare (to 2* Better Life certificate) and a 25% share of organic farming. In this combination, too, the land footprint and greenhouse gas footprint of food consumption are both decreasing, due to the reduction in the consumption of animal products and less food waste. It should be noted, however, that the food consumption footprint can never be zero, as food production will always require natural resources and therefore involve associated emissions.

Change via food supply chains and consumers is a socio-economic and socio-cultural challenge

Consumers and parties in the food supply chain are at the centre of food policy, because they influence both food production and the effects of food production on the physical environment. The sections below address the ways in which consumers and these parties could contribute to a more sustainable food system.

Increasing the sustainability of Dutch food consumption

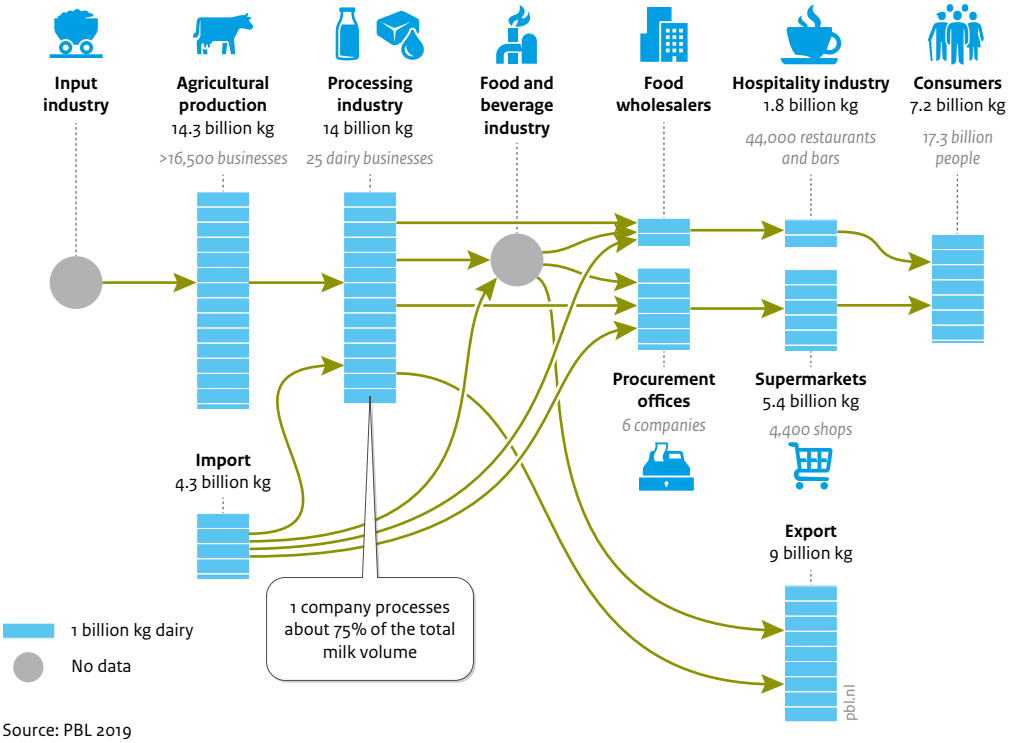
Changing consumer demand contributes to more sustainable Dutch agriculture

About a quarter of the food produced in the Netherlands is also consumed domestically (see Figure 3). Changes in food consumption can contribute to making Dutch agriculture more sustainable, particularly in terms of more careful production methods. Examples include the improvement of animal welfare in meat production (Better life — 'Beter Leven' — certificate), meadow milk and the demand for organic products, where consumers pay more for a more sustainable product.

The debate in Dutch society about agriculture and food also influences the way in which the Dutch food processing industry and supermarkets affect Dutch farmers, when these industries depend on Dutch farmers for certain products (e.g. milk and potatoes) (De Krom and Prins, 2019). This also applies to cases where farmers and the food processing industry export a large proportion of their products (Figure 7 provides an overview of the structure of the Dutch dairy chain). Food processing plants and supermarkets are making efforts to ensure that Dutch citizens and politicians continue to regard Dutch food production and processing methods as legitimate. They are working to achieve this through sustainability programmes in arable and dairy farming — such as the programme 'On the way to PlanetProof', which sets requirements for the handling of plant protection products, soil, fertilisation, energy and biodiversity.

Figure 7

Structure Dutch dairy chain, 2015–2016



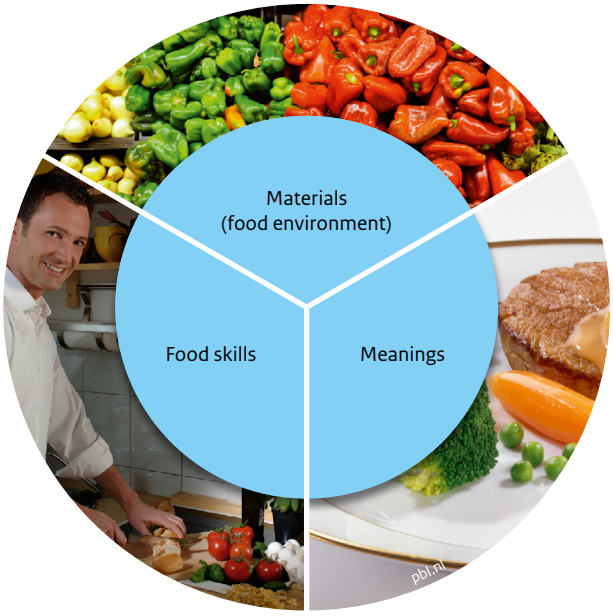
Source: PBL 2019

A large part of all dairy products produced in the Netherlands, both processed and unprocessed, is exported.

Eating more sustainably means changing routines

How does a more sustainable eating pattern emerge and with it the demand for more sustainable products? Food consumption and food waste are characterised by socio-cultural routines (Warde, 2016; Shove et al., 2012). Grocery shopping and kitchen practices are not so much expressions of individual conscious choices, but rather are signs of routines. Food-related routines are largely driven by the food environment (Where do consumers encounter which food products and at what price?), by the cultural significance of food products in Dutch society (e.g. what does a proper, fully fledged meal look like, and to what degree is home cooking valued in society?) and by the people's food skills (e.g. their cooking skills) (see Figure 8). Achieving a more sustainable diet and less food waste requires a change in these social and environmental aspects, i.e. a cultural change.

Figure 8
Food consumption as socio-cultural routines



Source: PBL

Socio-cultural routines around food consumption consist of three elements: the food environment, cultural meaning and skills.

Involvement of parties within the food supply chain is necessary to achieve changes in food-related routines

Food-related routines are developed from a combination of the food environment, social and cultural significance of food and people's food skills. The food environment is the physical supply and price of food. The physical supply of food has a major impact on food consumption — a quick snack is more easily obtained when it is available at the train station than if travellers first have to walk two blocks to get it. Moreover, consumers are affected each day by advertising that influences the social and cultural significance of food — for example, consumers prepare a cosy and nutritious family meal using a recipe from the free magazine they got at the supermarket. Hence, while consumer behaviour determines their eating pattern and they amount of food they waste, this behaviour is also influenced by others. Stakeholders in the food chain, such as retailers, the hospitality industry and food processing plants all affect food consumption routines, in a wide variety of ways, by influencing the three elements that make up these routines (socio-cultural significance, skills and the food environment). This means that it is often difficult for consumers to change their food routines on an individual level.

Stakeholders in the food chain may facilitate changes in consumption patterns. Addressing the three elements of these patterns and routines, simultaneously, would have the greatest chance of success. A more sustainable eating pattern can be stimulated, for example, by selling meat in smaller portion packs (food environment), paying attention to vegetarian dishes as fully fledged and culinary alternatives to meat dishes (cultural significance), and publishing vegetarian recipes and providing courses on cooking skills (food skills). Government policy can also stimulate a sustainable diet and less food waste by taking the three elements of consumption routines as a starting point.

Is sustainable food more expensive?

Sustainable food has the image of being 'expensive'. People often think of the more expensive organic products when they think about sustainability. Which is not necessarily always the case. According to the Netherlands Nutrition Centre, eating healthy and varied food for 5 euros per person per day is very doable. For example, eating less animal and more vegetable products can be cheaper by reducing meat portions or by eating more legumes. Fruit and vegetables that are in season or frozen are cheaper and more sustainable. Preventing food waste also saves money and protects the environment.
Nevertheless, more sustainable is not always cheaper. For example, products become more expensive if farmers receive a better price for them because they comply with non-statutory requirements. A price difference of a few cents per kilogram can enable farmers to produce in a more environmentally friendly way while maintaining a reasonable income.

Increasing sustainability by governing the supply chain

Market concentration and scale-ups in the food system are increasing
Over the last 20 to 30 years, market concentration and scale-ups have increased in the food system. In the Netherlands, too, fewer and fewer farmers are producing more and more food, and seven supermarket formats have a combined market share of 85% (Distrifood, 2018; WECR, 2018). Scale-ups and greater market concentration are also visible in the food processing industry; the largest company in a certain sector often has at least twice the turnover of the second-largest company (WUR, 2017a). Large companies have economic power; from a position of monopsony (one customer) or oligopsony (limited number of customers) in the food supply chain, they impose requirements on their suppliers.
For Dutch consumers, the trend towards scale-ups and market concentration is not clearly visible because the large range of products on offer carry many different brand names, but these brands and products are often produced by only a few large companies.

Parties within the food supply chain set requirements on food production and support farmers in making production more sustainable

Many companies in the food system pay attention to making the supply chain more sustainable. They take various sustainable initiatives that go beyond what is required by law. In doing so, they anticipate possible future legislation and try to meet demands from society and the market around various themes, such as a fair income for farmers (fair trade), animal welfare, soil management and the use of plant protection products. For example, they support farmers in making their production methods more sustainable.

Farmers often have limited opportunities and financial scope to independently choose a more sustainable production method (PBL, 2018b). Non-statutory initiatives help them take that step (De Krom and Prins, 2019). Parties within the food supply chain do this in various ways, such as by setting chain-wide market standards for production, through certification and allocating labels with a possible surcharge, and by exchanging knowledge through educational programmes aimed at farmers. Possibilities for capitalising on earning opportunities, preventing reputational damage and securing the supply of raw materials all form important motives for parties within the chain to work on sustainability (De Krom and Prins, 2019).

Sustainability in food supply chains also affected by parties outside the supply chain

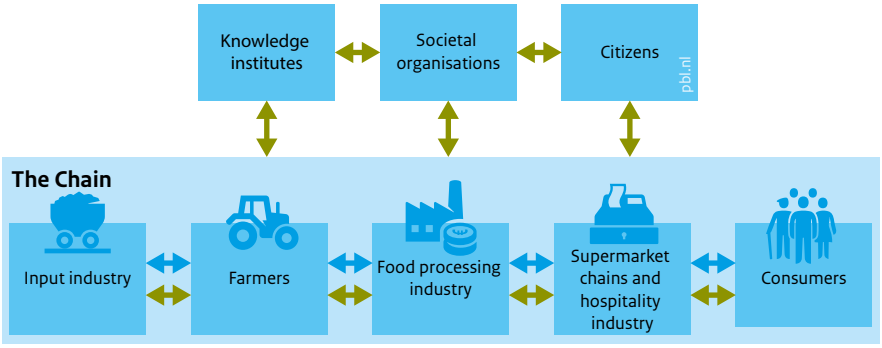
In addition to the economic power of companies within the chain, discursive sources of influence are also involved, such as undisputed knowledge, a good reputation, a large support base, and access to a wide public, and play a role in determining how production could be made more sustainable. These discursive sources of influence can be used to put certain ideas and perspectives on the agenda, provide legitimacy, and keep others out of the discussion in order to influence chain standards or sustainability programmes.

In addition to stakeholders in the chain, such as food processing plants and retailers, there are also parties outside the direct supply chain that are a discursive source of influence, such as farmers' organisations, NGOs (e.g. environmental organisations), financiers, knowledge institutions and government authorities (Figure 9).

Consumers' perception of what sustainability means does not always match what is considered important in agricultural practice; for instance, concerning animal welfare, consumers may consider pasturing of cows a sign of a high welfare level, whereas farmers may look at hoof health. In order to make production methods more sustainable, it is therefore necessary to translate what sustainability means to the various stakeholders, discussing the meaning of 'sustainability' in the specific context of a supply chain. Parties inside and outside the chain conduct this debate together, using their discursive influence. Sustainable coffee and cacao, and more recently meadow milk and animal-friendly meat production, are examples of products for which the public debate has had an influence on Dutch consumption and production methods within and outside the Netherlands.

Figure 9

Application of economic and discursive power in chain management



Source: PBL

Parties within the food system provide direction, using economic and discursive sources of influence.

Sustainability initiatives by supply chain parties are not the one solution to all problems

Making food production more sustainable 'via the food supply chain' seems a promising way to start, for the short term, within the boundaries of current rules and regulations. However, there are also limitations. Sustainability initiatives by parties within the supply chain focus mainly on production method (starting point 'careful production method'), not on reducing the production volumes of certain food products (starting points 'less food waste' and 'eating more sustainably'). In addition, the focus is particularly on issues that appeal to the general public (e.g. grazing period or child labour), or on issues that are easy to measure and implement on farms (e.g. emission reduction).

Subjects that are as yet difficult to measure and not very appealing to the general public (e.g. soil health), or where the usefulness of farm measures is not conclusive are not addressed or are less likely to get off the ground (De Krom and Prins, 2019). Moreover, certification and the setting of standards in international trade chains for soya, coffee and farmed fish, for example, also do not appear to be the solution for sustainability. This is because the market share of certified products lags behind the targets set, and the results of actual improvements in working conditions and effects on the physical environment fall short of society's expectations (SOMO, 2013; Van der Wal, 2018).

Government can use discursive influence to stimulate initiatives to enhance supply chain sustainability

When stimulating initiatives to enhance supply chain sustainability, it is important to realise that discursive sources of influence are not equally distributed between parties within the chain (and also those outside the chain). This may lead to a one-sided focus for

certain sustainability themes (e.g. animal welfare and others that are easy to communicate to consumers and the public at large) or to cautious progress due to mutual dependencies within the food supply chain. There are opportunities for government and politicians to accelerate long-term sustainability in food supply chains by making use of discursive sources of influence. Examples include supporting stakeholders by means of a governmental guiding vision on a sustainable food system, and facilitating strategic stakeholder dialogues on the implementation of private initiatives that seek to contribute to achieving public and politically formulated objectives. The government can also strategically focus on transparent reporting by parties within the food supply chain about the impact of their production practices on non-economic themes. It is important to note that sustainability initiatives by those parties take shape within existing rules and regulations and preconditions of the agricultural and food system. If a more sustainable food production is desired, there is an explicit role for government to change obstructing ground rules, on both national, EU and international levels.

Conclusion

How could the pressure of Dutch food consumption on the physical environment be reduced? To answer this question, we investigated the roles of government, businesses and consumers in making the food system more sustainable. Behind the food on our plate lies an international agriculture and food system. The production of the food consumed in the Netherlands has a major effect on the physical environment — in the Netherlands itself and in Europe and the rest of the world. By looking at the roles of food companies and consumers in the food system, new starting points for a sustainable food system are revealed.

Government authorities — national government, the European Union and local and regional authorities — have a key role to play in today's international and complex agricultural and food system. They are able to change the preconditions and rules that parties in the food supply chain have to abide by. This key role requires a system-sensitive food policy that links short- and long-term policies. Government authorities enable businesses and consumers to make the food system more sustainable by gradually influencing the framework within which the agriculture and food system operates, on the basis of a clear vision, goals, and monitoring.

Making the food system more sustainable is a socio-cultural challenge that requires changes in the dietary patterns of *consumers* and in the production methods used by parties in the food supply chain. Changing routines, eating patterns and food waste is difficult for individual consumers, even if they are very willing to do so. *Parties in the food supply chain*, such as supermarkets, restaurants and food processing plants, therefore, play an important role in implementing change in food consumption routines.

Parties within the food supply chain are showing initiative to make food production more sustainable by imposing non-statutory requirements on their suppliers, while supporting them in making production more sustainable. Parties outside the food supply chain, such as civil society organisations and knowledge institutes, influence these initiatives by drawing on their undisputed knowledge, good reputation, large support base, and access to a wide public. There are therefore also opportunities for government authorities to accelerate sustainability in food supply chains by, for instance, formulating a guiding vision on a sustainable food system and by facilitating strategic stakeholder dialogues in the implementation of chain initiatives.

Finally, sustainability initiatives by private actors do not change the preconditions of the agriculture and food system. If more sustainable food production is desired, then there is an explicit role for government to change any of the preconditions that currently form a barrier. Working on new preconditions and regulations, such as a 'fair price' that includes effects on health and the physical environment, or a sustainable diet as a new socio-cultural standard, remains important for a more sustainable food system, in the long term.

Appendix A: Options for reducing the food footprint

Options	Explanation
Eating more sustainably	
Current diet (2010)	This is the average Dutch diet. It is based on a food consumption survey held by RIVM (2007–2010). The diet contains roughly 60% animal protein and 40% vegetable protein (Van Rossum et al., 2011). The current diet (in 2010) is the basis for the alternative choices diets.
Fewer animal products (50%–50%)	The share of animal protein, in this diet, is reduced from 60% to 50%. This is conform the ambition for 2025 of the Green Protein Alliance (2017). The diet includes increased consumption of grains, legumes, nuts and meat substitutes. The total amount of protein decreases by about 7%.
Further reduction in animal products (40%–60%)	The share of animal protein, in this diet, is reduced from 60% to 40%. The diet includes increased consumption of grains, legumes, nuts and meat substitutes. The total amount of protein decreases by about 12%. The change is conform the ambition of the Transitie Agenda Biomassa en Voedsel [transitional agenda biomass and food] (Grondstoffenakkoord, 2018).
Two days no meat	This diet includes two days without meat. The diet contains roughly 57% animal protein and 43% vegetable protein. The total amount of protein decreases by about 1%.
Vegetarian with fish	This diet includes no meat at all, but does contain fish, eggs and dairy. The diet contains roughly 37% animal protein and 63% vegetable protein. The total amount of protein decreases by 17%.
Sustainable and healthy diet	This diet contains the food products and proteins as recommended by the Netherlands Nutrition Centre (the so-called Schijf van Vijf) and simultaneously minimises the impact on the physical environment. The main changes are: less meat, alcohol, coffee and sugar, and more vegetables, fruits and nuts (Kramer and Blonk, 2015). The diet contains roughly 37% animal protein and 63% vegetable protein. The total amount of protein decreases by 9%.
Less food waste	
Current level of food waste	Current amount of food waste at distribution, retail and consumers.
25% less food waste	A 25% decrease in food waste at distribution, retail and consumers.
50% less food waste	A 50% decrease in food waste at distribution, retail and consumers, conform the national ambition and Sustainable Development Goal 12.3 for 2030 (Duurzaam Ontwikkelingsdoel voor 2030, LNV (2018a)).
More efficient production	
Current crop yields	Average crop yields, per hectare, in production areas for the Dutch market (Kramer and Blonk, 2015).
Crop yield trend 2030 (+10%)	The projected increase in the trend for crop yields per hectare is 10% (up to 2030) in production areas for the Dutch market.

Crop yields larger than trend (+15%)	Possible increase up to 2030, if policy and practices on the ground make strong efforts to increase crop yields; for instance, by sharing best-practices information, and new technology (precision agriculture), in production areas for the Dutch market.
Crop yields smaller than trend (+5%)	Less strong projected increase in the trend of crop yields, per hectare (up to 2030), in production areas for the Dutch market.
Current efficiency in livestock production	Efficiency in livestock production, based on legal level and animal welfare conform legal standards of 2015.
Livestock production trend 2030 (+6%)	Projected increase in the trend of productivity per animal, and a better feed conversion; equalling a 6% increase in efficiency.
Livestock production greater than trend (+9%)	Potentially higher increase up to 2030 (to 9%), if policy and practices on the ground strongly focus on increasing efficiency.
Livestock production lower than trend (+3%)	Less strong increase up to 2030 (up to 3%).
More careful production	
Legal level of animal welfare 2015	Animal welfare conform legal standards of 2015 (Kramer and Blonk, 2015).
Improved animal welfare (1* pigs, chickens improved)	Large share in meat of Better Life certificate 1* (pork) and 'concept chicken' (Kip van morgen), conform ambitions by the government and business community in 2020.
Free-range pigs and chickens	Chickens and pigs conform Better Life certificate 2*.
Animals 25% organic	25% of chickens, pigs and cattle conform Better Life certificate 3*; in combination with organic crop production.
Animals 100% organic livestock farming	100% chickens, pigs and cattle conform Better Life certificate 3*; in combination with organic crop production (only in web tool and on individual level).
Crop production 25% organic	25% of crop production in the form of organic agriculture.
Crop production 100% organic	100% crop production in the form of organic agriculture (only in web tool and on individual level).
Combination	
1. Moderate steps	Decrease in animal products (50%–50%); 25% less food waste; crop yields trend 2030 (+10%); animal production trend 2030 (+6%); improved animal welfare; improved energy efficiency in the chain.
2. Focus on land use and greenhouse gases	Further decrease in animal products (40%–60%); 50% less food waste; crop yields higher than trend (+15%); animal production higher than trend (+9%); legal animal welfare level 2015; improved energy efficiency in the chain
3. Focus on careful production methods: animal welfare, biodiversity and environmental quality	Further decrease in animal products (40%–60%); 50% less food waste; crop yields lower than trend (+5%); animal production lower than trend (+3%); crop yield 25% organic; improved energy efficiency in the chain.

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