

# NEDER- LAND VEGAN- LAND?

Less meat and dairy products = more room for nature, recreation, improved climate, biodiversity and greater environmental justice

**STROOTMAN  
LANDSCHAPSARCHITECTEN**



**CML**  
Institute of Environmental Sciences

**E<sup>T</sup>  
L**  
EFL STICHTING



# NEDER- LAND VEGAN- LAND?

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# 01



THERE IS  
ENOUGH  
SPACE IN THE  
NETHERLANDS -  
IT'S A MATTER  
OF CHOICE!

**“OUR LAND IS FULL, PARTLY OVERCROWDED.”**

Queen Juliana in her 1979 inauguration speech

Source: [www.parlement.com](http://www.parlement.com)

## In the debates on the future design of the Netherlands, the claim is often put forward that the Netherlands is full and does not have enough space...

... adducing the arguments that the Netherlands is the most highly densely populated country in the world, that it is the world's largest food producing country, and that it has the responsibility to feed the world. The Netherlands is one of the countries with the highest livestock density in the world.<sup>1</sup> It opted in the past for large-scale production and the corresponding export of meat and dairy products. The intensive livestock farming developed for that purpose occupies a great deal of space and also puts heavy pressure on environmental quality and biodiversity.

The decision to produce as much animal food as possible may be justifiable when it comes to feeding people or the Dutch economy, but the question is whether it is also justifiable for the animals that are kept, the nature that is heavily polluted, the climate that is changed or the farmers who only derive limited returns from the system. Might different choices be able to create an equitable system, for example by freeing a lot of land by modifying our eating habits and changing the way we treat agricultural land? This would make it possible to use that space to do other things that society would also welcome.

<sup>1</sup> <https://nieuwscheckers.nl/heeft-nederland-de-hoogste-veedichtheid-ter-wereld-dat-hangt-af-van-de-berekening/>  
<https://nieuwscheckers.nl/heeft-nederland-de-hoogste-veedichtheid-ter-wereld-dat-hangt-af-van-de-berekening/>

12 After all, one of the major problems in the Netherlands is the limited space. There is a demand for more space for housing, nature, recreation, agriculture, sustainable energy production and water catchment. Because the country lacks that space, or rather, because of the choices that have been made, all those social desires and ambitions are often kept in cold storage for a long time. Take the plan to implement the Ecological Main Structure dating from 1990 (!) that has still not yet been carried out. The housing shortage, the forestry strategy, and so on.



In 2022 the Van Eesteren-Fluck & Van Lohuizen Foundation organised a competition around the key question: How can the Netherlands equitably design the climate transition in its social environment? In the form of a team comprising Strootman Landschapsarchitecten and the Centre for Environmental Sciences of Leiden University (CML), as one of the three award winners we have conducted design research to outline ways to tackle this question.

In doing so we put a thought experiment at the centre: just suppose that the Netherlands was a vegan country in which no agricultural land was used for the production of animal feed, meat or dairy produce and no animal products or animal feed were imported. Most people will not want a completely vegan diet, but just suppose that everyone was a vegan and there was no more importing of animal feed, what would the consequences be for environmental justice, the environment, the transition and the major design challenges facing the country?<sup>2</sup> This resulted in interesting insights that made it increasingly clear that the question of space is linked to the choices of diet and methods of production that are made.

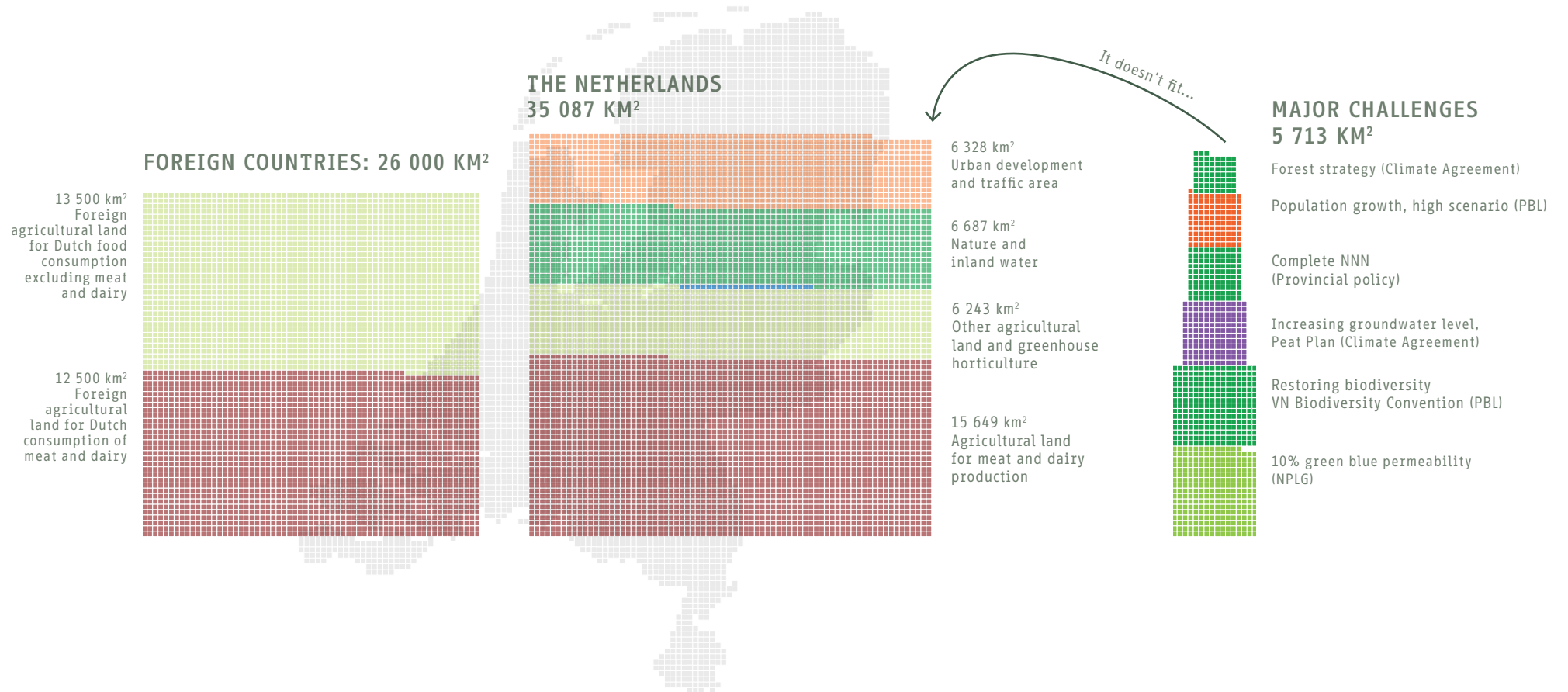
<sup>2</sup> The Dutch government also has the ambition to shift towards the consumption of more vegetable proteins: from the current 39% vegetable and 61% animal proteins to 50/50 by 2030 (incidentally, it was 40/60 in 1958) (<https://edepot.wur.nl/465561>). The National Protein Strategy aims to enhance the degree of self-sufficiency of new and vegetable proteins in a sustainable manner in the next 5 to 10 years for the benefit of human, animal and environmental health. See: <https://www.rijksoverheid.nl/documenten/kamerstukken/2020/12/22/nationale-eiwitstrategie#:~:text=De%20Nationale%20Eiwitstrategie%20heeft%20als,-mens%2C%20dier%20en%20natuurlijke%20omgeving>.

This publication sets out the steps in our thinking and developments. The choice is up to you:

**AN EQUITABLE  
USE OF SPACE,  
OR A PIECE  
OF MEAT AS  
A REGULAR  
FEATURE OF  
YOUR DIET.**



# 14 CURRENT LAND USE IN THE NETHERLANDS, MAJOR CHALLENGES, AND FOREIGN AGRICULTURAL LAND



## 16 Design research on an equitable system of vegan food production

We are curious about the contribution that a system of vegan food production can make to an equitable environmental climate transition of Dutch society and finding solutions to the major social challenges facing the country. That is why we conducted a 'Just suppose...' design research. Just suppose: the Netherlands is a vegan country in which no agricultural land is used for the production of animal feed, meat or dairy products and no animal products or animal feed are imported. What would this mean for environmental justice and the major spatial challenges facing the Netherlands? The aim: an elaborated future vision of a vegan food system, the use of land in the Netherlands and the challenges facing the country, as a discussion item for the debate on a future-sustainable food system in relation to our use of space.

We have conducted design research to this end. Design research is an essential link when it comes to taking steps in the devising of integral solutions for the major current social challenges. Design research can be deployed to explore opportunities for the combination of ambitions and tasks, and for the deployment of tasks as instruments for the improvement of regional and environmental quality.<sup>3</sup> In the present time when complexity is only growing, design research can help to develop (spatial) perspectives. It is an important instrument to get to grips with challenges and the debate on the choices that society makes and that determine the future of the Netherlands. 'What if...?' is often the initial question in design research, as in this research on the opportunities and problems of 'Nederland, Veganland?'. It provides insight into the choices that determine the possibility of speeding up social transitions.

An important message of our design research is that we should not forget that the present use of land in the Netherlands, with a relatively amount of land dedicated to export-related, intensive agriculture and livestock farming, is the consequence of all kinds of choices that Dutch society made, whether consciously or not. But at the same time we should realise that there is always the possibility of revising those choices to make the future use of land different from the present. 'Reshuffling the cards' in different ways and moving on from there to a discussion of the question 'in what

<sup>3</sup> As advocated, for example, in Panorama Nederland, Board of Government Advisors, 2018.

kind of a country do the Dutch want to live?' has been only too rare in the past decennia.<sup>4</sup> As a result, the picture has emerged of a land that has been overwhelmed by it all, while that is of course not the case. It is just that those choices were made insufficiently explicit by the Dutch government or an explanation of them was avoided. We emphatically argue for making the debate about the choices that Dutch society can make explicit, and for showing that there really is room for choices to be made.

# IN WHAT KIND OF LANDSCAPE DO THE DUTCH WANT TO LIVE?

<sup>4</sup> It is by now more than thirty years since the Scientific Council on Government Policy issued an interesting and controversial report in 1992 entitled 'Ground for choices; four perspectives on the rural areas in the European Community'. On the basis of normative premises, it contained elaborated technical scenarios for agriculture and forestry in the then EC down to around 2015. An important premise in that report was the surplus of agricultural land in the European Community.

## 18 Climate justice

A central theme in the three projects that are supported by EFL is climate justice. How do we approach it in 'Nederland, Veganland?'

A widely held view of climate justice begins with the recognition that various groups, such as future generations and people who live outside the Netherlands, as well as animal and plant species, may be the victims of injustice as a result of climate change or the way it is tackled. The recognition of an inequitable distribution of benefits and costs creates the room to take that into account in policy. This may be done by taking measures that minimise injustice or by adopting compensatory measures. In recognising this, we must be clear about what kind of justice we are talking about. We have drawn the following distinctions for this purpose:<sup>5</sup>

- Respect for the values of people, plants and animals that all have the right to exist on our planet in an ecological and evolutionary system.
- Transparent and honest decision-making. How are all voices heard and taken into account and included in the decision-making, and is every interest taken into account? That goes not only for people, but also for plants, animals and ecosystems.
- Restorative justice: How can (historical) injustice be put right, possibly with corrections and compensations?
- An equitable distribution of human costs and benefits, for example as expressed in financial costs and employment.

People weigh up justice, for nature too. We are increasingly taking into consideration possibilities to give nature a voice of its own, above all in the juridical system. We have taken the above points into account in our design research in 'Nederland, Veganland?' by considering each time to what extent others can be held accountable.

19

# 02

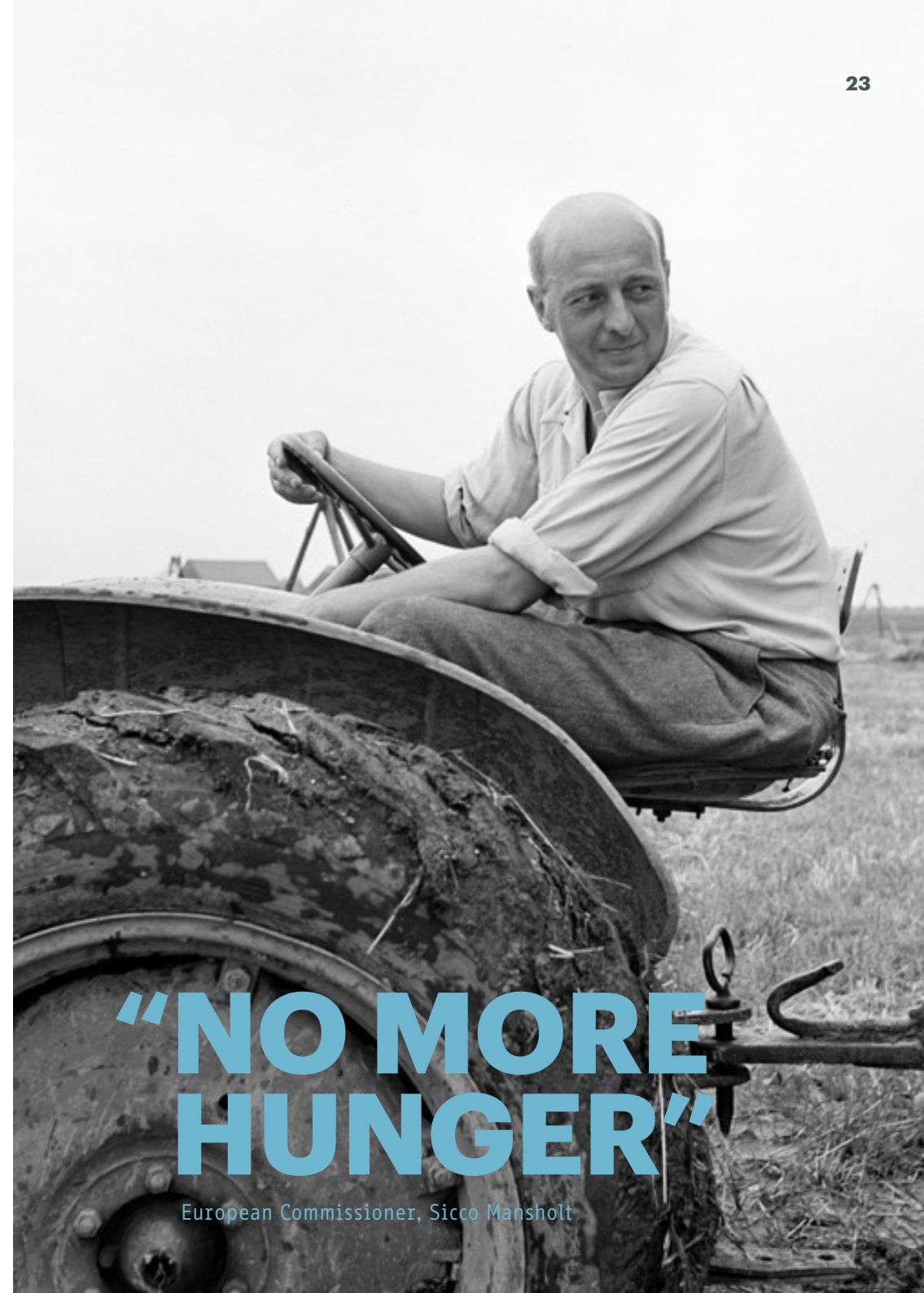


THE  
CURRENT  
FOOD  
PRODUCTION  
SYSTEM

## 22 **The present food production system is an edifice that was primarily set up after the Second World War...**

The Dutch government played a leading part in directing this process, especially in the first decades. Nevertheless, the agricultural policy has deeper roots. The Dutch government has conducted policy to promote the production and export of agricultural products ever since 1840. It acted in the spirit of a strong commercial mentality and by promoting the triad of research, information and education.

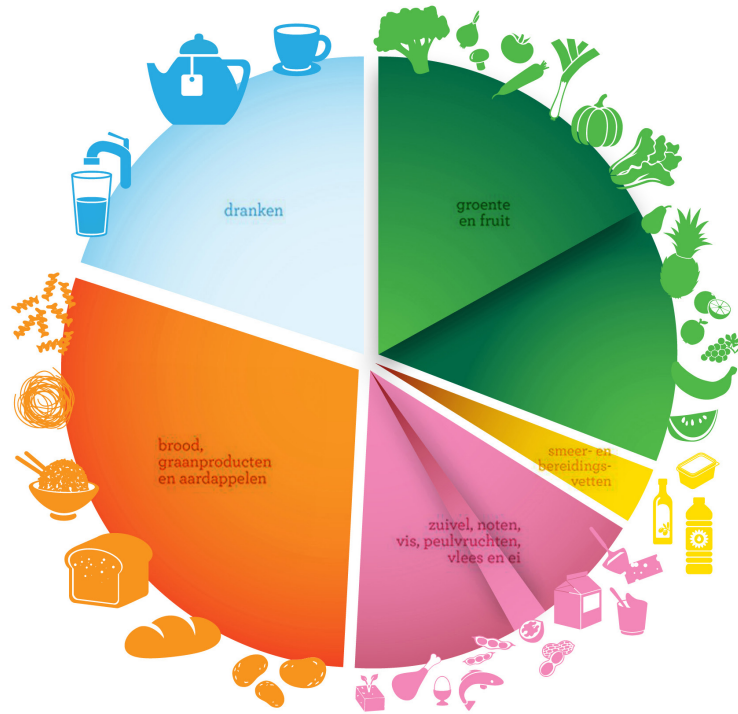
It was particularly after the Second World War that this policy proved to be a success. This was partly due to the European Commissioner Sicco Mansholt, who deployed the European policy to modernise agriculture. Innovation, availability of artificial fertilizer, increase of scale and mechanisation were important stimuli to raise production and productivity. Almost all the small, extensive, mixed enterprises of 1950 were replaced by today's larger, intensive and specialised enterprises. The number of agrarian enterprises has fallen from 500,000 in 1950 to 50,000 today.



**“NO MORE HUNGER”**

European Commissioner, Sicco Mansholt





Source: het Voedingscentrum

The government, agricultural lobby, food industry and organisations like the Food Advisory Centre made use of policy, executive instruments such as Land Development, commercials, school milk campaigns and the Wheel of Five (a recommendation to eat five different kinds of food each day) for an effective combination that gave and still gives a strong impulse to livestock farming. Intensive Dutch livestock farming became taken for granted.



1956



1965-1978 Joris Driepinter



1978



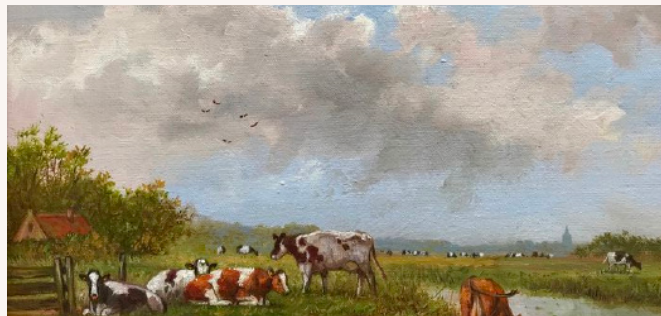
1994



WAAR SMAKEN  VERSCHILLEN

2022







**28** These developments have had enormous consequences for the landscape. They are the result of land reclamation, hydraulic management by creating canals, dykes and weirs, the use of resources like meadows, wood and peat, the creation of infrastructure, towns and villages, and agriculture. In peat bogs, drainage has led to subsidence and the environmental problems it entails. The largest part of the land surface of the Netherlands is used by agriculture. In the last few decades the agricultural landscape has changed drastically and suffered a deterioration in quality as a result of increase of scale, more intensive farming, the use of technology and substances such as artificial fertilizer and pesticides, drainage and the removal of landscape features. This has also led to changes in biodiversity and the ecological balance of the landscape, with consequences for natural habitats and species variety. Moreover, the expansion of agricultural activities has led to the conversion of natural areas into fields, to the detriment of the visual and cultural qualities of the Dutch countryside.

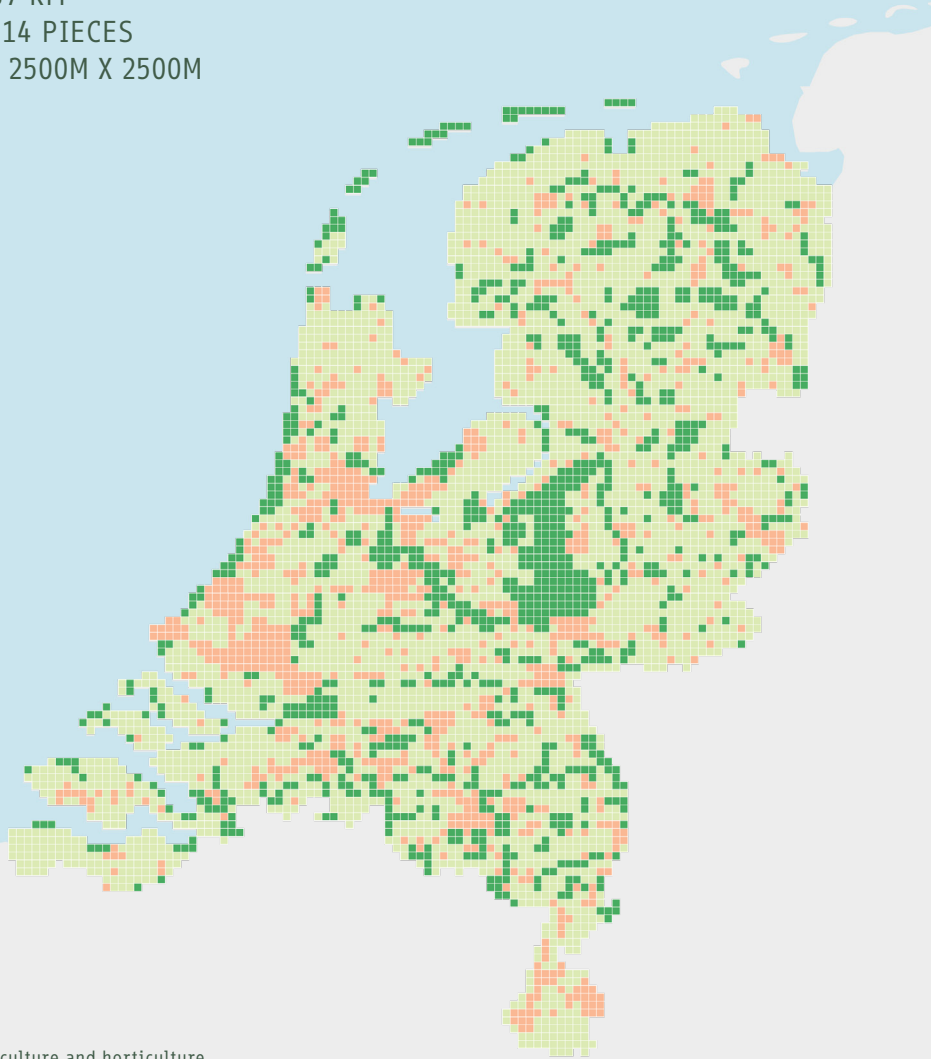
The impact of these changes has led to the adoption of initiatives aimed at sustainable agriculture, the conservation of nature and the restoration of the landscape. In spite of this, the Netherlands is at present caught between international obligations, the agricultural sector that wants change but not too much and certainly not too soon, and major social challenges requiring space. There is no way out of this impasse in sight at the present time, and it is questionable whether that can be achieved without major changes of direction.



Today the landscape with cattle is less idyllic and ecological.

# 30 THE NETHERLANDS AS A PUZZLE

35 087 KM<sup>2</sup>  
 IN 5614 PIECES  
 FROM 2500M X 2500M

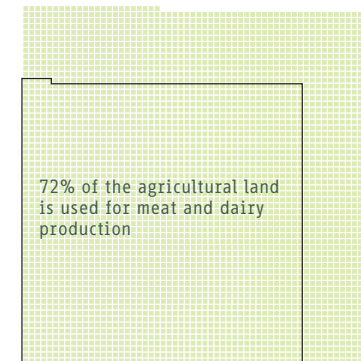


- Agriculture and horticulture
- Nature and inland water
- Urban development and traffic surface

## The present system in statistics

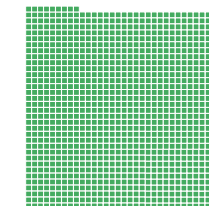
62% of the land in the Netherlands is used for agriculture and market gardening, 20% for nature and water, and 18% for buildings and roads. No less than 72% of that 62% is used for the reduction of meat and dairy products. Only 44% of the agricultural land is used for domestic food consumption. Outside the Netherlands, the country uses 3 times as much as its own surface area of agricultural land (equivalent to roughly 18 times the land surface area of Flevoland) for domestic food consumption. For example, the Netherlands imports 450 kilotons of soya from Brazil and other countries every year. Most of that also supplies the production of meat and dairy products. The Netherlands is not unique in this respect: 80% of agricultural land all over the world is used for the meat and dairy industry, which satisfies only 17% of the world demand for calories. One-third of that land is also suitable for arable farming for human consumption.

62% Agriculture and horticulture



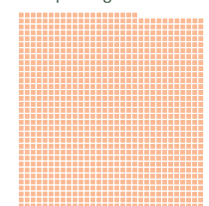
21 888 km<sup>2</sup>

20% Nature and water



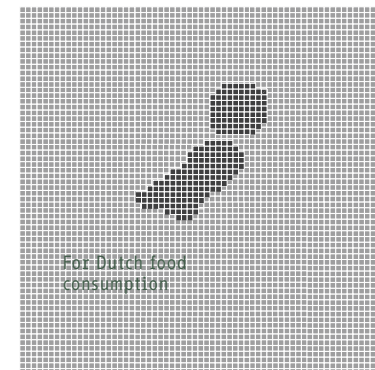
6 687 km<sup>2</sup>

18% Urban development and paving



6 328 km<sup>2</sup>

Foreign plots used for Dutch food consumption



26 000 km<sup>2</sup>

18 x Flevoland

Source: CBS, 2017  
<https://opendata.cbs.nl/statline/#/CBS/nl/dataset/37105/table?ts=1695217202194>



**Meat and dairy products provide only 17% of our requirement of calories**

17%

**and only 38% of our requirement of protein**

38%

# 80% OF ALL AGRICULTURAL LAND IS IN USE FOR LIVESTOCK FARMING

The Dutch agricultural system is export-orientated: 80% of the food produced in the country is for export, while 75% of the food in supermarkets in the Netherlands is imported. In other words, most farmers supplying the Dutch market live abroad. The same is true for grain: grain is primarily cultivated in the Netherlands for animal feed, while Dutch bakeries import their grain from France.

The average person in the Netherlands depends on 1,800 m<sup>2</sup> for food consumption and eats an average of 61% animal protein and 39% vegetable protein.

If we wanted to feed the whole world with the Dutch pattern of food consumption, it wouldn't work.<sup>6</sup>





Source: arte

# PIG DENSITY IN EUROPE ↓

# CATTLE DENSITY IN EUROPE ↑



Source: arte

# 36 STRIVING FOR LIFE WITHIN PLANETARY BOUNDARIES

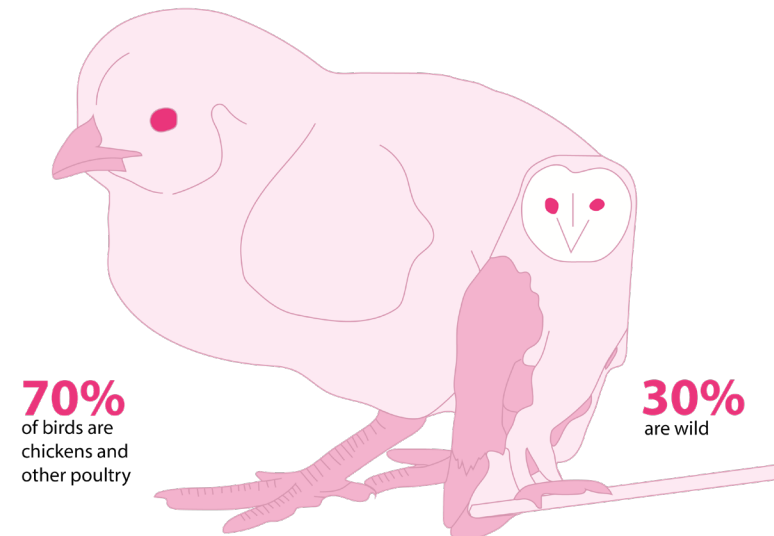
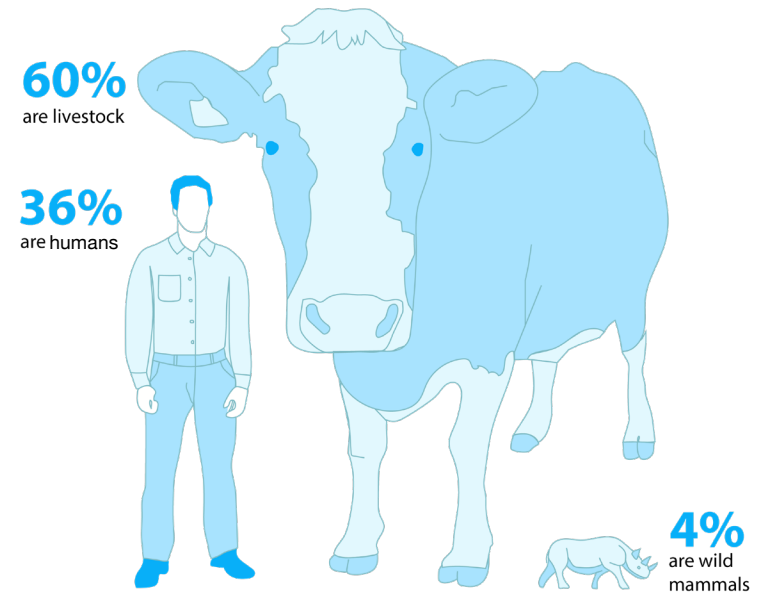
## Planetary limits

The Netherlands has an enormous concentration of livestock, by comparison with the rest of Europe, as these illustrations clearly show. The present food production system in the Netherlands is on the borderline, and regularly crosses it. The intensive food production has a considerable downside: bad smells, air pollution, eutrophication, greenhouse gases, subsidence, soil degradation, animal welfare problems, health (infectious diseases transmitted from animals to humans, etc.), water contamination, reduction in the quality of the landscape, nature and water, biodiversity, etc.

The impact of the present agricultural production system on biodiversity, in combination with urbanisation, is enormous all over the world. Only 4% of the biomass of all mammals on earth consists of wild animals, and only 30% of the total biomass of birds is wild; the rest are poultry. The agricultural livestock consists of only a handful of similar breeds and makes no contribution to biodiversity.

# PEOPLE & CATTLE VERSUS WILD ANIMALS 37

Of all the mammals on Earth, 96% are livestock and humans, only 4% are wild mammals



Gardian grafic

Source: The Guardian. <https://www.theguardian.com/environment/2018/may/21/human-race-just-001-of-all-life-but-has-destroyed-over-80-of-wild-mammals-study>

# 38 THE CONTRIBUTION OF FOOD PRODUCTION TO OVERSTEPPING THE PLANETARY BOUNDARIES

In 2009 the scientist Johan Rockström and colleagues introduced the idea of planetary boundaries. He determined nine boundaries within which humanity must operate in order to continue to make sustainable use of the earth's resources: climate change, rate of biodiversity loss, chemical environmental pollution, stratospheric ozone depletion, atmospheric aerosol loading, ocean acidification, disruption of phosphorus and nitrogen cycle, global freshwater shortage, change in land use/deforestation. Research shows that the boundaries have been seriously overstepped.<sup>7</sup> By reaching and remaining within the planetary boundaries, we protect our own environment and that of the rest of life on earth.

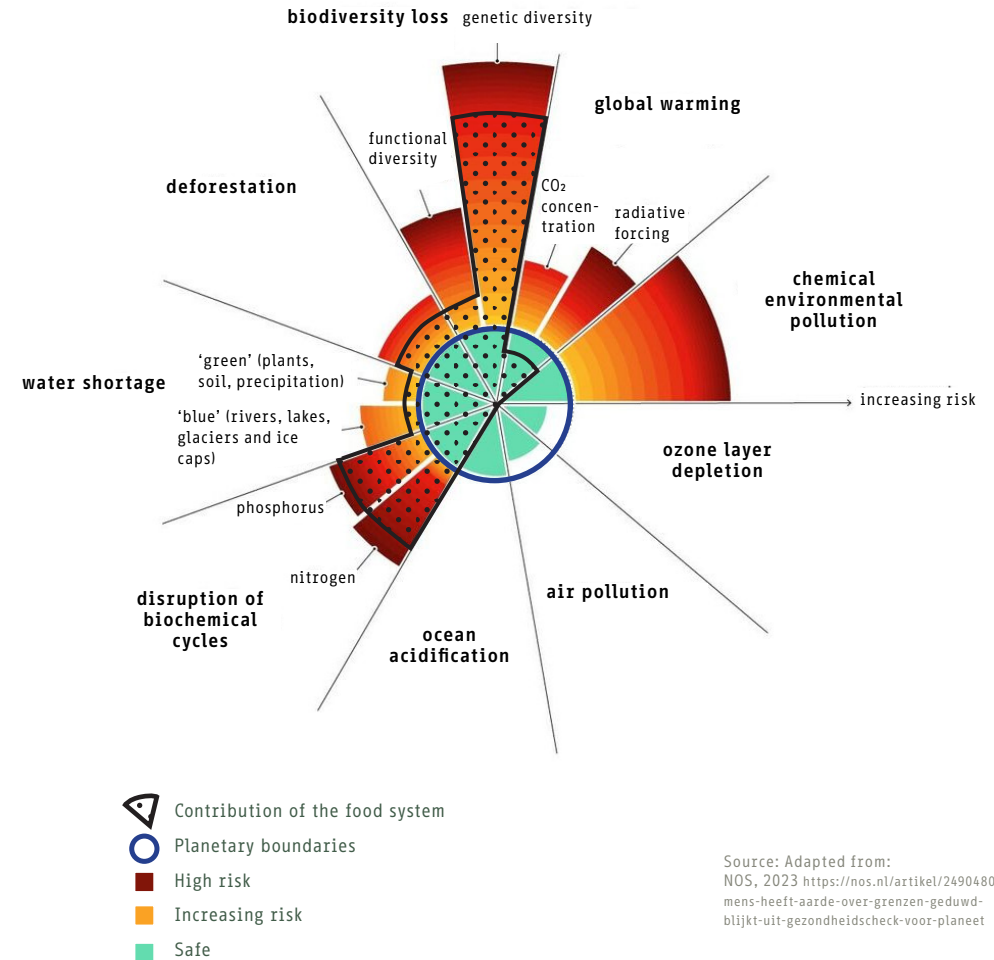
The global food production system is the main contributor to this overstepping of the planetary boundaries.<sup>8</sup> For example, the emissions of the entire food production system contribute 25% to climate change and 80-90% to the loss of biodiversity and the leaking of nitrogen and phosphorus.<sup>9,10,11</sup> The production of meat and dairy products is the main factor. A break with animals, rich in animal products, is inevitable if we are to remain within the planetary boundaries. In short, there is an urgent need to make the agricultural and food production system more plant-based and sustainable.

<sup>7</sup> Rockström, J., Steffen, W., Noone, K. et al. A safe operating space for humanity. *Nature* 461, 472–475 (2009). <https://doi.org/10.1038/461472a>

<sup>8</sup> Richardson, K., et al. 2023. Earth beyond six of nine planetary boundaries. *Science Advances* 9, 37.

<sup>9</sup> Campbell, B. M., D. J. Beare, E. M. Bennett, J. M. Hall-Spencer, J. S. I. Ingram, F. Jaramillo, R. Ortiz, N. Ramankutty, J. A. Sayer, and D. Shindell. 2017. Agriculture production as a major driver of the Earth system exceeding planetary boundaries. *Ecology and Society* 22 (4):8. <https://doi.org/10.5751/ES-09595-220408>

# 39 THE CONTRIBUTION OF THE FOOD SYSTEM TO THE TRANSGRESSION OF PLANETARY BOUNDARIES



<sup>10</sup> Nicholas Bowles, Samuel Alexander, Michalis Hadjikakou. 2019. The livestock sector and planetary boundaries: A 'limits to growth' perspective with dietary implications. *Ecological Economics* 160 (128-136). ISSN 0921-8009. <https://doi.org/10.1016/j.ecolecon.2019.01.033>.

<sup>11</sup> World Wide Fund, 2022. Dietary plan for the planet. WWF-NL, Zeist

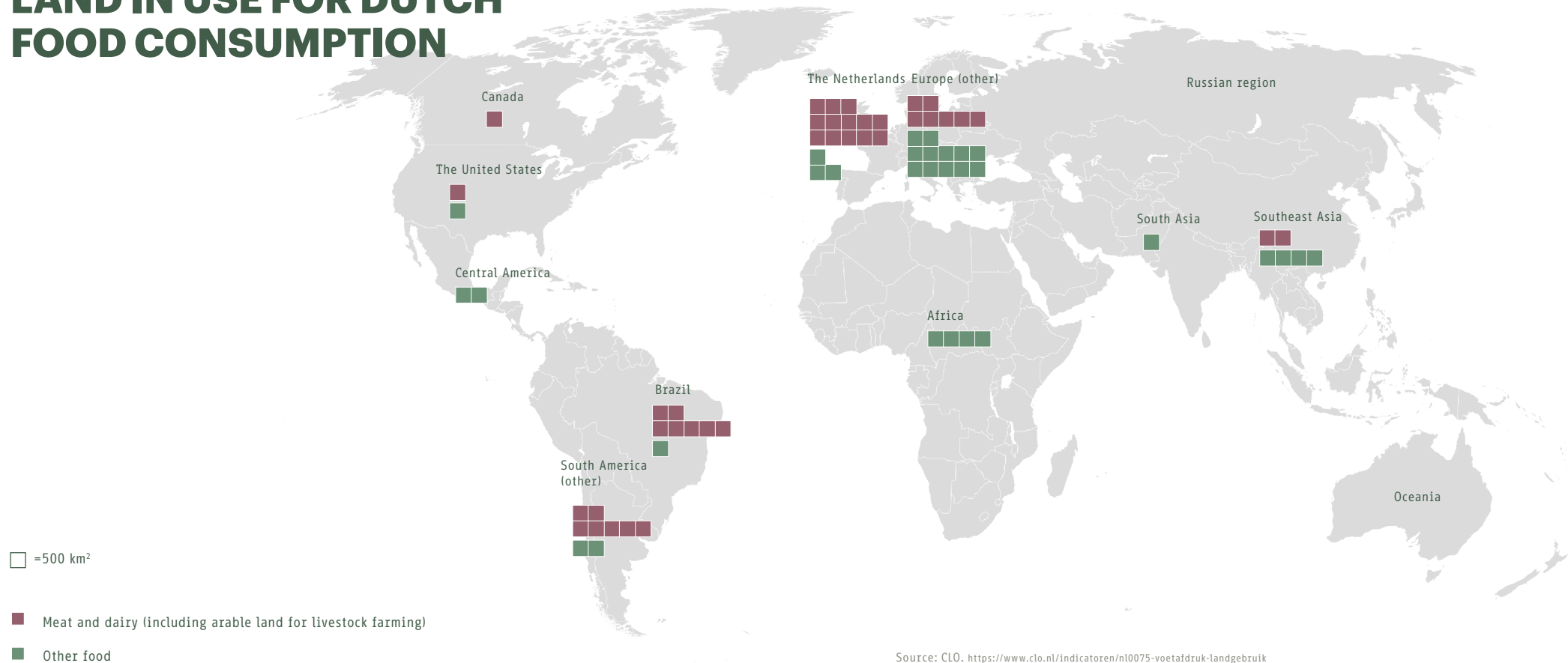


#### 40 To what extent is the present food production system just or unjust with regard to the climate?

The present food production system makes a great claim on land outside the national borders. This leads to deforestation and the replacement of the traditional system of food production of the local population by large-scale monocultures for export. The production of raw materials for Dutch meat and dairy consumption alone entails the cutting down of a tropical forest the size of the Veluwe every 30 months.

In terms of calories and proteins, meat and dairy production is very inefficient. By 2050 the world population will be around 9 billion (it is currently around 8 billion). The present Western diet cannot feed them all because it entails an excessive claim on space. Those who can afford meat and dairy products put an unfair burden on the space. That is unjust.

## FOREIGN AGRICULTURAL LAND IN USE FOR DUTCH FOOD CONSUMPTION



Source: CLO. <https://www.clo.nl/indicatoren/nl0075-voetafdruk-landgebruik>

**42** The negative impact on the environment and climate leads to injustice towards vulnerable groups, the generations after us, and nature and animals themselves. Those with a low income are relatively often the victims because they are less able to protect themselves against the consequences of climate change and a decline in environmental quality.

Paradoxically, those who contribute the most to climate change and the loss of biodiversity are the most able to withstand the financial consequences. For example, the total greenhouse gas emissions of the richest 1% (approx. 70 million people) are the same as those of the lowest 66% incomes.<sup>12</sup> On the other hand, those who contribute relatively little to overstepping the planetary boundaries often live in vulnerable areas. Around 3.3 to 3.6 billion people live in areas that are particularly susceptible to climate change.

The unequal distribution of both the causes and the consequences of overstepping the planetary boundaries makes the achievement and maintenance of these boundaries a question of both biophysics and justice. This is why Raworth has added a new social boundary to the concept of planetary boundaries. This shows that the attempt to meet the planetary boundaries must proceed hand in hand with striving for just boundaries.<sup>13</sup>

In short, the current food production system is not very just – reason enough to explore whether 'Nederland, Veganland?' could offer an attractive alternative.

<sup>12</sup> Oxfam international (2023). Climate Equality: A planet for the 99%. DOI: 10.21201/2023.000001

<sup>13</sup> <https://www.thelancet.com/action/showPdf?pii=S2542-5196%2817%2930028-1>



Source: Earth.org, 2023. <https://earth.org/the-silent-cry-of-the-forest-how-deforestation-impacts-indigenous-communities/>

5% of the world's population consists of Indigenous peoples. They manage approximately 20-25% of the Earth's land surface while maintaining biodiversity. These areas contain 80% of the world's biodiversity.



Source: WWF, 2021

Every 2.5 years, a tropical forest area equivalent to the size of the Veluwe is cleared for Dutch import of raw materials, a significant portion of which is used for meat and dairy production.



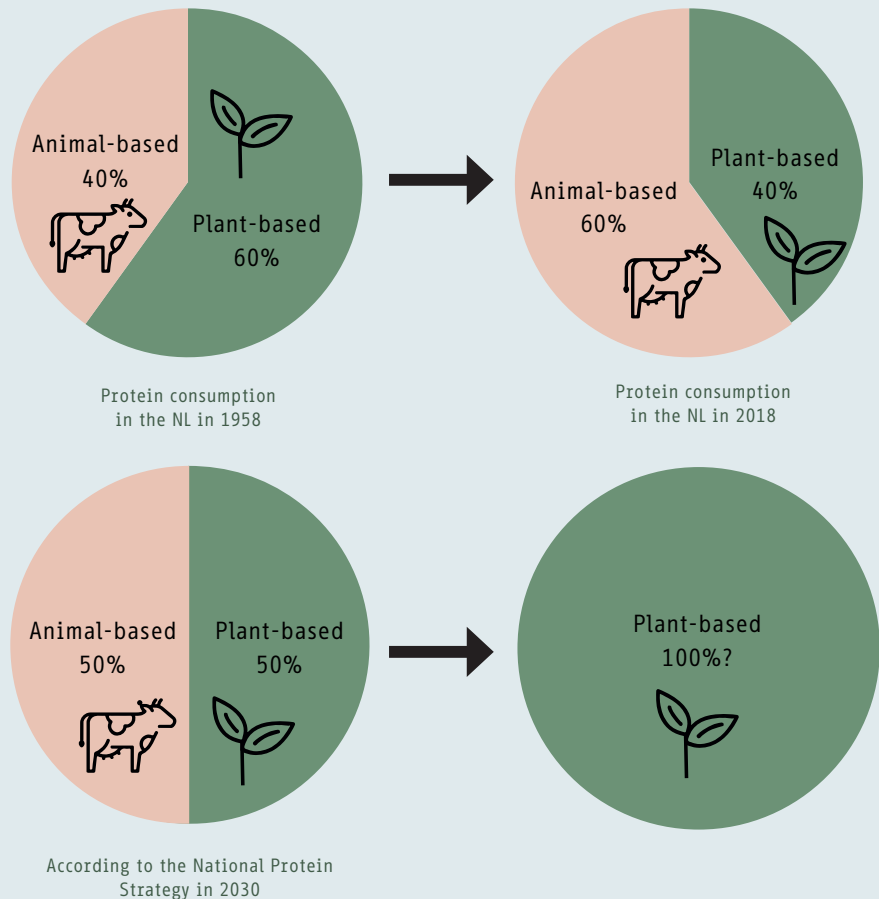
Source: NOS, 2021. <https://nos.nl/artikel/2376651-wnf-nederland-is-grote-europese-aanjager-van-ontbossing>

Raw materials imported by the Netherlands are responsible for around 30,000 hectares of tropical deforestation every year, particularly from the growing production of soya and palm oil.

# 03



NEDERLAND,  
VEGANLAND?



## Just suppose that the whole of the Netherlands would become completely vegan, what would that mean for climate justice and the major challenges facing the country?

Important factors in the transformation of the food production system are: optimisation of plant-based (protein) production, the achievement of a climate-resistant and biodiverse production, of an environment-neutral or even environment-positive production, of a more equitable food distribution, and shifting to healthier, local consumption. This chapter outlines a spatial profile of the Netherlands in which these factors are integrated.

In the previous chapters we have shown that the current food production system is in certain respects unjust and inefficient. Might a fully vegan system do a better job? In order to find out, we have formulated premises, made calculations, and drawn and analysed maps.

**We have adopted the following premises:**

- We anticipate a Dutch population growth from 18.5 to 20 million.<sup>14</sup>
- The entire Dutch population has a completely vegan diet. There is no livestock, so no animal feed is produced or imported either.
- The Dutch population eats food produced in the Netherlands as much as possible.
- The import of some products that are difficult to produce in the Netherlands continues: coffee, tea, chocolate, tropical fruit, etc.
- There is no longer any commercial fishing or fish farming.
- The Dutch eat no more than is necessary and healthy.
- Food waste is limited (our calculations assume a triple reduction for the entire chain of production).<sup>1516</sup>

<sup>14</sup> The State Commission on Demographic Developments recommends a population growth in the Netherlands up to a maximum of 20 million in 2050. See: <https://www.staatscommissie2050.nl/documenten/rapporten/2024/01/15/index>

<sup>15</sup> 25 to 30 percent of all worldwide food production ends up elsewhere than on the plates of the consumers. <https://www.ipcc.ch/srcccl/chapter/chapter-5/>

<sup>16</sup> <https://www.milieucentraal.nl/eten-en-drinken/voedselverspilling/hoeveel-voedsel-verspillen-we/#:~:text=Omdat%20het%20steeds%20om%20kleine,procent%20van%20ons%20gekochte%20eten.>

**The following are left out of account because they exceed the scope of this thought exercise:**

- More or less greenhouse market gardening: our calculations are based on the current surface area.
- Production on the sea (for example, algae), even though the prospects are very promising.
- The eventual return into the recycling chain of human fertilizer is important for maximal reduction of loss. If that succeeds, the quantity of artificial fertilizer required can be reduced.

## 50 Premises bearing on methods of production

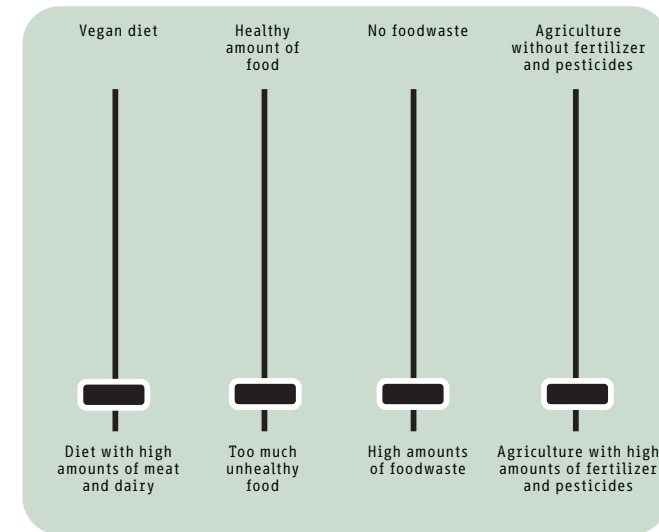
- Arable farmers and vegetable growers no longer use animal fertilizer, but they use hay as a plant fertilizer, nitrogen-binding papilionaceous flowers, a very limited amount of artificial fertilizer, and no pesticides.<sup>17</sup>
- Space for fallow crops in a cultivation rotation of 1:8 (one fallow year every eight years).
- A 30% drop in production as a result of using hay as a plant fertilizer, a very limited amount of artificial fertilizer, and no chemical pesticides.
- Space for the production of hay for use as a plant fertilizer.

These premises and limitations mean that more space per kg product will be required than in the present agricultural system. At the same time, they result in an agricultural system that has a much smaller negative impact on the environment.

<sup>17</sup> It is a persistent error to suppose that animals are needed to provide manure to fertilize the fields. By now there are farmers in the Netherlands who can show that vegetables can be cultivated perfectly without the use of animal manure. With a good crop rotation plan and the use of organic material to enrich the soil, food can be produced over a long period, although the levels of production are lower. See for example <https://www.noshitfood.nl/w>

## THE CURRENT SITUATION OF THE DUTCH FOOD SYSTEM

51



## PRINCIPLES FOR CALCULATION

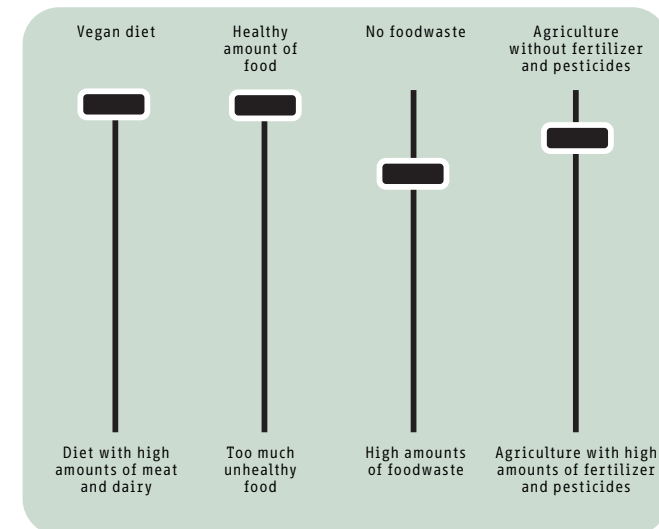






Photo: Harry Cock

## Space for social goals and ambitions:

- 10% of all agricultural land is reserved for green-blue services in line with the NPLG target for 2050.<sup>18</sup> At present this is roughly 2-3%, so we assume an increase of 7-8%.
- Completion of the Netherlands Nature Network (NNN).
- PBL scenario 'Higher Target Achievement' from the nature investigation to achieve the original EHS plus the later addition of the 'robust links'. This amounts roughly to a total surface area of between 140,000 and 150,000 hectares.
- Implementation of the Forestry Strategy: 10% more woodland (an additional 37,000 hectares).
- Expansion of the urban area by 14% in accordance with the broadest scenario from the PBL spatial planning investigation for 2050.<sup>19</sup>
- Cultivation of building materials, space for water storage and other forms of climate adaptation.

<sup>18</sup> <https://www.rijksoverheid.nl/binaries/rijksoverheid/documenten/publicaties/2023/12/15/samenvatting-ontwerpprogramma-nplg/Samenvatting+ontwerp+NPLG.pdf>

<sup>19</sup> Most of the plans for those million dwellings are already drawn up. We assume the building of compact towns and cities. That results in more quality and contributes to the level of support for amenities. The same is true for the quality of the public transport: a greater mass makes it easier to build up a good structure. A sprawl with less open space and many more traffic movements is not desirable. For a safety margin our calculations are based on the most generous urbanisation scenario, which assumes 14% of extra urban area by 2050: <https://www.pbl.nl/sites/default/files/downloads/pbl-2023-vier-scenarios-voor-de-inrichting-van-nederland-in-2050-4832.pdf>



# 54 FROM THE WHEEL OF FIVE



Source: het Voedingscentrum / The Netherlands Nutrition Centre

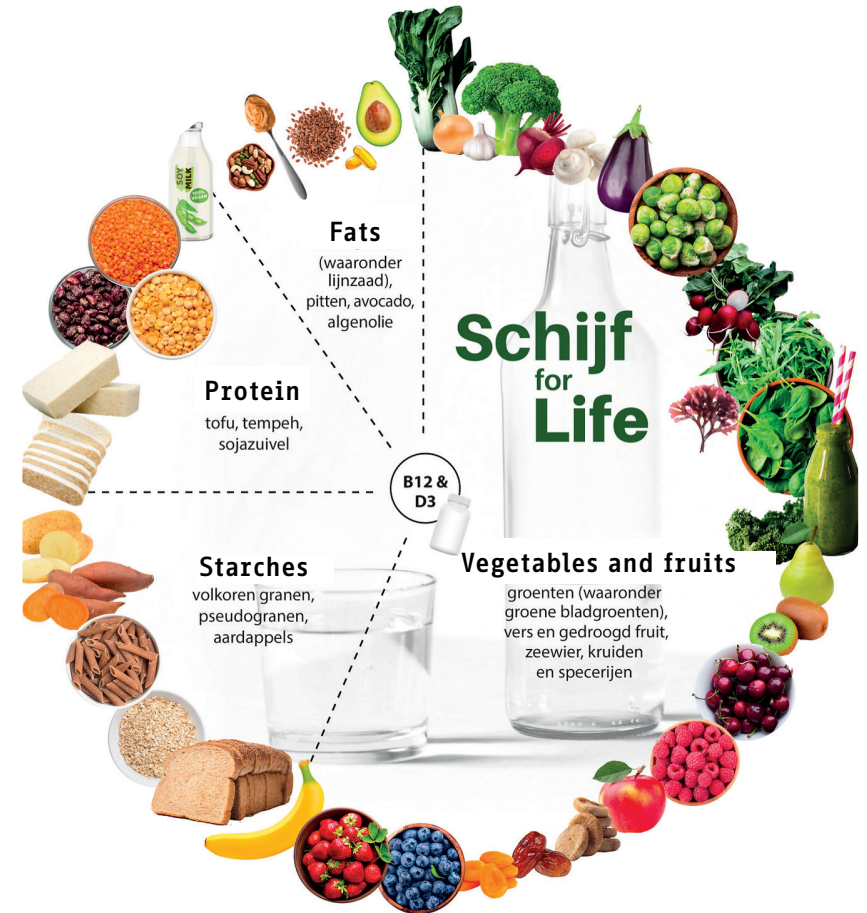
## Wheel for Life

The Food Advisory Centre<sup>20</sup> has been advising the Dutch to follow the Wheel of Five (Schijf van Vijf), that is, to eat from five different food groups, for many years.<sup>21</sup> A considerable part of the recommended foods contain animal proteins in the form of meat, fish, dairy products and eggs. In the meantime, an alternative has been developed: the Wheel for Life (Schijf for Life).<sup>22</sup> This was drawn up in 2021 by a large group of dieticians and is supported by almost two-hundred dietician practices. They consider that ‘the recommendation of the Food Advisory Centre is not in line with the climate, environmental and health targets’. The Wheel for Life does not contain any meat, fish, eggs or dairy products. They regard a vegan diet as ‘a win-win for the wellbeing of the planet and your health’.

We use the Wheel for Life as the basis for our calculations to determine how much of which nutrients is required to feed a Dutch population of 20 million, where it can best be cultivated, and how much surface area is needed for it.

<sup>20</sup> ‘The Food Advisory Centre offers consumers and professionals scientific and independent information about a healthy, safe and more sustainable dietary choice’. The Food Advisory Centre receives a 100% subsidy from the state.

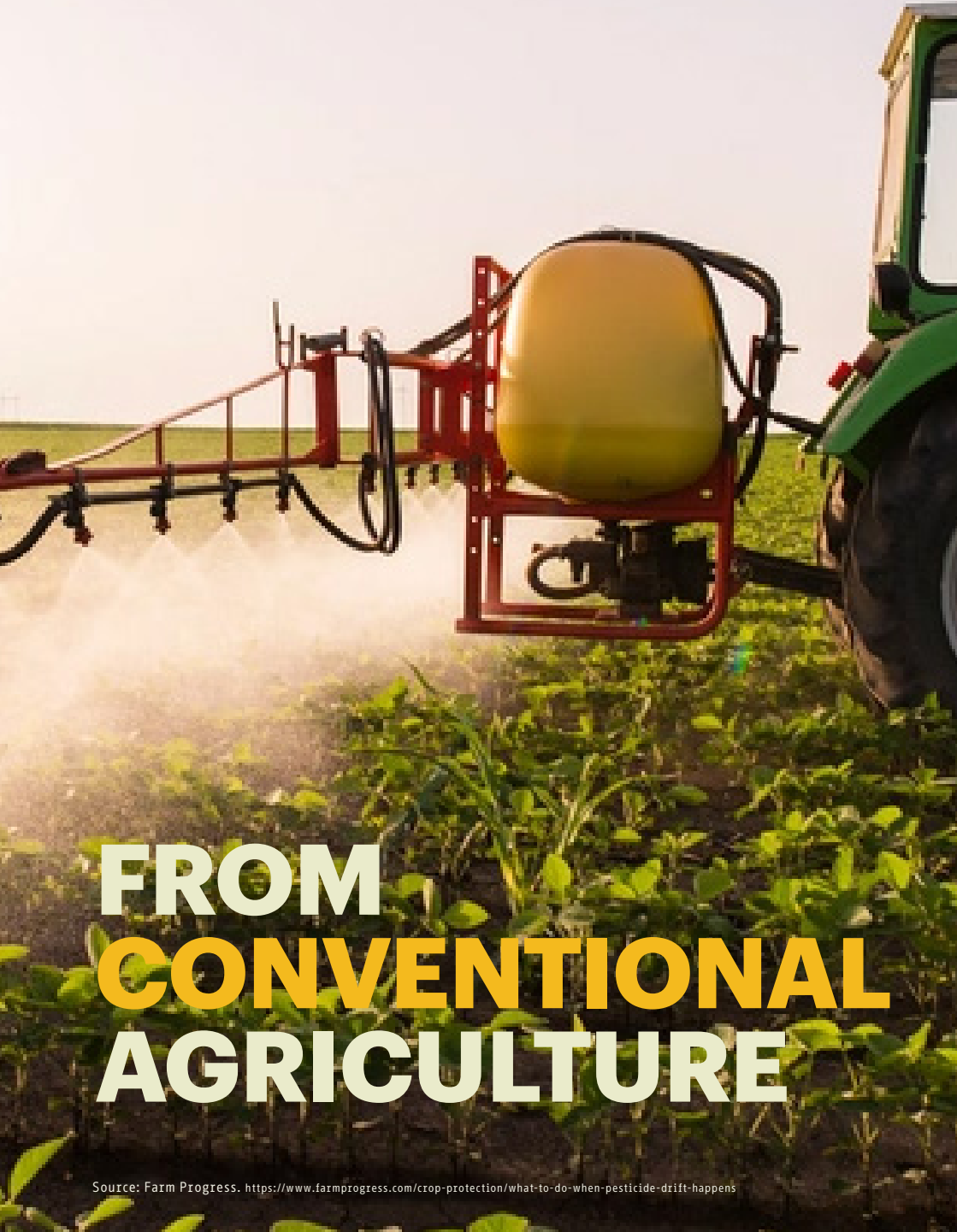
# 55 ... TO THE WHEEL FOR LIFE



<sup>21</sup> The name and model of the Schijf van Vijf with five categories has been around for a long time, but the content has been adapted in the course of time. The last major update was in 2016.

<sup>22</sup> The Schijf for Life is a non-profit initiative to provide the Dutch with dietary advice that is in line with the climate, environmental and health targets. See: <https://www.schijfforlife.nl/>





# FROM CONVENTIONAL AGRICULTURE

Source: Farm Progress. <https://www.farmprogress.com/crop-protection/what-to-do-when-pesticide-drift-happens>



# TO NATURE- INCLUSIVE AGRICULTURE

Source: WUR. <https://mehing.wur.nl/uitgelicht/meer-natuur-op-akkers/>

| 1                                     | 2   | 3  | 4  |
|---------------------------------------|---|--|--|
| Crop type and daily intake per person | Dutch model crops   | Required plot space (ha) (without corrections) | Required space (ha) Nederland, Veganland |
| <b>Fruit</b><br>300 gram              | Apple<br>Pear<br>Strawberry                               | 45 017   | 118 332                                  |
| <b>Vegetables</b><br>300 gram         | Spinach<br>Kale<br>Chicory<br>Carrot<br>Broccoli<br>Onion | 74 569   | 195 998                                  |
| <b>Grains</b><br>90 gram              | Wheat<br>Rye<br>Quinoa                                    | 113 878  | 299 319                                  |
| <b>Tubers</b><br>100 gram             | Potato<br>Sweet potato                                    | 14 515   | 38 152                                   |
| <b>Legumes</b><br>160 gram            | Brown beans<br>Field beans<br>Broad beans                 | 186 920  | 491 306                                  |
| <b>Nuts</b><br>25 gram                | Walnuts<br>Hazelnuts<br>Almonds                           | 56 804   | 149 305                                  |

Source: 30% production loss and crop rotation: Expertmeeting LBI, 2023  
Part Mowing manure: No Shit farm  
Food waste: IPCC  
Conversion plot/rural: BRP & CBS

# SPACE REQUIRED FOR A VEGAN FOOD PRODUCTION LANDSCAPE

## Method of calculations with premises

We have linked various types of crops that can be grown in the Netherlands with each nutritional category of the Wheel for Life. We have assumed crop production on open ground. To prevent the study from becoming too broad, we have not included the potential of food production on the sea, although it is very promising.<sup>23</sup>

On the basis of the crop types, we have calculated how much agricultural land is required per nutritional category of the Wheel for Life in order to provide the entire Dutch population with its daily nutritional needs. For these calculations we have used the production statistics of the CBS for the years 2020-2022. In the case of crops that are not yet, or only occasionally grown in the Netherlands, such as quinoa, we have based our calculations on publications that provide an estimate of the possible production in the Netherlands. For each nutritional category we have taken the average of the production figures for the corresponding crop types.

The technical cultivation principles (shown in page 48) are taken into account to calculate the agricultural land take for 'Nederland Veganland'. We also take into account reserved space for other uses (such as farm estates and roads) and (reduced) food. What it boils down to, roughly speaking, is a multiplication of the net space required for the production of certain crops by 2.6 for the pressure on land in a vegan Netherlands.

$$\frac{\text{daily needs the Wheel for Life} \times 365 \times \text{current population} \times 2,6}{\text{average productivity food category (kg/ha)}}$$

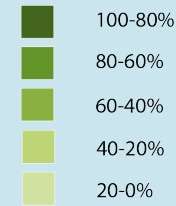
<sup>23</sup> <https://www.change.inc/agri-food/waarom-algen-de-duurzame-grondstof-van-de-toekomst-zijn-37122>

# 60 PRODUCTION POTENTIAL OF AGRICULTURAL SOILS

## Productive potential for arable land

Not all soil types in the Netherlands are equally suitable to produce food for human consumption. This is made abundantly clear in this map with the productive potential for arable crops.<sup>24</sup> The best soils are the clay soils that are now also used for arable farming in the Zeeland, South Holland, Flevoland and Groningen belt.<sup>25</sup> The silty or loamy soils of South Limburg are also among the best in the Netherlands. On the sandy soils the old reclamation lands of the common fields, plots and old fields in the Southern Netherlands are suitable, but this is much less the case for the new reclamations. Those areas of the sandy soils could only be reclaimed and made productive after artificial fertilizer became available on a large scale, at the end of the 19th century. These soils are not very productive without the applications of considerable quantities of fertilizers. That is also certainly true for the fen communities, while the peat meadows are yet another case: they were indeed cultivated as arable land soon after their reclamation, but that is no longer possible today, although experiments are being conducted here on a small scale with alternative crops that are also intended to prevent subsidence such as reed mace, aquatic ferns like azolla,<sup>26</sup> cranberries, rice and peat moss. These are not very lucrative so far and have a major effect on the landscape.

Production potential of agricultural soils



<sup>24</sup> Adapted from <https://www.atlasnatuurlijkkapitaal.nl/kaarten>

<sup>25</sup> They are facing serious problems of salinisation as a result of the climate change. This has not been taken into account in the present thought exercise.

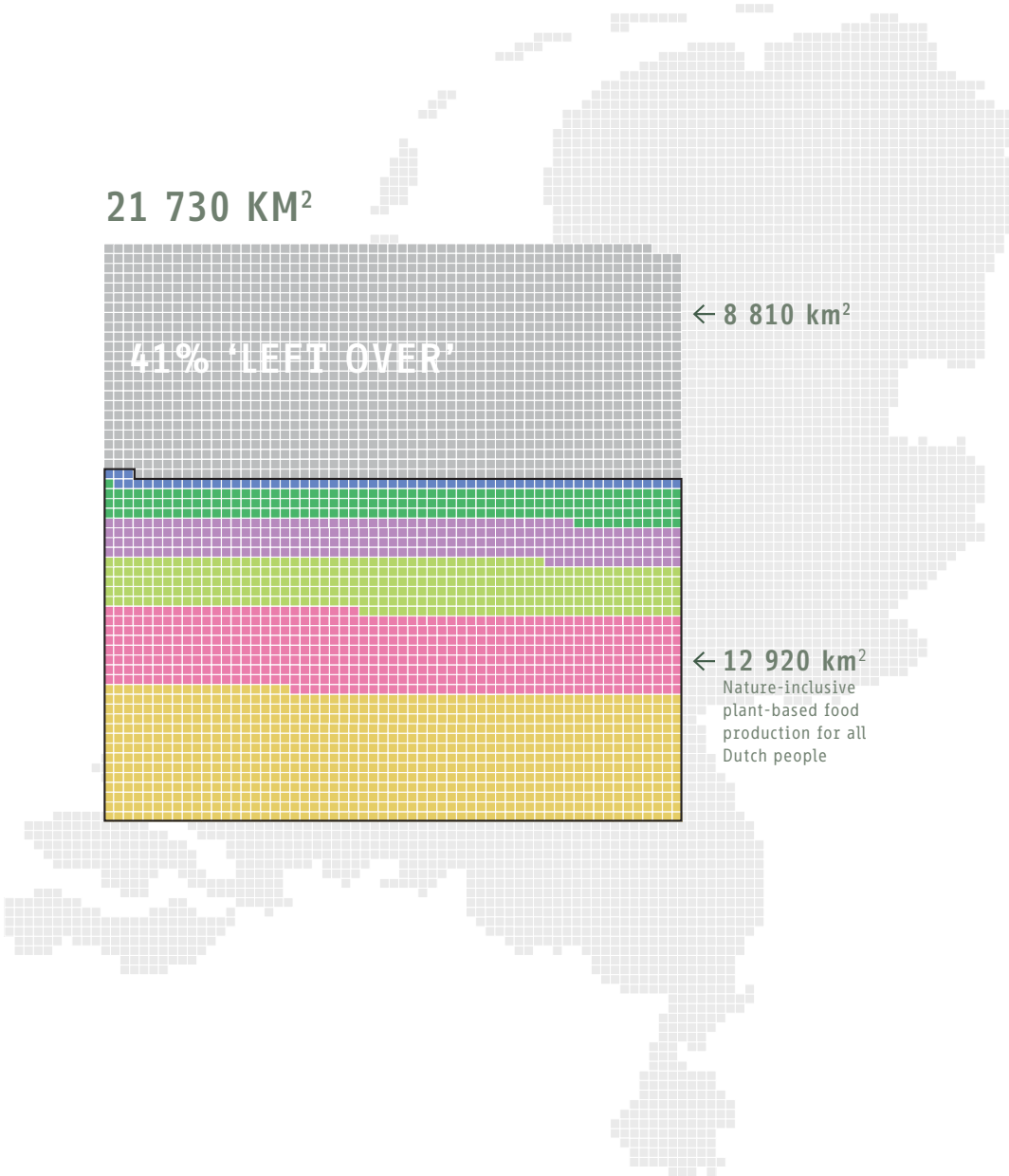
<sup>26</sup> Azolla is an aquatic fern that lives in symbiosis with nitrogen-fixing cyanobacteria, so that the fern has its own nitrogen supply, like papilionaceous flowers. Azolla can be highly productive, and the protein has a favourable composition of amino acids for mammals.



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Source: Atlas of natural capital, Editing map production potential for arable crops  
<https://www.atlasnatuurlijkkapitaal.nl/kaarten>

# 62 AGRICULTURAL LAND IN THE NETHERLANDS



# 63 Required agricultural land per capita

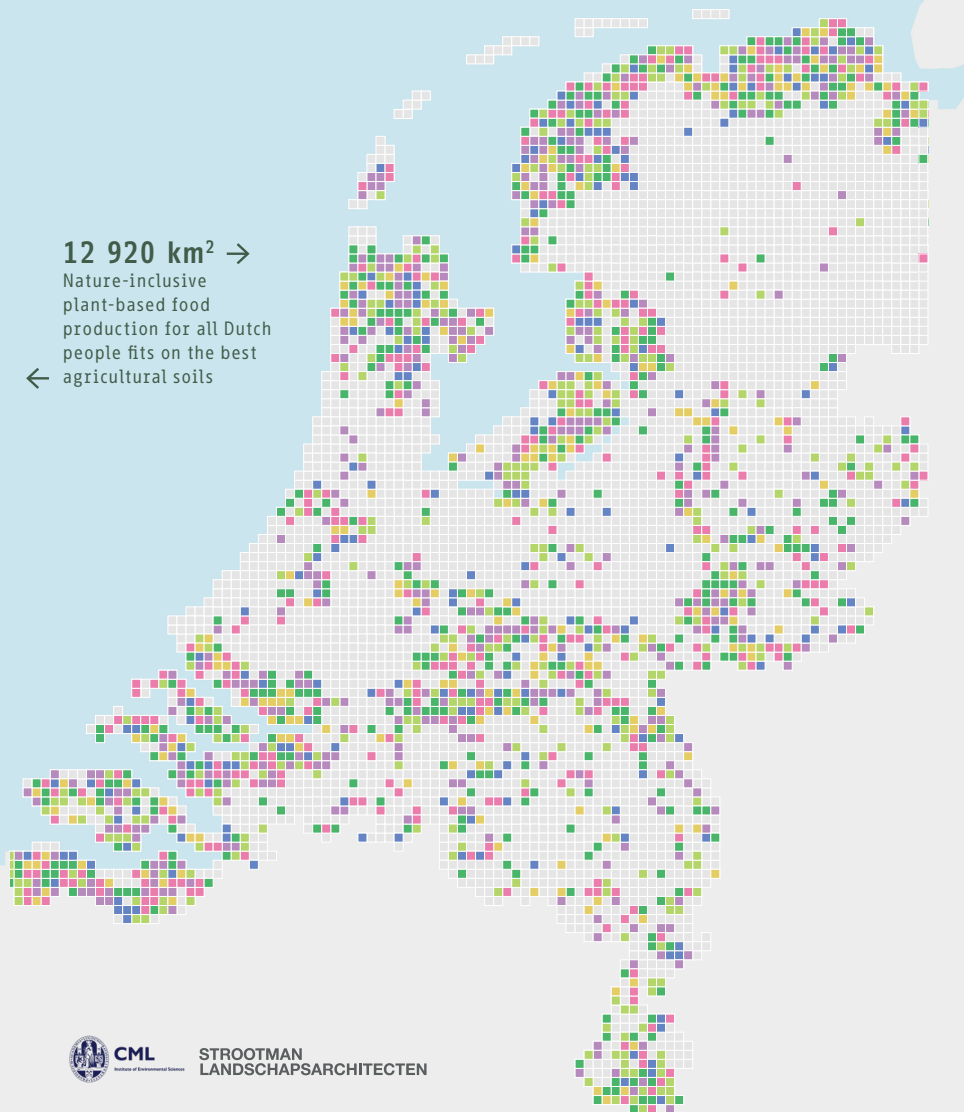
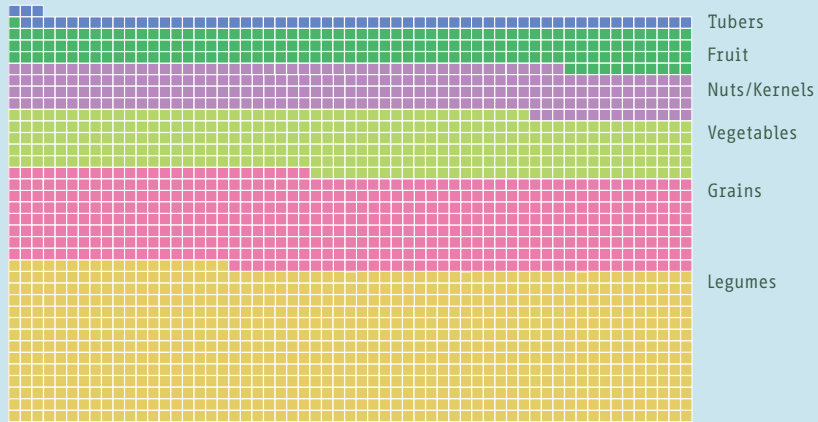
From our calculations we arrive at a use of space of 720 m<sup>2</sup> per capita. This compares favourably with the current situation of 1,800 m<sup>2</sup> for the Netherlands and other countries combined. We have calculated that 59% of the current agricultural land is sufficient for this, meaning that 41% of the current agricultural land is 'surplus' and could be used to meet the challenges facing the country (see Chapter 4).

Because we assume nature-inclusive agriculture, crop rotation, green manure, and so on, the plant-based food production landscape of a vegan Netherlands requires more space per person than would be the case with conventional arable farming. The food production landscape that we envisage leaves room for nature on and around the plots, met the emphasis on soil and water quality. The rotation pattern has been extended from 1 to 3 crops to 1 to 8, and mosaic, strip and mixed cultivation are applied. The landscape is diverse with different crops and free of pesticides. Hay is used as a plant fertilizer and there is a strong reduction in the use of artificial fertilizer.

27 Similar studies on the land use of alternative low-carb and low-dairy diets are usually calculated from nutritional guidelines. As this is a spatial design study, we put the focus on using a limited number of sample crops for our calculation, and then compared our results with existing studies. These arrive at figures of the same order of magnitude. These include the following publications or projects: Urgenda (2023), Poore, Nemeck (2018), Navarre et al. (2023) and Nieuwe Vroenten (2024)



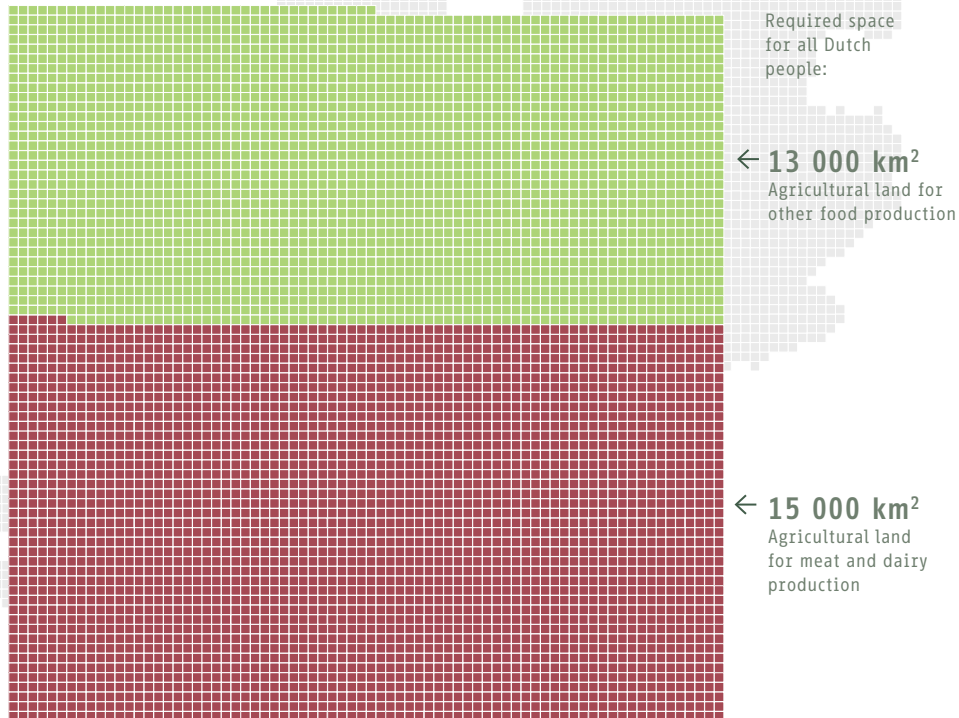
64 **FOOD PRODUCTION  
FITS WITHIN THE BEST  
AGRICULTURAL SOILS**



12 920 km<sup>2</sup> →  
Nature-inclusive  
plant-based food  
production for all Dutch  
people fits on the best  
← agricultural soils

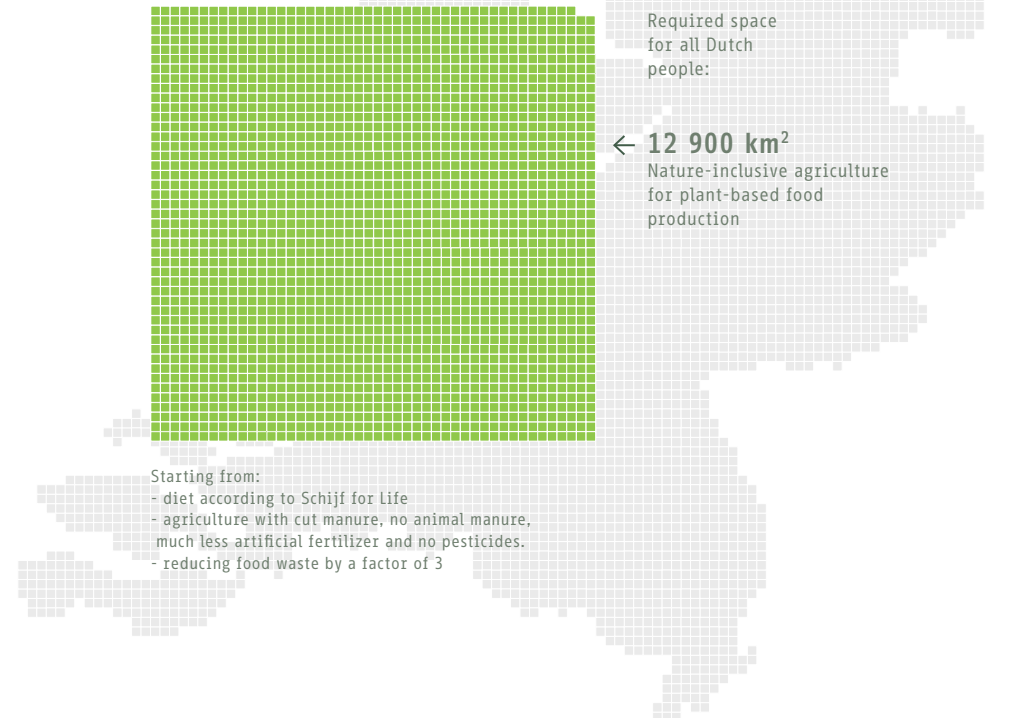
# 66 FROM 1800 M<sup>2</sup>

THE NETHERLANDS NOW  
FOODPRINT DOMESTIC+ABROAD:  
1800 M<sup>2</sup> PER PERSON



Source: (PBL)

NEDERLAND, VEGANLAND?  
FOODPRINT:  
720 M<sup>2</sup> PER PERSON



# TO 720 M<sup>2</sup>

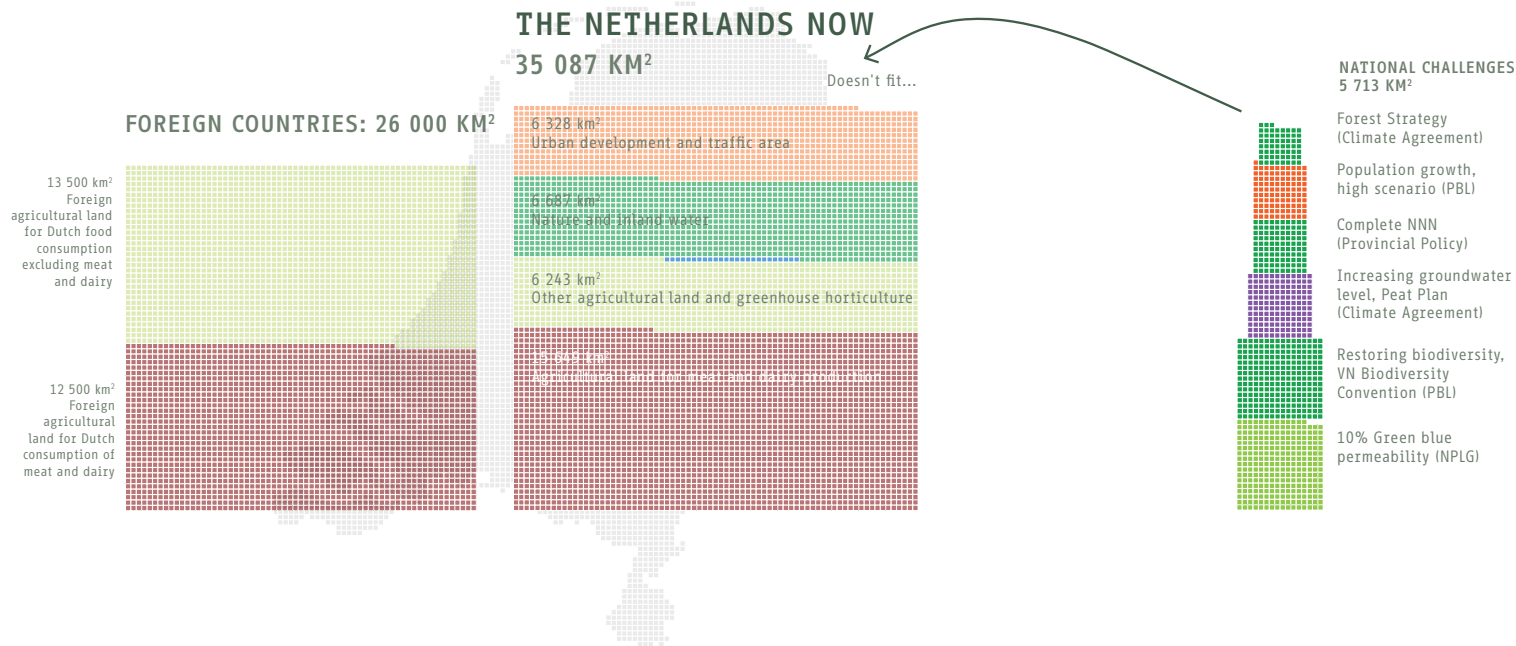
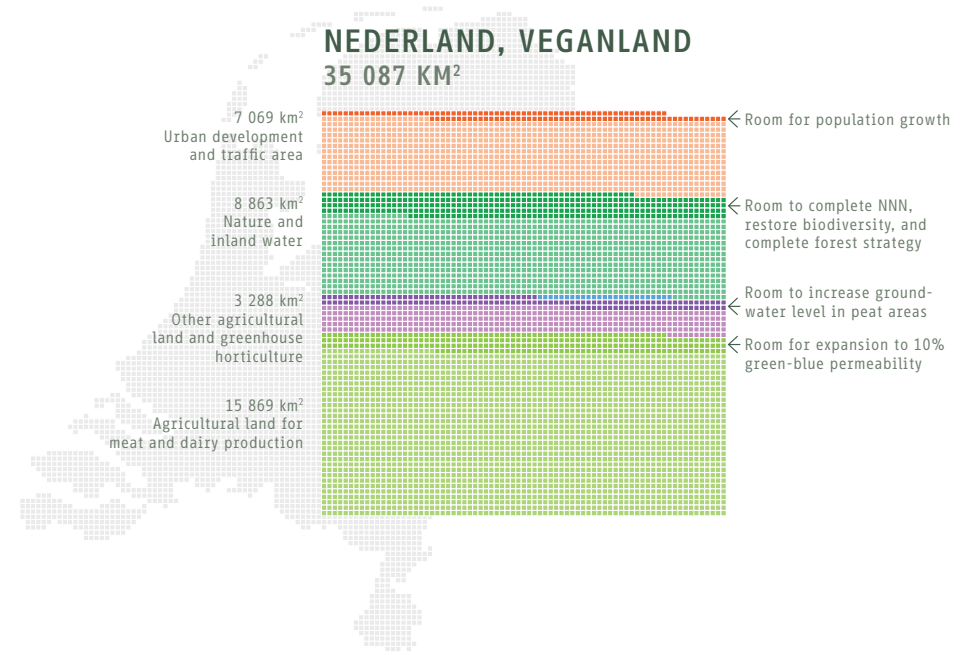
# 04

The previous chapter has shown that a fully vegan diet for a Dutch population of 20 million can be produced in a nature-inclusive way within the national borders, while still leaving enough room for the achievement of various other social desiderata. What are the pros and cons of a vegan Netherlands?

## IMPACT OF NEDERLAND, VEGANLAND



The previous chapter showed that the entire Dutch population can be fed with an integral nutritional diet according to the Wheel for Life within the national borders. That is not all: we can also achieve the entire list of social demands, with all those aspects for which there is not enough room in the present situation. In fact, not even all of the available agricultural land is needed to achieve that goal. Some areas in the Netherlands have a fairly low productive potential for arable crops. You could envisage extensive forms of arable farming there, but it probably makes more sense to think in terms of different crops such as agroforestry, woodlands, energy-yielding crops and water storage. The peat meadows can become natural grasslands that supply the hay plant fertilizer for the arable lands.



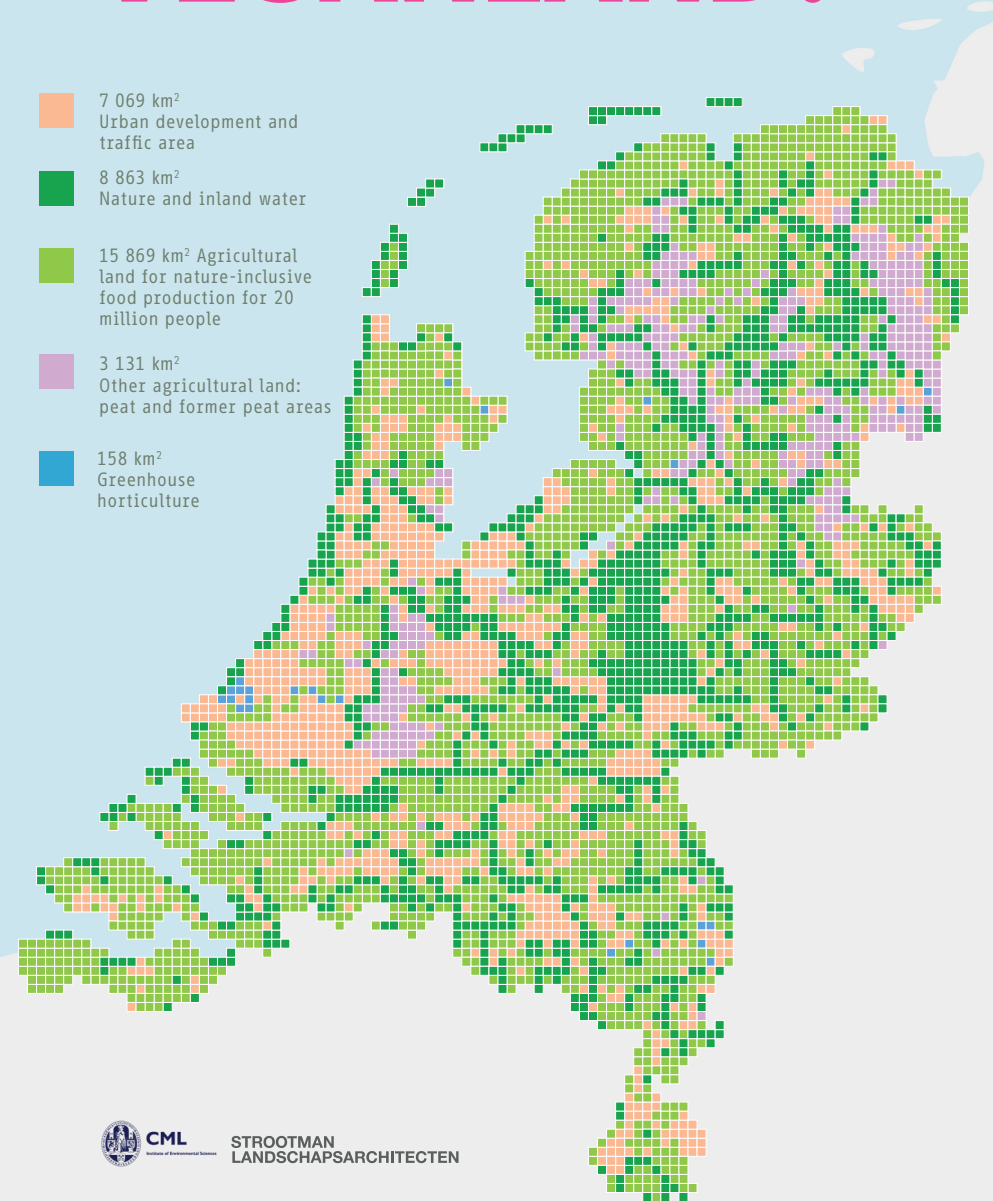


# 72 ADVANTAGES OF A FULLY PLANT-BASED FOOD PRODUCTION SYSTEM IN THE NETHERLANDS:

We have reshuffled the cards of the Netherlands with a self-sufficient vegan food production system that includes the space for meeting social demands. The various components of 'Nederland, Veganland?' are explained step by step in the following pages.

# 73 NEDERLAND, VEGANLAND?

- 7 069 km<sup>2</sup> Urban development and traffic area
- 8 863 km<sup>2</sup> Nature and inland water
- 15 869 km<sup>2</sup> Agricultural land for nature-inclusive food production for 20 million people
- 3 131 km<sup>2</sup> Other agricultural land: peat and former peat areas
- 158 km<sup>2</sup> Greenhouse horticulture

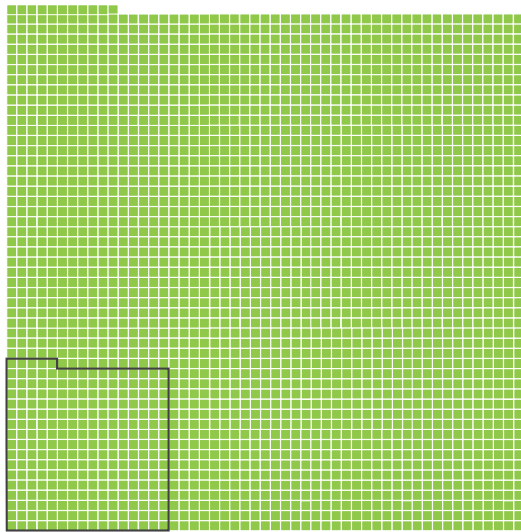


CML

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# 74 WE CAN PROVIDE HEALTHY AND SUSTAINABLE NUTRITION FOR A POPULATION OF 20 MILLION IN THE NETHERLANDS.

15 869 km<sup>2</sup>  
Agricultural land for nature-inclusive food production for 20 million people



1 678 km<sup>2</sup>  
Including 10% green-blue permeability (NPLG)



# 76 ENOUGH SPACE TO REACH NATURE GOALS

## More nature

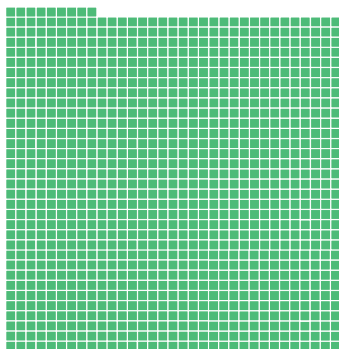
The Netherlands Nature Network is implemented, plus 150,000 hectares of extra nature. This makes it possible, among other things, to fully implement the original EHS along with the later additions of 'robust links'.

## More biodiversity

Besides the considerable increase in the surface area for nature, the biodiversity of the agricultural land will also increase considerably because of a more extensive farming and the abandonment of chemical pesticides. The agricultural landscape becomes more diverse as a result of the change in crops and the many transitions that will be created.

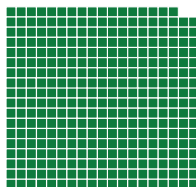
Current: 6 687 km<sup>2</sup>

Nature and inland water (excluding large coastal lakes)



Extra: 2 176 km<sup>2</sup>

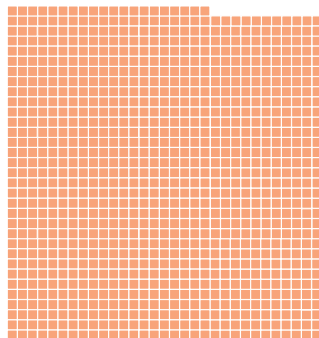
Restore biodiversity, UN Convention on Biodiversity (PBL)(150.000ha)  
Complete NNN (Provincial policy)  
Complete the forest strategy (Climate Agreement)



# 78 ENOUGH SPACE FOR POPULATION GROWTH AND THE GREENING OF CITIES

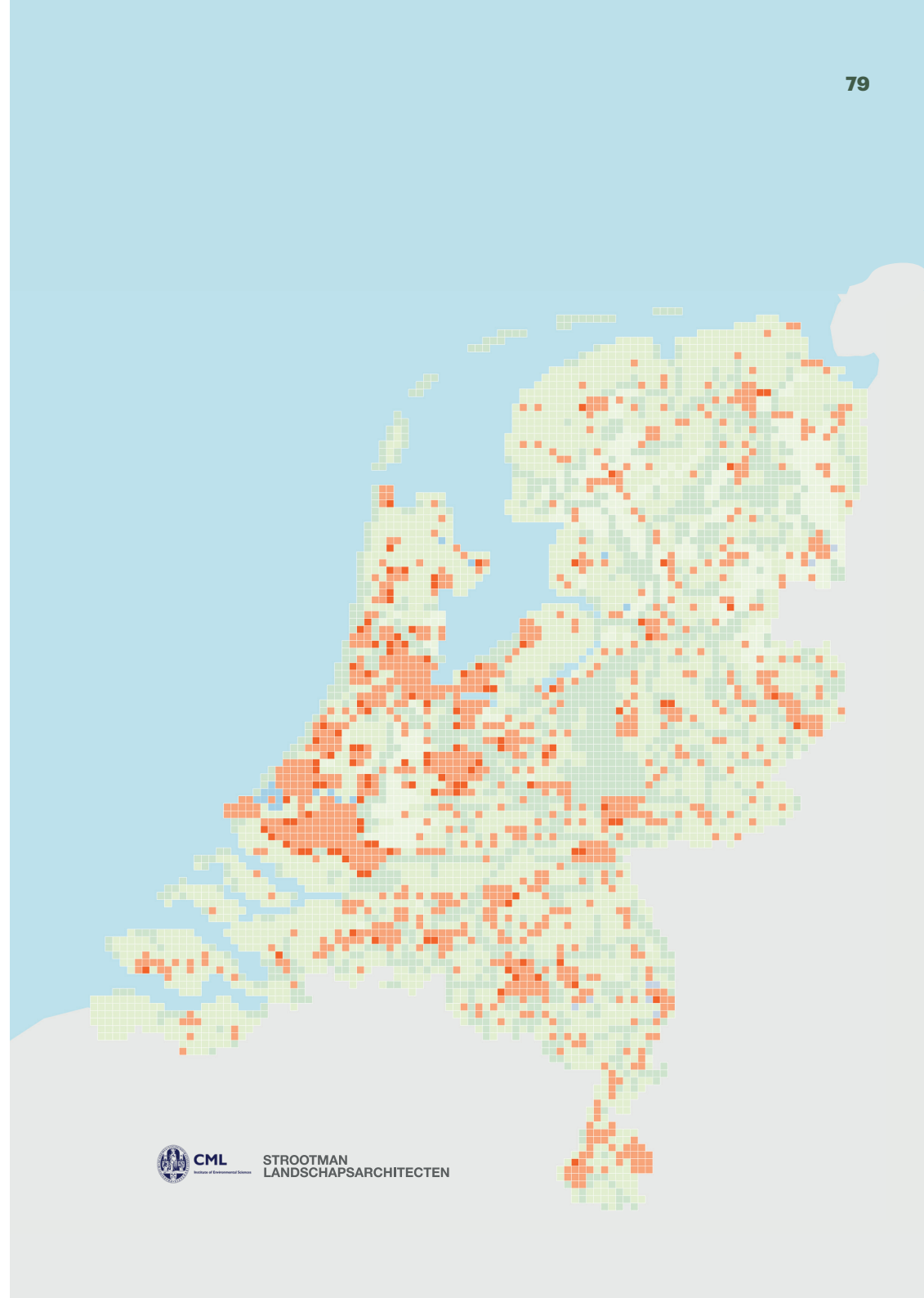
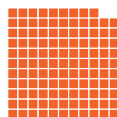
10% extra woodlands in line with the forestry strategy, 10% green-blue services, spaces for water storage, etc. Enough room for housing according to the most generous urban development scenario which assumes 14% extra urban area in 2050.

Current: 6 328 km<sup>2</sup>  
Urban area and traffic terrain



Extra: 741 km<sup>2</sup>  
Population growth + 3.4 million,  
high scenario (PBL)

Space for greening  
the urban environment





## 80 MORE BEAUTIFUL LANDSCAPES

Thanks to the extra nature, 10% green-blue services and extensive crop cultivation without the use of chemical pesticides, the quality of the landscapes will be considerably enhanced. In designing the transformation of all those landscapes, it will of course be necessary to take into account their cultural historical values and characteristic qualities.<sup>28</sup>

<sup>28</sup> A good starting point for this is provided by the 78 landscapes that the Netherlands Cultural Heritage agency distinguishes in the Netherlands, to be refined further with landscape biographies. See: <https://www.cultureelerfgoed.nl/onderwerpen/bronnen-en-kaarten/overzicht/panorama-landschap>



Willows and ditches in the flower-rich meadow (Photo: Harry Cock)



## 82 **CLEAN AIR, WATER AND SOIL**

The KRW targets are met without any problem because the poor water quality is mainly due to the washing out of artificial fertilizers and chemical pesticides. The soil will become healthier because virtually no more artificial fertilizers will be used, no animal fertilizer, and no chemical pesticides. The quality of the air improves sharply: the problem of ammonia is solved in one blow.





## 84 **GOOD FOR THE ECONOMY**

The social cost-benefit analysis shows that in spite of the heavy investments required for the transition to a fully plant-based agriculture, there is nevertheless a positive effect on the Dutch economy (see appendix).



Plant-based dairy alternatives from Dutch soil (Source: De Nieuwe Melkboer)



## 86 ANIMAL WELFARE

Because no animals are kept for their meat, milk and eggs any longer, the associated animal welfare problems disappear.



## 88 HEALTH

Thanks to the much improved environmental quality and the promotion of biodiversity, the health of the population will improve. More nature also makes its contribution to health. Whether a vegan diet is healthier depends to a large extent on the level of consumption of snacks, processed food, fruit and vegetables.

89



No shit farm (farm Zonnegoed van Joost van Strien)

# <sup>90</sup> ZOONOSES WILL BE LESS COMMON

A zoonosis is an infectious disease that can be transmitted from animals to humans. Zoonoses that occur in the Netherlands are COVID-19, Lyme disease, Q fever, toxoplasmosis, salmonella infection and avian influenza. Roughly two-thirds of the transmitters of infectious diseases are animals. People can become infected by them in various ways: via food, water or air, and via direct contact with infected animals or infected animal material such as animal manure.<sup>29</sup> Zoonoses will decline sharply because animals will no longer live in crowded conditions in sheds.



<sup>29</sup> <https://www.rivm.nl/rivm/kennis-en-kunde/expertisevelden/zoonosen>

Meadows between the onions and carrots, Cornelis Mosselman (Photo: Harry Cock)

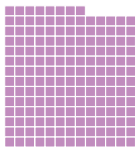


# 92 SPACE FOR CULTURAL-HISTORIC PEAT LANDSCAPES AND FOOD FORESTS

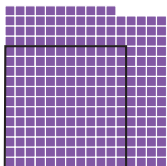
## Room for crops for building material

On the soils that are least suitable for the production of plant-based food – peatlands, fen communities and the recent heath reclamations – there is room for the cultivation of building materials such as timber, reed mace, peat moss, elephant grass, etc.

3 131 km<sup>2</sup>  
Other agricultural land:  
Peat and Peat Colony

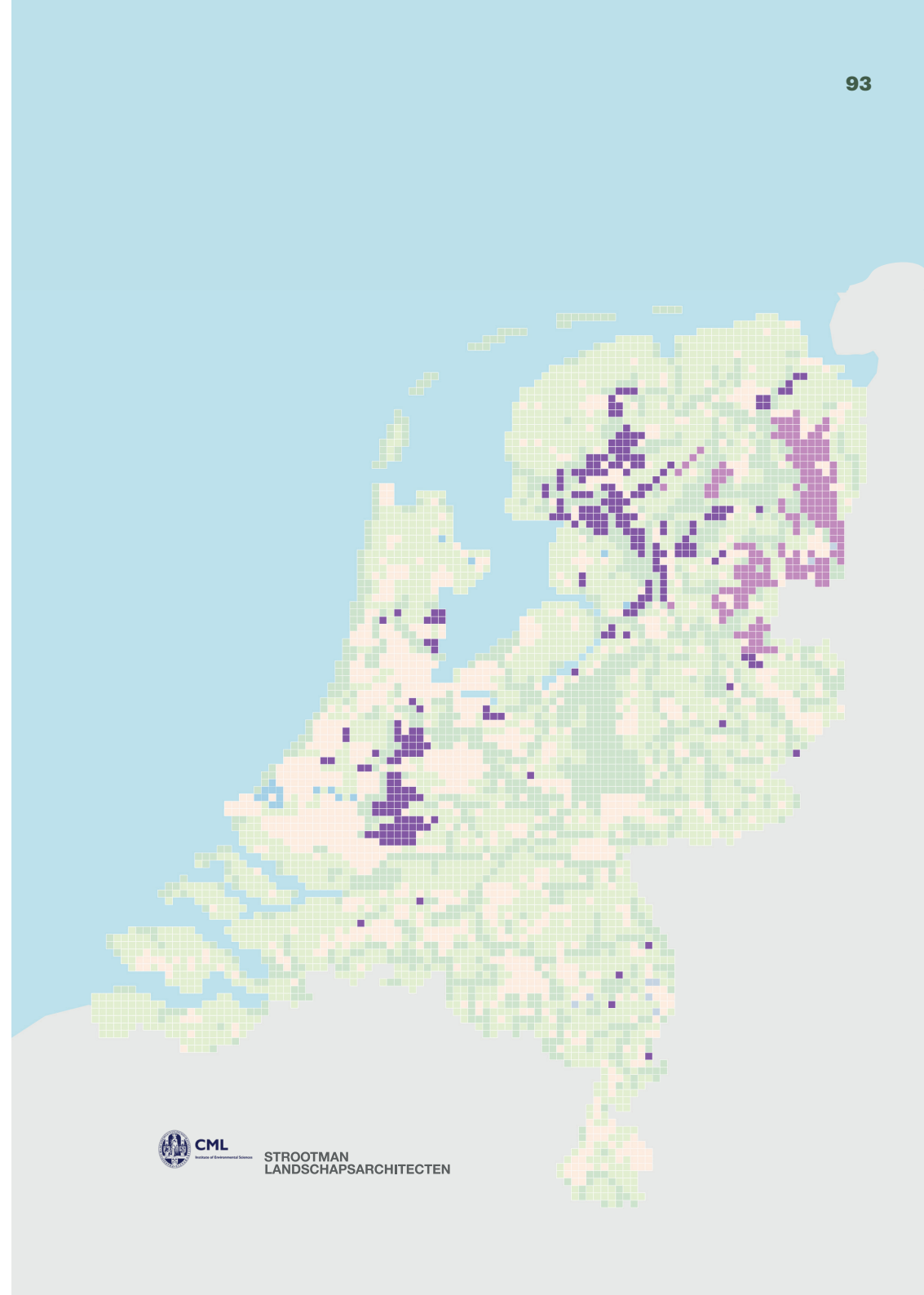


Peat colonies:  
Use for growing biomass, mulch, food forests or other extensive agriculture



Peat:  
Cultural heritage in combination with extensive agriculture

900 km<sup>2</sup>  
Including raising the groundwater level, Peat Plan (Climate Agreement)



## 94 **ROOM FOR WATER STORAGE**

Because of the use of hay as a fertilizer, the content of organic matter in the soil will increase and so will its ability to retain moisture. In addition, the water level will be raised in peat meadow areas to retain more water. Our model has also taken into account the availability of more room for water storage.



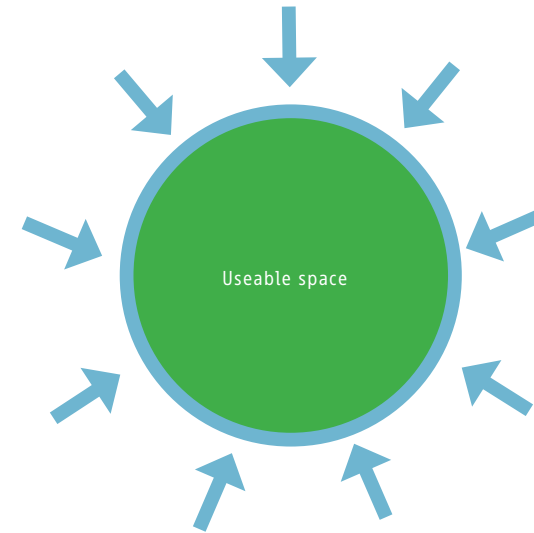
High water levels in the landscape (Photo: Harry Cock)

## 96 CLIMATE JUSTICE

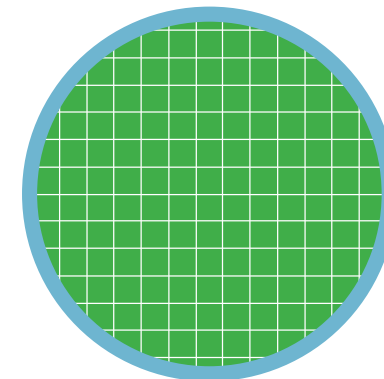
One of the main questions of the EFL Foundation concerned the justness of the climate transition. In 'Nederland, Veganland?' there is more respect for the values of people, animals and plants, who all have the right to exist on our planet within an ecological and evolutionary system. Food will become slightly less expensive in the Netherlands, making it easier for those with a low income to purchase healthy food. People with relatively low incomes suffer relatively more disadvantages from the present system. If those disadvantages disappear, it will be to their benefit and will make the Netherlands a more equitable country. The burdens will be better distributed, but whether that is also true of the benefits is questionable, because that requires specific policy that is independent of the food issue itself. The vegan diet will also have consequences internationally. First of all, the Netherlands would be a splendid example for others, but even more important is the fact that it would ease the pressure on countries like Brazil, where tracts of the Amazon are being deforested for the production of soya that is imported as animal feed for poultry, pigs and dairy cows.

Climate justice also requires the involvement of citizens and other interested parties in a transparent and honest decision-making. That applies not only to people but also to plants, animals and ecosystems. We have not developed that aspect here. It involves taking into account the interests of everyone and preventing the passing on of accountability to others as much as possible. 'Nederland, Veganland?' contributes to restorative justice by no longer keeping animals and restoring biodiversity. If 'Nederland, Veganland?' were to be copied elsewhere in the world, the contribution to climate justice would be even further enhanced.

## 97 HOW CAN WE REACH A POSITION WITHIN THE PLANETARY BOUNDARIES



## ... AND STAY THERE AND DISTRIBUTE THIS SPACE FAIRLY?



○ Planetary boundaries

## 98 CONS

Disadvantages of a fully plant-based food production system in the Netherlands:

### Not eating meat or dairy products any longer

Many Dutch are attached to eating meat and cheese and drinking yoghurt and milk. A shift to a different diet will have a major impact. Consumers will have to grow used to eating differently and will have to learn to cook differently. Not everyone is keen on eating legumes to obtain protein. Vitamin B12 will have to be taken in the form of supplements. All the same, the transition to a vegan diet has never been as easy as today, and more and more vegan products will appear in the years ahead that resemble the animal products to which people are accustomed: vegan dairy and meat substitutes, for instance. Work is also under way in the Netherlands (Those Vegan Cowboys)<sup>30</sup> and in Denmark (Remilk)<sup>31</sup> on the production of vegan dairy products by fermentation; that results in vegan dairy products like the familiar ones, but without lactose, cholesterol, hormones and antibiotics.

### No more cows and sheep grazing in the meadow

Most farm animals in the Netherlands are never seen by the public. Of the approximately 4 million cattle, about a third sometimes walk in the meadow. Of the approximately 1 million sheep and goats, the 12 million pigs and 100 million Dutch chickens are never seen by the public. If the Netherlands had no livestock farming at all, the characteristic image of a cow in the meadow would also disappear.

<sup>30</sup> <https://thosevegancowboys.com/>

<sup>31</sup> <https://www.remilk.com/>

## 99 The transformation calls for a major transition

The impact is great. A complete shift to the production of plant-based food means that all livestock farmers must abandon a tradition and will have to learn a new profession, and that new arable farmers and vegetable growers will also have to be trained. Furthermore, it means that all kinds of investments that have been made in livestock farming will have to be written off in a faster tempo. Arable land will have to be parcelled afresh. The meat processing and dairy processing industry will have to be dismantled, alternative processing will have to be built up, etc.

**It's like  
milk but  
made for  
humans.**



So what is this oat drink anyway? Milk? No, it's not milk. Milk comes from a cow. It was designed for baby cows. Oats grow. You plant them in the soil of the earth and allow the sun to shine on them and they grow. Tall and strong and full of purpose. A couple of decades ago, we looked into the nutritional characteristics of oats and thought: what if we forgot the cow altogether and turned these oats into a drink that was designed for humans? So we did. And here it is. Please do enjoy!

Source: <https://www.oatly.com/nl-nl>

# 100 COSTS AND BENEFITS

Is it economically viable to take such a big step? What would it mean for the Dutch economy? Aren't the agricultural sector and the meat and dairy processing industry very important for the Dutch world of industry and commerce? To answer that question we invited Max van der Sleen<sup>32</sup> to carry out a Social Cost-Benefit Analysis with particular attention for General Welfare.<sup>33</sup> A compact version is included as an appendix to this publication.

In short, the conclusions are:

'Nederland, Veganland?' has the potential to bolster and transform the Dutch economy over a period of 20-25 years in such a way that the General Welfare in the Netherlands increases.

The Gross Domestic Product (GDP), an important indicator of General Welfare, grows in 'Nederland, Veganland?' more than in the Business as Usual (BAU) scenario.<sup>34</sup>

In 'Nederland, Veganland?' the scaling down of livestock farming by 100% is accompanied by the building up of market gardening and arable farming by 200%. This entails a more limited drop in the GDP than in the BAU scenario, because the Added Value per hectare of market gardening and arable farming is larger than with livestock farming.

The Internal Rate of Return of the social investment in 'Nederland, Veganland?' of € 117 billion over 20 years amounts to 13% as against the BAU scenario with a total investment of € 58 billion. An Internal Rate of Return of 13% is high by comparison with the 2 to 4% that the Ministry of Finance applies standard to large-scale national projects in infrastructure and climate.

The two other result indicators – the Net Present Value and the Cost-Benefit ratio – are also positive for 'Nederland, Veganland?'.

<sup>32</sup> Max van der Sleen is an economist, was director of Ecorys Netherlands BV, worked for 17 years at the Netherlands Economic Institute, and now works for Ethical Growth Strategies B.V.

<sup>33</sup> <https://www.cbs.nl/nl-nl/dossier/dossier-brede-welvaart-en-de-sustainable-development-goals>

<sup>34</sup> Business as Usual: here defined as: full implementation of the National Rural Areas Programme with an investment of € 58 billion, as estimated by the regional governments.

## Nederland Veganland scored using the CBS Bredewelvaartsindicatoren





## 102 Is 'Nederland, Veganland?' realistic?

Certainly not in the short term. But it is a thought exercise, not a plan. People are attached to their piece of meat or cheese and to the yoghurt they have for breakfast. Livestock farmers will not be keen on the switch and their interest organisations will exert their influence to oppose such a development. The meat and dairy processing industrial lobby is powerful.

Nor is it our purpose to force everyone to become a vegan in the short term. You could never impose that anyway.

But what we do find interesting is that it would bring so many benefits to the Netherlands: the promotion of animal welfare, the achievement of the agricultural climate targets, the greater availability of space, the improvement in the water quality, the provision of more space for nature, the benefits for biodiversity, the solution of the nitrogen problem, the promotion of health, and the use of less land internationally, which leads to a more equitable system. In short, a more relaxed Netherlands.<sup>35</sup> The environmental damage due to the emission of polluting materials in the air by livestock farming, calculated at € 8.3 billion for 2021,<sup>36</sup> disappears. An en masse switch to a vegan diet has nothing but advantages.

'Nederland, Veganland?' hopes to contribute to raising awareness of the influence of the choices that we make and helps to form a picture of how the Netherlands might look if we radically change our present diet. Extreme ideas are sometimes helpful to arrive at new insights, because they broaden our gaze and enable us to consider the present state of affairs and the future in a different light.

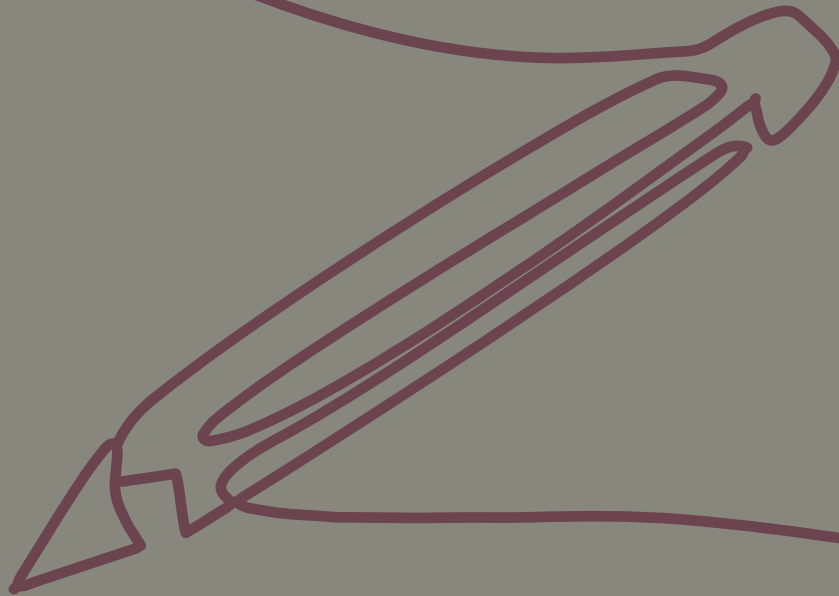
## 'NEDERLAND, VEGANLAND?', A DOCUMENT FOR DISCUSSION



<sup>35</sup> See too [www.OntspannenNederland.nl](http://www.OntspannenNederland.nl)

<sup>36</sup> Position paper for the Second Chamber Ministry of Economic Affairs Committee for its sitting on the economic costs of the nitrogen crisis, September 2023, Max van der Sleen, Ethicalgrowth2020

# APPENDIX



- 01 SOCIAL  
COST-BENEFIT  
ANALYSIS
- 02 LAND USE  
CALCULATIONS

by Max van der Sleen, economist

## 106 APPENDIX 01 Social Cost-Benefit Analysis

by Max van der Sleen, economist

'Nederland, Veganland?' is a thought exercise that seeks to give an answer to the question: to what extent would a switch to a completely vegan diet be able to contribute to greater climate justice in the world? Climate change requires us to adapt our behaviour in order to achieve a drastic reduction in greenhouse gas emissions. Since the food industry, and particularly livestock farming, contributes almost 30% to the emission of greenhouse gas in the world, it may be attractive to consider alternative diets. This gave rise to the question: what if everyone in the Netherlands were to switch to a vegan diet and no more meat or animal feed were to be imported?

An important research question in 'Nederland, Veganland?' bearing on considerations of justice is what the ratio between costs and benefits would be. To answer this question, a Social Cost-Benefit Analysis has been conducted. In 2023 the Food and Agriculture Organisation of the United Nations (FAO) carried out a study of the external costs of the global food production system and also indicated the costs per country. For the Netherlands it estimates that the annual environmental costs amount to € 11.7 billion, and health costs coming to an additional € 38.9 billion. The latter are the health costs arising from an unhealthy diet. So the total social costs of the present agricultural and food production system amount to € 50.6 billion. On the other hand, the benefits for the farmers amount to around € 10 billion, and all agro-chains taken together including the food processing industry (sugar, coffee, chocolate) in the Netherlands earn € 50 million. So in economic terms our present food production system only breaks even, because the costs are as high as the benefits.

Using the General Welfare Monitor developed by Statistics Netherlands (CBS),<sup>37</sup> we have identified the fields and General Welfare Indicators (GWI) that would be affected by a structural switch by the agricultural sector in the Netherlands to a fully plant-based production. The economic costs and benefits for Dutch society have been charted for 13 GWIs, using the procedure, methods of assessment<sup>38</sup> and information that are in use in the Netherlands, the rest of Europe and elsewhere for Social Cost-Benefit Analysis.<sup>39</sup> For the other five we conducted a qualitative analysis on the basis of academic knowledge, logical reasoning, or common sense.

This Social Cost-Benefit Analysis has been elaborated for the present Dutch agricultural system (2021) for 'Nederland, Veganland?' and for a scenario which assumes that the targets of the National Rural Areas Programme (NPLG) are achieved: the Business as Usual scenario. The latter scenario makes the following assumptions: (i) the National Rural Areas Programme targets for nature, water and the climate are achieved between 2035 and 2040; (ii) achievement of the targets is accompanied by a 30% reduction in livestock farming; and (iii) an investment of € 58 billion is made to implement the scaling down and reorganisation of agriculture and the restoration of nature over the period 2022-2040. This is based on the plans that the regional governments submitted in July 2023.

<sup>37</sup> Netherlands Statistics Monitor General Welfare and Sustainable Development Goals, 2023

<sup>38</sup> CE Delft, Environmental Prices Manual, 2023

<sup>39</sup> This is a 'just suppose' story. Vegan Netherlands is a thought exercise and this report is about an economic analysis of this thought exercise. Economists use the method of Cost-Benefit Analysis to help think through and calculate theoretical possible solutions to various problems. Such analyses are conducted all over the world for feasibility studies of investment plans. In Europe Cost-Benefit Analyses are even compulsory to obtain financing from EU structural funds for investment projects.

## 108 Explanatory comments on the Social Cost-Benefit Analysis method

The idea of conducting a Social Cost-Benefit Analysis is to obtain a clear picture in advance (ex-ante) of the change that a project aims to achieve within a number of years. It takes into consideration the differences both with and without the project or new policy. The analysis of these differences is crucial. In the present research, the 'Nederland, Veganland?' perspective is compared with the Business as Usual perspective (see Table 1). In both cases the temporal horizon is 2050. Financial prices have been used if they are available, and economic calculation prices if there are no market or administrative prices. In a conventional financial analysis, only the market or administrative prices are taken into account in calculating the cost prices of products. Economic analysis takes a broader view by taking the external costs into account as well. These are production factors that have no socially determined price because there is no supply and demand to fix a price, or because the market prices are so heavily influenced by subsidies, for example, that they no longer present a picture of the actual social costs and can no longer be used to orientate choices. These costs remain out of sight for the producers and consumers, which is why they are called external costs. The emissions of ammonia, fine particles, methane and other emissions that pollute the air and the water are charted each year in the Netherlands, but the costs of their effects on nature, water, climate and health are not yet charged to those responsible for them.<sup>40</sup>

<sup>40</sup> The costs are not charged to the polluter either in advance or afterwards. 'The polluter pays' is a basic principle in environmental science, but the opposite is usually the case in the agricultural sector. In the past phosphate rights and animal rights were created and now attempts are being made to see whether a trading system in nitrogen rights and CO2 rights can be set up. It is therefore profitable for farmers to speculate on the moment of its introduction and to have as many livestock as possible at that moment.

Table 1 characteristics of the present situation, the Business as Usual and the Vegan Netherlands scenarios

| Scenario  |               | NOW   | Δ<br>BAU-<br>NOW | BAU   | Δ<br>Veganland<br>NOW | Veganland |
|---|---------------|-------|------------------|-------|-----------------------|-----------|
| Year  |               | 2023  | 2024-40          | 2050  | 2024-43               | 2050      |
| Transition period in years                          | Number        |       | 17               |       | 20                    |           |
| Population  | mln.          | 17,8  |                  | 20    |                       | 20        |
| Land use  |               |       |                  |       |                       |           |
| Built up  | Ha*1000       | 632   | 74               | 706   | 74                    | 706       |
| Livestock farming + animal feed crops               | Ha*1000       | 1.157 | -181             | 976   | -1.157                | -         |
| Agrarian nature - hayfields                         | Ha*1000       |       | 181              | 181   | 221                   | 221       |
| Arable farming + market gardening                   | Ha*1000       | 655   | -                | 655   | 562                   | 1.217     |
| Other agrarian land – unprotected                   | Ha*1000       | 266   | -151             | 115   | -151                  | 115       |
| NNN forest and land                                 | Ha*1000       | 341   | 77               | 418   | 250                   | 591       |
| Other nature  | Ha*1000       | 345   |                  | 345   | 200                   | 545       |
| NNN water   | Ha*1000       | 759   |                  | 759   | -                     | 759       |
| Total NL land surface area                          | Ha*1000       | 3.509 |                  | 3.509 |                       | 3.509     |
| Total NL incl. sea + IJsselmeer etc.                | Ha*1000       | 4.155 |                  | 4.155 |                       | 4.154     |
| Protected land cover                                | % land        | 20%   |                  | 22%   |                       | 32%       |
| Environmental harm (gas emissions) from agriculture |               |       |                  |       |                       |           |
| Ammonia (NH3)                                       | Kilotons p.a. | 108   | -50%             | 54    | -91%                  | 9         |
| Greenhouse gases (CO <sub>2</sub> - eq.)            | Megatons p.a. | 27    | -50%             | 13    | -81%                  | 5         |
| Investment in the scenarios                         | EUR billion   | n.a.  | 58               | 58    | 117                   | 117       |



## 110 The General Welfare Trends for the scenarios

Statistics Netherlands distinguishes three dimensions in the General Welfare Trends: (i) here and now; (ii) later; and (iii) elsewhere. Red indicates that the trend/situation is bad, grey is neutral and green is good. If we consider 'Nederland, Veganland?' from a General Welfare perspective, 18 General Welfare Indicators are relevant for the economic analysis. For the GWIs 1-4 and 6-14 the trend direction can be determined using financial and economic methods of assessment. For GWI 5 (norms and values) and for the last four – GWIs 15-18 –the trend assessment is qualitative.

The following figure provides a total breakdown of the calculations.

**Table 4. Conclusions: the economic impact of Nederland, Veganland by comparison with the Business as Usual scenario**

| 1   | 2  | 3                  | Unit                         |   |             | Differences      |                     |                           |                         |
|---|--|--------------------|------------------------------|---|-------------|------------------|---------------------|---------------------------|-------------------------|
|   |  |                    | Scenarios                    | NOW   | BAU         | Veganland        | Δ BAU vs NOW        | Δ Veganland vs NOW        | Veganland vs BAU        |
| 1   | 2  | 3                  | 4                            | 5   | 6           | 7                | 8                   | 9                         |                         |
|   | <b>The effects of Nederland, Veganland on GWIs</b>                         | <b>Nº</b>          | <b>Unit</b>                  |   |             |                  |                     |                           |                         |
| General Welfare Here and Now                              | <b>GDP</b>   | <b>1</b>           | <b>Eur bn.</b>               | <b>33,1</b>   | <b>28,6</b> | <b>32,3</b>      | <b>-4,5</b>         | <b>-0,8</b>               | <b>3,7</b>              |
|   | <i>Contribution livestock farming</i>                                      | <b>1A</b>          | <b>Eur bn.</b>               | 15,3  | 10,7        | 0                | -4,6                | -15,3                     | -10,7                   |
|   | <i>Contribution arable farming, market gardening and nature management</i> | <b>1B</b>          | <b>Eur bn.</b>               | 17,8  | 17,9        | 32,3             | <b>0,1</b>          | <b>14,5</b>               | <b>14,4</b>             |
|   | <b>Individual consumption: spending on basic foodstuffs</b>                | <b>2</b>           | <b>Eur bn.</b>               | 34,5  | 39,9        | 32,0             | <b>5,4</b>          | <b>-2,5</b>               | <b>-7,9</b>             |
|   | <i>Annual spending on basic foodstuffs</i>                                 | <b>2</b>           | <b>€ pppyr.</b>              | 1.995   | 1.995       | 1.598            | -                   | <b>-397</b>               | <b>-397</b>             |
|   | <i>Average annual consumptive spending</i>                                 | <b>2</b>           | <b>€ 1000 per capit</b>      | 20.080  | 20.080      | 20.080           | <b>0,0</b>          | <b>0,0</b>                | <b>0,0</b>              |
|   | <i>Households' consumptive spending</i>                                    | <b>2</b>           | <b>Eur bn.</b>               | 361   | 402         | 402              | <b>40,8</b>         | <b>40,8</b>               | -                       |
|   | <i>Reduction in medical costs of obesity</i>                               | <b>2</b>           | <b>Eur bn.</b>               | 2,8   | 2,6         | 2,0              | <b>-0,3</b>         | <b>-0,8</b>               | <b>-0,5</b>             |
|   | <b>Overweight</b>  | <b>3</b>           |                              |   |             |                  |                     |                           |                         |
|   | <b>Overweight: NL with overweight</b>                                      | <b>3</b>           | <b>Nº mln.</b>               | 7,0   | 7,1         | 6,3              | <b>0,1</b>          | <b>-0,7</b>               | <b>-0,8</b>             |
|   | <b>No. of persons with severe overweight</b>                               | <b>3</b>           | <b>Nº mln.</b>               | 1,0   | 0,9         | 0,7              | <b>-0,1</b>         | <b>-0,3</b>               | <b>-0,2</b>             |
|   | <b>Benefit to GDP from less obesity</b>                                    | <b>3</b>           | <b>Eur bn.</b>               | -   | <b>0,4</b>  | <b>1,2</b>       | <b>0,4</b>          | <b>1,2</b>                | <b>0,8</b>              |
|   | <b>Society: norms and values</b>   | <b>4</b>           | <b>EIRR</b>                  | social cost-benefit analysis assessment standard          |             |                  | <b>5%</b>           | <b>8%</b>                 | <b>13%</b>              |
|   | <b>Work and leisure</b>  | <b>5</b>           | <b>Eur bn.</b>               | Depreciation of livestock farming and abattoirs in GWI 1A |             |                  |                     |                           |                         |
|   | <i>Job loss in the chain from livestock farming reduction</i>              | <b>1</b>           | <b>1000fte</b>               | 374   | 317         | 332              | <b>-56</b>          | <b>-42</b>                | <b>14</b>               |
|   | <i>New jobs outside agriculture and market gardening</i>                   | <b>5</b>           | <b>1000fte</b>               | 0   | 45          | 33               | <b>45</b>           | <b>33</b>                 | <b>-12</b>              |
|   | <b>GDP contribution new jobs</b>   | <b>5</b>           | <b>Eur bn.</b>               |   | <b>3,2</b>  | <b>2,4</b>       | <b>3,2</b>          | <b>2,4</b>                | <b>-0,8</b>             |
|   | <b>Land cover management</b>   | <b>6</b>           | <b>1000Ha</b>                | 686   | 809         | 1.107            | 122                 | 421                       | <b>298</b>              |
| <i>Land cover management in %NL</i>                       | <b>6</b>   | <b>%</b>           | 20%                          | 24%   | 32%         | <b>5%</b>        | <b>12%</b>          | <b>7%</b>                 |                         |
| <i>New jobs in nature/landscape management</i>            | <b>5</b>   | <b>1000fte</b>     | 0                            | 1,9   | 8,3         | <b>1,9</b>       | <b>6,3</b>          | <b>6,3</b>                |                         |
| <b>Environmental problems and benefits</b>                | <b>7</b>   | <b>Eur bn./yr.</b> | <b>11,6</b>                  | <b>5,8</b>  | <b>1,5</b>  | <b>5,8</b>       | <b>10,1</b>         | <b>4,3</b>                |                         |
| <i>Water quality</i>                                      | <b>8</b>   | <b>Eur bn.yr.</b>  | 1,0                          | 0,5   | 0,2         | <b>-0,5</b>      | <b>-0,8</b>         | <b>-0,3</b>               |                         |
| <i>Nitrogen deposit and land cover management</i>         | <b>9A</b>  | <b>Eur bn.yr.</b>  | 6,5                          | 3,2   | 0,6         | <b>-3,2</b>      | <b>-5,8</b>         | <b>-2,6</b>               |                         |
| <i>Urban exposure to fine particles (PM2,5) &amp; NEC</i> | <b>9B</b>  | <b>Eur bn.yr.</b>  | 0,7                          | 0,3   | 0,0         | <b>-0,3</b>      | <b>-0,6</b>         | <b>-0,3</b>               |                         |
| <i>Cumulative CO2 emissions</i>                           | <b>10</b>  | <b>Eur bn.yr.</b>  | 3,5                          | 1,7   | 0,6         | <b>-1,7</b>      | <b>-2,8</b>         | <b>-1,1</b>               |                         |
| <b>Gain in healthy life expectancy m+f</b>                | <b>11</b>  | <b>Eur bn./yr.</b> | -                            | <b>0,1</b>  | <b>1,2</b>  | <b>0,1</b>       | <b>1,2</b>          | <b>1,1</b>                |                         |
| <b>Physical capital goods stock</b>                       | <b>12</b>  | <b>Eur bn.</b>     | -                            | <b>57,86</b>  | <b>117</b>  | <b>58</b>        | <b>117</b>          | <b>59</b>                 |                         |
| <i>Land value mutations (part of 12)</i>                  | <b>13</b>  | <b>Eur bn.</b>     | 144                          | 337   | 331         | 193              | 187                 | -7                        |                         |
| <b>Average debt per livestock farm</b>                    | <b>14</b>  | <b>Eur 1000</b>    | 900                          | 900   | 450         |                  |                     |                           |                         |
| <b>Total debt</b>   | <b>14</b>  | <b>Eur bn.</b>     | 18,0                         | 18,0  | 18,0        | <b>0,0</b>       | <b>0,0</b>          | <b>0,0</b>                |                         |
| General Welfare Elsewhere                                 | <b>Import of goods from America</b>  | <b>15</b>          | <b>Eur bn.</b>               | added value trade loss is incorporated in GWI 1A          |             |                  |                     |                           |                         |
|   | <b>Import of biomass</b>   | <b>16</b>          | <b>Kton</b>                  | added value trade loss is incorporated in GWI 1A          |             |                  |                     |                           |                         |
|   | <b>Footprint on land (cultivated land in NL and elsewhere)</b>             | <b>17</b>          | <b>m² pp</b>                 | 1.832   | 1.217       | 719              | <b>-615</b>         | <b>-1.113</b>             | <b>-498</b>             |
|   | <b>Greenhouse gas footprint</b>  | <b>18</b>          | <b>Mt CO<sub>2</sub>-eq.</b> | 36,1  | 18,0        | 5,1              | <b>-18,0</b>        | <b>-31,0</b>              | <b>-13,0</b>            |
| <b>Environmental damage from greenhouse gas footprint</b> | <b>18</b>  | <b>Eur bn./yr.</b> | 4,7                          | 2,3   | 0,7         | <b>-2,3</b>      | <b>-4,0</b>         | <b>-1,7</b>               |                         |
| Social Cost-Benefit Analysis                              | <b>Investment</b>  |                    | <b>bn.</b>                   |   | -58         | -117             | -57,9               | -117                      | <b>-59,4</b>            |
|   | <b>Cost-Benefit ratio</b>  |                    | <b>Index</b>                 |   | 1,03        | 1,31             | 1,03                | 1,31                      | <b>1,49</b>             |
|   | <b>Internal Rate of Return</b>   |                    | <b>IRR %</b>                 |   | 5%          | 8%               | 5%                  | 8%                        | <b>13%</b>              |
|   | <b>Net present value of the cash flow</b>                                  |                    | <b>bn.</b>                   |   | 2,9         | 27,1             | 2,9                 | 27,1                      | <b>24,3</b>             |
|   | <b>Characteristics and GWIs</b>  |                    | <b>Scenarios</b>             | <b>NOW</b>  | <b>BAU</b>  | <b>Veganland</b> | <b>Δ BAU vs NOW</b> | <b>Δ Veganland vs NOW</b> | <b>Veganland vs BAU</b> |

## 112 External costs of agriculture

In the agricultural sector, and particularly in livestock farming, the external costs are high (see Figure 1). The contribution of the livestock farming sectors to the GDP for 2021 was € 25 billion. For that same year the external costs of the sector were calculated to be € 8.3 billion. The purpose of the ex-ante impact legislation in Europe is to take the external costs into account in structural decisions for the future and to spend the scarce public resources as efficiently as possible.

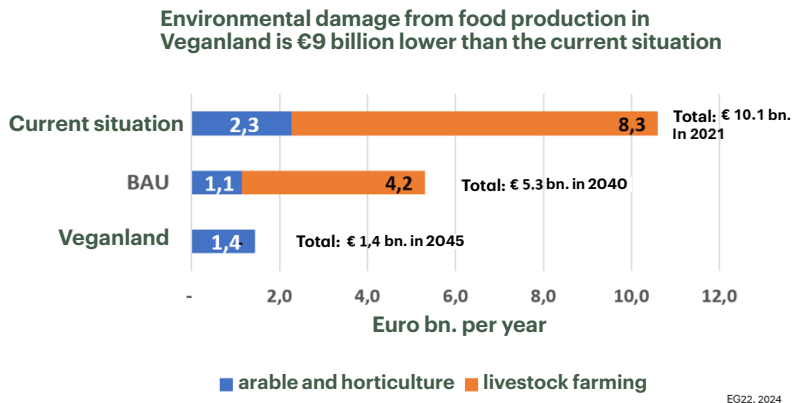


Figure 1. Social General Welfare benefit through reduction of the external costs in Dutch agriculture: now (2021) and at the end of the Business as Usual and 'Nederland, Veganland' transitions (2040-2045).

## Contribution of agriculture to the Gross Domestic Product (GDP)

For the BAU scenario, the most important premise is that a reduction of 30% will be needed in livestock farming if the National Rural Areas Programme targets are to be met. This works 1:1 in a loss of jobs, income and the contribution of livestock farming to the GDP. In the BAU scenario, the market gardeners and arable farmers are confronted with stricter environmental requirements. The assumption is that the sector tackles this and that entrepreneurs continue to make a profit, both in the short chains and in the input-intensive businesses. In the 'Nederland, Veganland?' scenario our calculations are based on the premise that livestock farming is progressively abandoned over a period of 20 years. Arable farming and market gardening are extended, the increase of scale trend comes to an end, and smaller businesses

specialise more in fresh products for the local market with short-chain agreements. Potatoes and onions remain in crop rotation (1:8 instead of 1:4) and a part of the commerce continues to exist (Dutch export of potato chips and potatoes, import of grain for bread). It is assumed that the number of farmers in the primary sector and the rest of the market gardening and arable farming chains will increase and that the present profit margins in these sectors will at least remain the same.

The result of this GDP comparison is that agriculture as a whole will earn less in the future than it does at present. The difference with the 'Nederland, Veganland?' scenario is, however, small (2.5% loss). This is a surprising result, given the enormous differences between the two agricultural systems: a self-sufficient vegan Netherlands versus 50% livestock farming with 70% export of meat, dairy and egg production. This is because the added value per FTE in livestock farming is lower than in arable farming and market gardening.

## Consumer spending incl. spending on basic foods

In 2020 the Dutch population spent € 35 billion on meat, fish, dairy products, eggs, potatoes and vegetables. This is € 1,995 per capita. The BAU scenario predicts that this remains roughly the same (12% of the available household income). In a vegan Netherlands € 32 billion of food is produced to meet the dietary needs of 20 million people. That amounts to € 1,600 per capita per year. This is because some of the present foods are imported (meat and grains) and that their contribution to the GDP is credited to the suppliers. In a vegan Netherlands the added value is built up by the Dutch chains. But it is not necessarily the case that the total spending power of the consumer grows as a result. Some of the substitutes for meat, dairy products and eggs will be processed products, and other products such as coffee and tea will still have to be imported. What this analysis shows is that the spending on basic foodstuffs will be lower in a vegan Netherlands, but that there is insufficient evidence to conclude that opting for a vegan diet in the Netherlands will increase the consumers' spending power. This means that in the calculations of the Social Cost-Benefit Analysis, the balance of costs and benefits of this GWI is zero.

## 114 Work and leisure: Employment in and outside agriculture

Both scenarios assume that 80% of the entrepreneurs and employees (fte per year) who lose their business and/or job because of the 30% reduction (BAU) or the total shutting down of livestock farming in a vegan Netherlands will find new work within a period of two years. This labour market reaction is in line with the Netherlands Environmental Assessment Agency and Statistics Netherlands prognoses of a structural shortage of technically qualified workers in the coming decades. This is one of the factors that limit the GDP loss due to the structural changes in the agricultural sector.

### Land cover management

The number of hectares of land under management will increase through the completion of the Netherlands Nature Network (40,000 hectares and 37,000 ha of forestry), the target of 181,000 hectares of new agrarian nature (BAU) and the additional space in the 'Nederland, Veganland?' scenario. It is supposed that there will be a subsidy for laying out, restoring and maintaining nature-inclusive landscape land of € 1,000 per hectare. This may take the form of existing farmers who make their enterprise more nature-inclusive or of action by new nature management organisations. This form of land cover management provides new jobs and offers scope for new enterprises (see too the second column in Table 5).

### Environmental problems and benefits

For the economic analyses the environmental problems, related to the emissions of substances that are harmful for the quality of water, air and nature, were quantified in volume of emissions and subsequently expressed in monetary terms according to environmental prices (see also Figure 1). The subsidiary components of the harm to nature, climate and health are listed separately.

### Water quality

The BAU scenario assumes that the National Rural Areas Programme targets for water quality will be met in the period 2024-2040. The 'Nederland, Veganland?' scenario assumes that the harm to water quality will decrease further because in the present situation the poor quality of the water is largely due to the leakage of nitrogen and phosphate from livestock farming. The calculation is based on the assumption that the level of pollution will drop by 80%.

## Nitrogen deposit and land cover type

The environmental damage is calculated by assigning prices to the quantities of gas emissions of ammonia and nitrogen oxides. The nitrogen component in the external costs due to livestock farming is calculated at € 6.46 billion in the present situation. The BAU 2040 scenario assumes a 30% reduction in livestock farming and a 50% drop in nitrogen emissions. In the 'Nederland, Veganland?' scenario emissions from livestock farming drop by 100% but there is an increase in the emissions caused by arable farming and market gardening. The nitrogen emissions are reduced more in 'Nederland, Veganland?' than in the BAU scenario. In the end the value of the nitrogen gain is € 2.6 billion per annum by comparison with the BAU scenario, and € 5.8 billion per annum by comparison with the present situation.

### Natural capital: Cumulative CO<sub>2</sub> emissions

This component in the natural capital of the Netherlands is an inseparable part of the global CO<sub>2</sub>-eq. level in the atmosphere. In this economic impact study, a theoretical approach is used to chart and assess the differences in impact of the BAU and Vegan Netherlands scenarios. A value was chosen of € 130 per ton CO<sub>2</sub>-eq. within the price range used by CE Delft. There is no method of measuring the cumulative emission levels directly. Instead, we have calculated how much an extra ton of emissions or a reduction in emissions costs or may cost Dutch society. Since there is no significant livestock farming in a vegan Netherlands, the CO<sub>2</sub> emissions drop by at least 15 megatons by comparison with the present situation and the BAU scenario.

### Benefit of healthy life expectancy

A Quality-Adjusted Life approach can be adopted to determine a value of extra years of life expectancy as the result of a healthier lifestyle. Various estimates have been made. We have chosen a study by the University of Maastricht (2013) which indicated that one healthy year of life may cost € 50,000. The life expectancy prognoses are made by Statistics Netherlands. Harvard published on the life-extending effect of five healthy lifestyle factors in 2019. To determine the economic effect of a vegan Netherlands on life expectancy, we assumed that a healthy diet contributes at least 2% to the total effect of a healthy lifestyle. In the BAU scenario this yields a social benefit of € 0.1 billion per annum, while the 'Nederland, Veganland?' scenario yields a social

**116** benefit of € 1.2 billion per annum. N.B. This is a very conservative estimate. If it can be incontrovertibly demonstrated in the future that a well-balanced vegan diet can yield a substantial health benefit – say 10% instead of 2% – the social benefit would rise to € 6 billion per annum.

### Physical capital goods stock

The physical capital goods stock is a measure of the growth potential of the economy. In this research we looked into the investments required to implement the BAU scenario and the 'Nederland, Veganland?' scenario. The following table indicates how the investment figures are determined. For the BAU scenario we have followed the € 58 billion quoted by the regional governments as the total required for the implementation of the National Rural Areas Programme. The investment required in the 'Nederland, Veganland?' scenario is roughly twice as much, covering: buying out livestock farming enterprises, assistance with the transition, extension of the arable farming and market gardening sector, extension of the surface area of nature and nature restoration, writing off land value, and the implementation costs of farming enterprises.<sup>41</sup>

### Land value mutations

It is assumed that in the decades ahead the space required for housing, recreation, traffic and work by the growth in population will be sought mainly in urban areas or those directly adjacent to existing infrastructure. The increase of the total built up area (74,000 hectares) is therefore limited. The value of building land is roughly 50 times higher than that of agricultural land, so the total land value will rise. The two future scenarios handle this in the same way. In the 'Nederland, Veganland?' scenario only part of the land that is made available by shutting down livestock farming is sold or leased for the extension of arable farming and market gardening and as hayfields to provide organic fertilizer. A large part will be used to extend the nature networks and natural landscape land. In financial terms this means a depreciation of roughly € 60,000 per hectare. The difference in depreciation costs between the BAU scenario and 'Nederland, Veganland?' has been calculated at € 30 billion. This has been included as part of the investment costs of the 'Nederland, Veganland?' scenario

<sup>41</sup> There are less expensive alternatives to set the transition in motion, but the advantage of these statistics is that they are transparent and in line with the estimates for the National Rural Areas Programme by the regional governments

## Conclusions arising from the Social Cost-Benefit Analysis

The analysis leads to the following insights:

- 1.** The 'Nederland, Veganland?' scenario has the potential to bolster and transform the Dutch economy over a period of 20-25 years in such a way that there is an increase in general welfare in the Netherlands. The GDP, an important General Welfare Indicator, also grows more in the 'Nederland, Veganland?' scenario than in the BAU scenario.
- 2.** In the BAU scenario livestock farming is made extensive (30% reduction) and the contribution to the GDP drops by comparison with the null situation. Against these social costs there are social benefits. The main benefits are a 50% reduction in environmental damage to water, nature and climate (following the National Rural Areas Programme targets).<sup>42</sup>
- 3.** In the 'Nederland, Veganland?' scenario, the scaling down of livestock farming by 100% is accompanied by the building up of market gardening and arable farming by 200%. This entails a more limited drop in the GDP because the Added Value per hectare of market gardening and arable farming is larger than with livestock farming. Moreover, a vegan diet as part of a healthy lifestyle – among some of the population – can make a limited contribution to the fulfilment of the Statistics Netherlands prognoses concerning extended life expectancy in the future.
- 4.** A Social Cost-Benefit Analysis uses three indicators to chart the potential impact of initiatives for change on the economy: (i) the Internal Rate of Return; (ii) the Net Present Value; (iii) the Cost-Benefit ratio. The Internal Rate of Return concerns the return on social investment. Its rate in the 'Nederland, Veganland?' scenario with an investment of € 117 billion over a period of 20 years is 13%, by comparison with the BAU scenario with an investment of € 58 billion. An Internal Rate of Return of 13% is high by comparison with the 2 to 4% that the Ministry of Finance applies standard to large-scale national projects in infrastructure and climate. The other two indicators – the Net Present Value and the Cost-Benefit ratio – are also positive for the 'Nederland, Veganland?' scenario.

<sup>42</sup> Draft National Rural Areas Programme and National Rural Areas Programme Planner, Dutch Government, 15 December 2023.



**118** These insights are relevant for a number of the major challenging facing the Netherlands in the field of urban and country planning, agriculture, environmental problems, nature, climate, nutrition, health and life expectancy. The Social Cost-Benefit Analysis of 'Nederland, Veganland?' provides a picture of the spatial organisation of the Netherlands at present and the relatively large significance of the agricultural sector for general welfare in the country. The harm to the environment by the agricultural sector is particularly striking. The results of this research on the effects of current land use in the Netherlands are relevant for policymakers and for all those interested in the economic aspect of explorations of the future. The results are interesting, perhaps even surprising. A 100% vegan Netherlands, but also a more plant-based production system, would provide not only greater climate justice but also a higher level of welfare for Dutch society. It would be wonderful if this exploratory research is followed up.

**Table 5 Survey of structural changes in the BAU and Vegan Netherlands scenarios for 2021**

| Agriculture   |               | Primary sector         |                      |                       |                |                 |               | Other chains         |                       | Total agriculture          |                             |               |
|---|---------------|------------------------|----------------------|-----------------------|----------------|-----------------|---------------|----------------------|-----------------------|----------------------------|-----------------------------|---------------|
| Structure of agriculture primary sector (2021)              |               |                        |                      |                       |                |                 |               |                      |                       |                            |                             |               |
| Sector  | Enterprises   | Surface area (1000 Ha) | Added Value (€ mld.) | Employment (1000 fte) | Added Value/ha | Added Value/fte | Added Value   | Added Value (€ mld.) | Employment (1000 fte) | Total Added Value (€ mld.) | Total Employment (1000 fte) | Added Value   |
| Arable farming  | 14.180        | 551                    | 1,2                  | 15                    | 38,9           | 2.114           | 77.667        | 4,5                  | 44                    | 5,6                        | 59                          | 95.719        |
| Market gardening  | 5.205         | 94                     | 2,0                  | 23                    | 18,0           | 21.894          | 89.022        | 1,5                  | 15                    | 3,5                        | 38                          | 92.368        |
| Greenhouse agriculture                                      | 3.300         | 10                     | 5,0                  | 46                    | 3,1            | 480.843         | 107.717       | 3,7                  | 37                    | 8,7                        | 83                          | 104.725       |
| Livestock farming   | 29.420        | 1.157                  | 1,9                  | 60                    | 39,3           | 1.658           | 31.958        | 13,4                 | 134                   | 15,3                       | 194                         | 78.808        |
| <b>Total</b>  | <b>52.105</b> | <b>1.812</b>           | <b>10,1</b>          | <b>144</b>            | <b>34,8</b>    | <b>5.567</b>    | <b>70.035</b> | <b>23,0</b>          | <b>230</b>            | <b>33,1</b>                | <b>374</b>                  | <b>88.586</b> |
| Structure of agricultural sector in the BAU scenario (2040) |               |                        |                      |                       |                |                 |               |                      |                       |                            |                             |               |
| Arable farming  | 14.180        | 551                    | 1,2                  | 15                    | 38,9           | 2.114           | 77.667        | 4,5                  | 44                    | 5,6                        | 59                          | 95.719        |
| Market gardening  | 5.205         | 94                     | 2,0                  | 23                    | 18,0           | 21.894          | 89.022        | 1,5                  | 15                    | 3,5                        | 38                          | 92.368        |
| Glastuinbouw  | 3.300         | 10                     | 5                    | 46                    | 3              | 480.843         | 107.717       | 3,7                  | 37                    | 8,7                        | 83                          | 104.725       |
| Livestock farming   | 20.594        | 1.083                  | 1,3                  | 42                    | 52,6           | 1.240           | 31.958        | 9,4                  | 94                    | 10,7                       | 136                         | 78.808        |
| <b>Subtotal</b>   | <b>43.279</b> | <b>1.737</b>           | <b>9,5</b>           | <b>126</b>            | <b>40,1</b>    | <b>5.473</b>    | <b>75.474</b> | <b>19,0</b>          | <b>189</b>            | <b>28,5</b>                | <b>315</b>                  | <b>90.391</b> |
| Nature management   | 1.925         | 77                     | 0,1                  | 2                     |                | 1.000           | 40.000        | 0                    |                       | 0,1                        | 2                           | 40.000        |
| <b>Total</b>  | <b>45.204</b> | <b>1.814</b>           | <b>9,6</b>           | <b>128</b>            | <b>40,1</b>    | <b>5.284</b>    | <b>74.940</b> | <b>19,0</b>          | <b>189</b>            | <b>28,6</b>                | <b>317</b>                  | <b>90.085</b> |
| Structure of agriculture in the Vegan Netherlands scenario  |               |                        |                      |                       |                |                 |               |                      |                       |                            |                             |               |
| Arable farming  | 20.741        | 806                    | 1,7                  | 22                    | 38,9           | 2.114           | 77.667        | 6,5                  | 64                    | 8,2                        | 86                          | 95.719        |
| Market gardening  | 22.317        | 401                    | 9                    | 99                    | 18,0           | 21.894          | 89.022        | 6,3                  | 64                    | 15,0                       | 163                         | 92.368        |
| Glastuinbouw  | 3.300         | 10                     | 5                    | 46                    | 3              | 480.843         | 107.717       | 3,7                  | 37                    | 8,7                        | 83                          | 104.725       |
| Livestock farming   | 0             | 0                      |                      |                       |                |                 |               |                      |                       |                            |                             |               |
| <b>Subtotal</b>   | <b>46.358</b> | <b>1.217</b>           | <b>15,4</b>          | <b>167</b>            | <b>26,3</b>    | <b>12.681</b>   | <b>92.689</b> | <b>16,5</b>          | <b>165</b>            | <b>31,9</b>                | <b>332</b>                  | <b>96.316</b> |
| Nature management   | 8.254         | 330                    | 0,3                  | 8,3                   | 40,0           | 1.000           | 40.000        |                      |                       | 0,3                        | 8                           | 40.000        |
| <b>Total</b>  | <b>54.613</b> | <b>1.548</b>           | <b>15,8</b>          | <b>175</b>            | <b>28,3</b>    | <b>10.189</b>   | <b>90.201</b> | <b>16,5</b>          | <b>165</b>            | <b>32,3</b>                | <b>340</b>                  | <b>94.948</b> |

# APPENDIX 02 LAND USE CALCULATIONS

by Max van der Sleen, economist

## 2.1 REQUIRED AREA FOR THE WHEEL FOR LIFE

| Quantity of food required for the Netherlands |                             |                             |   |
|---|-----------------------------|-----------------------------|---|
| Schijf for Life food categories               | daily recommended dose (gm) | daily recommended dose (kg) | annual requirement for entire Dutch population (kg) |
| Grain   | 90                          | 0,09                        | 587918125   |
| Legumes                                       | 160                         | 0,16                        | 1045187778  |
| Nuts  | 25                          | 0,025                       | 163310590   |
| Tubers  | 100                         | 0,1                         | 653242362   |
| Fruit   | 300                         | 0,3                         | 1959727085  |
| Greens  | 150                         | 0,15                        | 979863542   |
| Other vegetables                              | 150                         | 0,15                        | 979863542   |
|   |                             |                             | population NL                                       |
|   |                             |                             | 17897051  |

<https://www.schijfforlife.nl/>

### Premises and extra info

from agricultural plot  
algal oil capsules (small footprint, see calculation below)  
beverages, e.g. coffee and tea  
seaweed (marine production not taken into account)  
vitamin B12 (can be produced in laboratories)

| algal oil              | current population               |
|------------------------|----------------------------------|
| daily requirement (kg) | 0,00025                          |
| annual requirement     | 17897051                         |
|                        | kg/ha                            |
|                        | 1633105,904                      |
|                        | required land (blocks 2500x2500) |
| required land (ha)     | 33                               |
|                        | 50000                            |
|                        | 0,05                             |

| Schijf for Life food categories | Examples       | average harvest 2020, 2021, 2022 (kg) | average harvested area 2020, 2021, 2022 (kg) | index (kg/ha) | average harvest per ha (kg/ha) |
|---------------------------------|----------------|---------------------------------------|--|---------------|--------------------------------|
| Grain                           | Wheat          | 1038286000                            | 116945                                       | 8878          | 5163                           |
|                                 | Rye            | 8400333                               | 2044   | 4110          |                                |
|                                 | Quinoa         | n.v.t.                                | n.v.t.                                       | 2500          |                                |
| Legumes                         | Brown beans    | 4819667                               | 1796   | 2684          | 5592                           |
|                                 | String beans   | n.v.t.                                | n.v.t.                                       | 6000          |                                |
|                                 | Broad beans    | 3800000                               | 470  | 8091          |                                |
| Nuts                            | Walnoten       | n.v.t.                                | n.v.t.                                       | 2750          | 2875                           |
|                                 | Hazelnuts      | n.v.t.                                | n.v.t.                                       | 3000          |                                |
| Tubers                          | Potatoes       | 3515478000                            | 73999  | 47507         | 45004                          |
|                                 | Sweet potatoes | n.v.t.                                | n.v.t.                                       | 42500         |                                |
| Fruit                           | Apples         | 233666667                             | 6012   | 38869         | 43533                          |
|                                 | Pears          | 363666667                             | 10060  | 36151         |                                |
|                                 | Strawberries   | 83500000                              | 1502   | 55580         |                                |
| Greens                          | Spinach        | 6763333                               | 3272   | 2067          | 26281                          |
|                                 | Kale           | 7166667                               | 372  | 19248         |                                |
|                                 | Chicory        | 54166667                              | 3187   | 16998         |                                |
| Other vegetables                | Carrots        | 284383333                             | 4566   | 62287         |                                |
|                                 | Broccoli       | 25966667                              | 2561   | 10141         |                                |
|                                 | Onions         | 1704666667                            | 36313  | 46944         |                                |

### Required plot area in the Netherlands

| Schijf for Life food categories | Average index (kg/ha) | Annual quantity required for entire population (kg) | Plot area required for current population without corrections |
|---------------------------------|-----------------------|---|---|
| Grain                           | 5163                  | 587918125   | 113878  |
| Legumes                         | 5592                  | 1045187778  | 186920  |
| Nuts                            | 2875                  | 163310590   | 56804   |
| Tubers                          | 45004                 | 653242362   | 14515   |
| Fruit                           | 43533                 | 1959727085  | 45017   |
| Greens                          | 26281                 | 1959727085  | 74569   |

## 122 2.2 LAND USE CBS CONVERSION TO BLOCK MAP

| Built up land   Total built up land                         | ha        | 370140         | 592         |
|---|-----------|----------------|-------------|
| Residential   | ha        | 241408         |             |
| Retail and catering   | ha        | 12028          |             |
| Public amenities  | ha        | 12057          |             |
| Socio-cultural amenities                                    | ha        | 16463          |             |
| Industry and business                                       | ha        | 88184          |             |
| <b>Semi-built up land</b>                                   | <b>ha</b> | <b>39221</b>   | <b>63</b>   |
| Refuse tip  | ha        | 1930           |             |
| Wreck storage   | ha        | 429            |             |
| Cemetery  | ha        | 4540           |             |
| Mineral extraction  | ha        | 3147           |             |
| Building site   | ha        | 25046          |             |
| Semi-metalled other   | ha        | 4129           |             |
| <b>Recreational land</b>                                    | <b>ha</b> | <b>108335</b>  | <b>173</b>  |
| Parks and public gardens                                    | ha        | 32863          |             |
| Sports  | ha        | 36288          |             |
| Allotments  | ha        | 3608           |             |
| Day recreation  | ha        | 11526          |             |
| Public squares  | ha        | 24051          |             |
| <b>Agrarian land   Total agrarian land</b>                  | <b>ha</b> | <b>2230445</b> |             |
| <b>Agrarian land   Land for greenhouse market gardening</b> | <b>ha</b> | <b>15766</b>   | <b>25</b>   |
| <b>Agrarian land   Other agrarian land</b>                  | <b>ha</b> | <b>2214680</b> | <b>3543</b> |
| <b>Woods and open nature   Woods</b>                        | <b>ha</b> | <b>501461</b>  | <b>802</b>  |
| Woods   | ha        | 340646         |             |
| Open dry nature   | ha        | 93780          |             |
| Open wet nature   | ha        | 67035          |             |
| <b>Waterways   Total Waterways</b>                          | <b>ha</b> | <b>374381</b>  |             |
| IJsselmeer / Markermeer                                     | ha        | 182893         |             |
| Closed inlet  | ha        | 31982          |             |
| <b>Waterways   Rhine and Maas</b>                           | <b>ha</b> | <b>18178</b>   | <b>29</b>   |
| Reclaimed lake  | ha        | 15514          | 25          |
| Water catchment basins                                      | ha        | 1240           | 2           |
| Recreational waterways                                      | ha        | 11104          | 18          |
| Waterways for mineral extraction                            | ha        | 2976           | 5           |
| Leach and/or sludge fields                                  | ha        | 484            | 1           |
| <b>Other waterways</b>                                      | <b>ha</b> | <b>110008</b>  | <b>176</b>  |
| <b>Coastal water   Total coastal water</b>                  | <b>ha</b> | <b>415211</b>  |             |
| Wadden Sea, Eems, Dollard                                   | ha        | 254432         |             |
| Oosterschelde   | ha        | 34578          |             |
| Westerschelde   | ha        | 29812          |             |
| North Sea   | ha        | 96389          |             |

### From CBS table to block map

|  | Blocks 2500x2500 m | NL NOW Blocks 2500 x 2500 m | NL NOW. km 2 | for meat and dairy production |
|--|--------------------|-----------------------------|--------------|-------------------------------|
| Agrarian land                                  | 3543               | 3477,5                      | 21734,3      | 15649                         |
| Of which agrarian nature                       | 66                 | 0,0                         | 0,0          |                               |
| Greenhouse market gardening                    | 25                 | 25,2                        | 157,7        |                               |
| Nature + waterways (excl. large coastal lakes) | 1033               | 1098,7                      | 6867,0       |                               |
| Built-up/metalled land                         | 1012               | 1012,5                      | 6328,0       |                               |
| <b>Total</b>                                   | <b>5614</b>        | <b>5614</b>                 | <b>35087</b> |                               |

Because agrarian nature often forms part of NNN or N2000 land, it has been added to the category of nature.

### Agrarian plots of land surface area

| BRP* crop plots | m2          | blocks (2500X2500) |
|-----------------|-------------|--------------------|
| Arable land     | 8021560000  | 1283               |
| Grassland       | 10070300000 | 1611               |
| Natuurterrein   | 415078000   | 66                 |
| Fallow          | 8820680     | 1                  |
| Other           | 61920600    | 10                 |
| <b>Total</b>    |             | <b>2972</b>        |

### Arable farming potential assigned by National Institute for Public Health and the Environment (RIVM) to BRP crop plots of land

|   | 100-90%       | 846         |
|---|---------------|-------------|
|   | 90-80         | 448         |
| These categories show the potential production and corresponding land surface area in NL. E.g. a plot with a score of 90% has 2x the potential in potato production of a plot with a score of 45% | 80-70         | 147         |
|   | 70-60         | 269         |
|   | 60-50         | 146         |
|   | 50-40         | 546         |
|   | 40-30         | 70          |
|   | 30-20         | 70          |
|   | 20-10%        | 364         |
|   | 10-0          | 0           |
|   | Natuur        | 66          |
|   | <b>Totaal</b> | <b>2972</b> |

### Agrarian land, production potential

| Production potential arable crops % | BRP crop parcels | Agrarian land in blocks | General soil distribution |
|-------------------------------------|------------------|-------------------------|---------------------------|
| 100-80                              | 1294             | 1548                    | Sea clay/river 45%        |
| 80-60                               | 416              | 498                     | Sea clay/river 14%        |
| 60-40                               | 692              | 828                     | Sand 24%                  |
| 40-20                               | 140              | 168                     | Sand/peat bo 5%           |
| 20-0                                | 364              | 436                     | Peat bog 13%              |
| <b>totaal</b>                       | <b>2906</b>      | <b>3477</b>             | <b>100%</b>               |

Ratio of agrarian land/agrarian plot: Statistics Netherlands/BRP  
1,196490021

### Agrarian land, use for meat and dairy production

|                                      | (Blokken 2500x2500m) |
|--------------------------------------|----------------------|
| Agrarian land                        | 3477                 |
| In use for meat and dairy production | 2500                 |
| Other use                            | 977                  |

### For reference

#### NNN + Natura 2000 on land

| NNN + Natura 2000 on land = 20% of NL surface area (ha) | Blocks 2500x2500m |
|---|-------------------|
|   | 3362400           |
|   | 1076              |

## 124 2.3 REQUIRED AGRICULTURAL LAND FOR 'NEDERLAND, VEGANLAND?'

| Calculated use of land for vegan plant-based production landscape |  |  |   |
|---|--|--|---|
| Schijf for Life categories  | Plot area required for present population according to Schijf for Life, without corrections (ha) | 2/3 reduction in food wastage throughout the chain | Allowing for fallow crop rotation from 1 to 8 years |
| <b>Grain</b>  | 113878   | 125370   | 143280  |
| <b>Legumes</b>  | 186920   | 205783   | 235181  |
| <b>Nuts</b>   | 56804  | 62536  | 71470   |
| <b>Tubers</b>   | 14515  | 15980  | 18263   |
| <b>Fruit</b>  | 45017  | 49560  | 56640   |
| <b>Vegetables</b>   | 74569  | 82094  | 93822   |
| <b>TOTAL</b>  | 491702   |  | Total   |

| Allowing for 30% loss in yield | for hay production on 2/9 individual plot | Converted from plot to agricultural area (farmyards, ditches, etc.) |                     |                     |
|--------------------------------|---|---|---------------------|---------------------|
|                                |   | In blocks 2500x2500   | In blocks 2500x2500 | In blocks 2500x2500 |
| 204685                         | 250171                                    | 299319  | 479                 | 167                 |
| 335973                         | 410634                                    | 491306  | 786                 | 275                 |
| 102100                         | 124789                                    | 149305  | 239                 | 83                  |
| 26090                          | 31888                                     | 38152   | 61                  | 21                  |
| 80914                          | 98895                                     | 118323  | 189                 | 66                  |
| 134031                         | 163815                                    | 195998  | 314                 | 110                 |
|                                |   | 1292404   | 2068                | 722                 |

| Allowing for population growth to 20 million | Converted from plot to agricultural area (farmyards, ditches, etc.) + completion of 10% green-blue services | Area required in Vegan NL in blocks of 2500x2500m | Required area per person in Vegan NL (m2) |
|--|---|---|---|
| 279567                                       | 367464  | 588   | 184                                       |
| 458884                                       | 603160  | 965   | 302                                       |
| 139452                                       | 183296  | 293   | 92  |
| 35635  | 46839   | 75  | 23  |
| 110515                                       | 145261  | 232   | 73  |
| 183064                                       | 240621  | 385   | 120                                       |
|  | 1586641   | 2539  | 793                                       |

| Factors   | Ratio       | Explanation         | Source   |
|---|-------------|---------------------|--|
| Fallow crop in rotation from 1 to 8 years   | 1,14        | 1/7*8               | On basis of expert meeting at LBI  |
| 30% drop in yield by abandoning pesticides and artificial fertiliser  | 1,43        | 100/(100-30)        | On basis of LBI expert meeting, farm of the future, Jaap Korteweg and Joost van Strien |
| Hay production on 2/9 of individual plot  | 1,22        | 1/9*11              | On basis of management by Joost van Strien   |
| 2/3 reduction in food wastage throughout the chain from 27.5% to 9.2%   | 1,10        | 100/(100-(27,5/3))  | On basis of IPCC report. Estimated 25-30% food wastage throughout the chain            |
| Converted from plot to agricultural area, allowing for 16.44% land use for farmyards, ditches, local roads, wooded banks, etc.) | 1,20        | 100/(100-16,42)     | Calculated by comparing CBS land use with plot area of BRP arable plots                |
| <b>Total</b>  | <b>2,63</b> |                     |  |
| Variables for spatial scenario Vegan NL   |             |                     |  |
| Calculation for population of 20 million  | 1,12        | 1/17897051*20000000 | CBS  |
| Completion of 10% green-blue services +7.5%   | 1,31        | 100/(100-16,44-7,5) | Current services occupy between 2 and 3% of the land. Source: Landscape plan of attack |
| <b>Totaal</b>   | <b>3,23</b> |                     |  |



## 126 2.4 TOTAL LAND USE AND AREA ASSIGNMENTS

| Survey of land use now and in Vegan NL   |                              |                                |        |              |
|--|------------------------------|--------------------------------|--------|--------------|
|  | blocks 2500x2500 m<br>NL NOW | blocks 2500x2500 m<br>Vegan NL | in km2 |              |
| Nature   | 1099                         | 1418                           |        | 8863         |
| Built-up/metalled land   | 1012                         | 1131                           |        | 7069         |
| Agricultural land for self-sufficient food production (all ground types with 40-100% productive potential)                           | nvt                          | 2539                           |        | 15869        |
| Other agricultural land (extensively managed fens, or used for hay/building materials. Ground types with 0-40% productive potential) | nvt                          |                                |        | 3131         |
| Greenhouse market gardening (or vertical farming)  | 25                           | 25                             |        | 156          |
| Agricultural land in use for meat and dairy production   | 2501                         | nvt                            |        |              |
| Agricultural land in use for other production  | 977                          |                                |        | 0            |
| <b>Total</b>   | <b>5614</b>                  | <b>5614</b>                    |        | <b>35088</b> |

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| Extra surface area of nature to achieve nature targets |                   |                                  |                              |
|--|-------------------|----------------------------------|------------------------------|
|  | Surface area (ha) | Surface area in blocks 2500x2500 | Extra blocks in map Vegan NL |
| NNN rounded off  | 736000            | 1177,6                           |                              |
| NNN/N2000 on land now                                  | 672480            | 1075,968                         |                              |
| Nature on block map now                                |                   | 1099                             |                              |
| Extra blocks of nature required                        |                   |                                  | 101,632                      |
| NNN rounded off  |                   |                                  |                              |
| Extension of nature to achieve target                  | 150000            |                                  | 240                          |
| <b>New area allocation block map.</b>                  |                   | <b>1418</b>                      | <b>342</b>                   |
| Extra blocks filled in on basis of original EHS map    |                   |                                  |                              |

| Extra surface area required for population growth to 20 million  |                   |                                  |                              |
|--|-------------------|----------------------------------|------------------------------|
|  | Surface area (ha) | Surface area in blocks 2500x2500 | Extra blocks in map Vegan NL |
| Built-up/metalled land now   | 6328040000        | 1012                             |                              |
| Built-up/metalled land per person  | 354               |                                  |                              |
| Built-up/metalled land NL with population of 20 million  | 7071600791        | 1131                             | 119                          |
| Although densification of existing residential cores is probable, for convenience's sake we have made proportional calculations for 20 million persons. The extra blocks have been filled in on the basis of the current housing plans. See table below. |                   |                                  |                              |

| Spatial distribution of extra blocks on the basis of current housing plans per province |        |            |                           |
|---|--------|------------|---------------------------|
| Housing by 2030   | number | percentage | extra blocks per province |
| Groningen   | 19000  | 2%         | 2                         |
| Friesland   | 12600  | 1%         | 2                         |
| Drenthe   | 13000  | 1%         | 2                         |
| Overijssel  | 44400  | 5%         | 5                         |
| Flevoland   | 38900  | 4%         | 5                         |
| Gelderland  | 89600  | 9%         | 11                        |
| Utrecht   | 105900 | 11%        | 13                        |
| Noord-Holland   | 220900 | 23%        | 27                        |
| Zuid-Holland  | 280200 | 29%        | 35                        |
| Zeeland   | 7900   | 1%         | 1                         |
| Noord-Brabant   | 109300 | 11%        | 14                        |
| Limburg   | 19400  | 2%         | 2                         |
| Nederland   | 961300 |            | 119                       |

| This area is at the expense of agricultural land. We spare the best agricultural land as far as possible. |                  |  |      |  |      |                           |
|---|------------------|--|------|--|------|---------------------------|
| Productive potential arable crops %   | BRP crop parcels | Agrarian land in blocks NL now (2500x2500 m) |      | Agrarian land in blocks Vegan NL (2500x2500 m) |      | Als percentage van geheel |
|   |                  | As percentage of whole                       |      |  |      |                           |
| 100-80  |                  | 1294   | 1548 | 45%  | 1531 | 50%                       |
| 80-60   |                  | 416  | 498  | 14%  | 492  | 16%                       |
| 60-40   |                  | 692  | 828  | 24%  | 589  | 19%                       |
| 40-20   |                  | 140  | 168  | 5%   | 119  | 4%                        |
| 20-0  |                  | 364  | 436  | 13%  | 310  | 10%                       |
| total   |                  | 2906   | 3477 | 100%   | 3040 |                           |
| Ratio agrarian land/agrarian plot: CBS/BRP<br>1,196490021   |                  |  |      |  |      |                           |

**128 Additional agricultural land in map Vegan NL**

|  |             |
|--|-------------|
| Land for self-sufficient nature-inclusive food production for 20 million | 2539        |
| Filled in on map: productive potential 100-40%                           | <b>2611</b> |
| Other land 40-0% (mainly fens and former peat bog)                       | <b>429</b>  |

For convenience's sake we have rounded up the surface area required for self-sufficient food production in the block map to the surface area of agricultural land with a productive potential of 100-40%.

**Distribution of loss of agricultural land by productive potential category, sparing the best land as much as possible**

| Best land            | with even distribution (2500x2500m) |     | corrected for preservation of 90% best land (2500x2500m) total |             |
|----------------------|-------------------------------------|-----|--|-------------|
| 100-80               | 1354                                | 76% | 177  | 1531        |
| 80-60                | 435                                 | 24% | 57   | 492         |
| <b>Totaal</b>        | <b>1789</b>                         |     | <b>234</b>   | <b>2023</b> |
| <b>Inferior land</b> |                                     |     |  |             |
| 60-40                | 724                                 | 58% | -135   | 589         |
| 40-20                | 146                                 | 12% | -27  | 119         |
| 20-0                 | 381                                 | 30% | -71  | 310         |
| <b>Total</b>         | <b>1251</b>                         |     | <b>-234</b>  | <b>1017</b> |

**10% green-blue infrastructure**

|   | Area(ha)      | Blocks (2500x2500m) |
|---|---------------|---------------------|
| Area of rural land                      | 2237000       | 3579                |
| 10% of the rural area                   | 223700        | 358                 |
| Current green-blue infrastructure, 2.5% | 55925         | 89                  |
| <b>Remaining task</b>                   | <b>167775</b> | <b>268,4</b>        |

**NNN completing and achieving conservation targets**

|                            | Area (ha)  | Blocks (2500X2500m) |
|----------------------------|------------|---------------------|
| NNN when completed         | 736000     | 1178                |
| NNN/N2000 on land, current | 672480     | 1076                |
| <b>NNN complete</b>        | <b>102</b> |                     |

**Forest strategy**

|                                      | Area (ha)    | Blocks (2500X2500m) |
|--------------------------------------|--------------|---------------------|
| <b>Intended additional area 2030</b> | <b>37000</b> | <b>59</b>           |

**Achieving conservation targets**

|  | Area (ha)     | Blocks (2500X2500m) |
|--|---------------|---------------------|
| <b>Expanding nature in order to reach the target</b> | <b>150000</b> | <b>240</b>          |

**Rewetting the peatland, outlined in the Climate Agreement and the Peat Plan:**

|   | Area (ha)    | Blocks (2500X2500m) |
|---|--------------|---------------------|
| <b>Intended surface area increase of groundwater levels</b> | <b>90000</b> | <b>144</b>          |

**Urban development scenarios from spatial exploration PBL 2023**

| Urban expansion       | Area (ha) | Blocks (2500X2500m) |
|-----------------------|-----------|---------------------|
| <b>Green land</b>     |           |                     |
| 280 km2               | 28000     | 45                  |
| Globally enterprising |           |                     |
| 440 km2               | 44000     | 70                  |
| High-speed world      |           |                     |
| 580 km2               | 58000     | 93                  |
| Regionally rooted     |           |                     |
| 630 km2               | 63000     | <b>101</b>          |

**Dutch consumption's global footprint in 2019: Meat, Dairy, and Other Foods**

| Abroad                               | Number of blocks (500km2) |             | Inland        | Number of blocks (500km2) |             |
|--------------------------------------|---------------------------|-------------|---------------|---------------------------|-------------|
|                                      | Meat and Dairy            | Other Foods |               | Meat and Dairy            | Other Foods |
| Western Europe                       | 7                         | 12          | The Netherlar | 13                        | 3           |
| Central Europe                       | 0                         | 0           |               |                           |             |
| Africa                               | 0                         | 4           |               |                           |             |
| Russian region                       | 0                         | 0           |               |                           |             |
| South Asia                           | 0                         | 1           |               |                           |             |
| Southeast Asia                       | 2                         | 4           |               |                           |             |
| Oceania                              | 0                         | 0           |               |                           |             |
| Canada                               | 1                         | 0           |               |                           |             |
| United States                        | 1                         | 1           |               |                           |             |
| Central America                      | 0                         | 2           |               |                           |             |
| Rest of South America                | 7                         | 2           |               |                           |             |
| Brasil                               | 7                         | 1           |               |                           |             |
| <b>Total number of blocks</b>        | <b>25</b>                 | <b>27</b>   |               | <b>13</b>                 | <b>3</b>    |
| Global land use in square kilometers |                           |             |               |                           |             |
|                                      | 12500                     | 13500       |               | 6500                      | 1500        |
| <i>Brasil</i>                        | 3500                      | 500         |               |                           |             |
| In 2500 by 2500 units blocks         |                           |             |               |                           |             |
|                                      | <b>2000</b>               | <b>2160</b> |               | <b>1040</b>               | <b>240</b>  |
| Total                                |                           |             |               |                           |             |
|                                      | blocks                    | km2         |               |                           |             |
| Total                                | 5440                      | 34000       |               |                           |             |
| Total meat and dairy                 | 3040                      | 19000       |               |                           |             |
| Total remaining                      |                           | 15000       |               |                           |             |

# COLOPHON

## STROOTMAN LANDSCHAPSARCHITECTEN:

Joran Lammers\*, Berno Strootman, Lotte Embregts,  
Lisa Peters, Jessica Minn

## CENTRUM VOOR MILIEUWETENSCHAPPEN LEIDEN (CML):

Joran Lammers\*, Jan Willem Erisman

\*Joran worked at Strootman until June 2023, after which he joined CML.

## APPENDIX:

Max van der Sleen

## GREAT THANKS FOR THE CRITICAL REFLECTION AND INSPIRING CONVERSATIONS:

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