

Scenario descriptions

This document contains detailed descriptions for each key variable under each scenario. Each scenario includes a timeline with possible 'newspaper headlines' identified by our focus groups.

This is supplementary material to:

Creating the Dutch One Health Shared Socio-economic Pathways (SSPs)

in Regional Environmental Change

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SSP1: Together Green (*Samen Groen*)



Variable	Description	Sources
Global context	After the declaration of peace in Ukraine and the increasingly managed and effective competition between China and the US, the world enters a new period of optimism, similar to that of the 1990's. There are promising advances in technology, particularly in alternative energy sources, and nuclear fusion becomes available in the 2040's, leading to abundant clean energy and a further reduction in global conflict. There is a highly effective system of global governance. At the same time, there is mounting evidence that inequality and environmental degradation have high costs, not just economically, but also socially and culturally. There is a gradual shift towards prioritising well-being over economic growth. This is spurred by the increasing frequency and intensity of extreme weather events all around the world. Groups at the local, regional, national and international levels support change and are mutually reinforcing, leading to wider collaboration, encompassing governments, the private sector and civil society. This ultimately leads to the creation of the World Environmental Organisation (WEO). Europe becomes a leader in renewable technologies, in large part thanks to its rapid move away from fossil fuels as a consequence of the Russia-Ukraine war. As the world-leader in battery production, China also sees considerable economic growth as the global demand for batteries soars with the worldwide move to electric-powered transport, machinery and appliances. Other countries, particularly the US, also see high prosperity and growth, as this period of rapid change and cooperation leads to many new opportunities for research and innovation.	- SSP1¹ - Delta: Druk² - Stakeholder workshop - Expert consultation
Demographics	The population steadily grows up to 19.2m in 2050, then peaks around 2080 before decreasing down to 19.1m in 2100. There is medium fertility and low mortality. In 2050, 58.0% of the population are between 20 and 65, 21.2% are over 65, and 10.4% of the population are over 80. Life expectancy increases. There are few restrictions on travel and the strong economy and generous social support	- SSP1^{1,3,4} - Delta: Druk² - WLO2015: Hoog^{5,6} - NIDI: Midden^{7,8} - Stakeholder workshop

	available in the Netherlands mean that it is a popular destination for migrants. Migration is relatively high and includes both the highly-skilled and the less well educated. This helps to counteract the trend of an aging population. Migrants are largely accepted and people appreciate their contribution to the economy and to the well-being of society. There is a high level of urbanisation. By 2050, 91% of the population lives in urban areas. Up until 2050 this is mainly concentrated in the Randstad, since this is where the majority of economic activity is located. However, in the second half of the century, there is increased movement to other cities, particularly in North Brabant and the eastern part of Gelderland. This is partly in response to the need to spread out as the population increases, and partly due to the threat of rising sea-levels encouraging the eastward movement of economic activity. Most areas see some amount of population growth, the exception being rural areas in more peripheral parts of the country such as Zeeland and Groningen.	
Economy and Technology	There is medium economic growth at around 2% per year and the Euro is strong. This is largely driven by new innovations in sustainable technologies, but is constrained by environmental protections which limit new developments. There is a high degree of globalisation and international cooperation; the world is increasingly connected. Increasing international trade means that the ports of Amsterdam and Rotterdam flourish. While trade in food diminishes as people prefer locally produced products, there is still flourishing trade in technological components, manufactured goods, pharmaceuticals, etc. The government moves towards the political left and successfully responds to the many societal challenges. As such, everyone receives a universal basic income (UBI), which is financed by removing many existing benefits (as they are no longer necessary with a UBI) and increasing taxes, particularly for the higher income levels, which will also have the effect of increasing income equality. There is a high level of government investment in health, education, social support and research. Such interventions	- SSP1^{1,3} - EurSSP1⁹ - Delta: Druk² - WLO2015: Hoog⁵ - Stakeholder workshop - EU Green Deal¹⁰ - A Circular Economy in the Netherlands by 2050¹¹ - Agenda Natuurinclusief¹² - Kansrijk armoedebeleid¹³ - Expert consultation

	are often collaborative efforts with business or social organisations. The Netherlands meets the EU Green Deal target to decouple economic growth from resource use by 2050. By 2030, the consumption of primary raw materials is reduced by half and the Dutch economy is completely circular by 2050. There is a growing understanding that environmental challenges can have major financial consequences and there is a move to safeguard the economy via environmental protection. There are more regulations on companies and they have to report on their nature and biodiversity-related impacts, as well as their social impacts. Technological development is rapid, particularly in the area of sustainability as a result of government investment. For example, use of hydrogen and electric powered vehicles becomes widespread, including for shipping and air travel. Nuclear fusion is delivering electricity to the Netherlands by 2050. Companies which focus on sustainable technologies are particularly successful. There are also high levels of automation, which help with the reduced proportion of working-age people as the population ages. Artificial intelligence (AI) also sees considerable progress and is used in a wide range of applications.	
Land use	As the population increases and more people move to live in built-up areas for work, there is necessarily an increase in urban spaces. However, there is also a strong desire to leave space for nature and so urban areas tend to become more compact and densely populated rather than spreading out too much and there are more tall buildings. It is estimated that in 2050, 17% of the Dutch land surface area is used for urban areas, with the growth mainly occurring in the Randstad but also in North Brabant and the eastern parts of Gelderland. The port cities of Amsterdam and Rotterdam grow as exports increase. There is also increased demand for food forests and community gardens and many of these spring up around the outskirts of urban areas. This follows the trend for locally-produced, organic	- SSP1^{1,3,14,15} - EurSSP1^{9,16} - Delta: Druk² - WLO2015: Hoog⁵ - OmdT: Groenrijk¹⁷ - Stakeholder workshop - Agenda Natuurinclusief¹² - Programma Mooi Nederland¹⁸ - Sea-level rise adaptation paths: Beschermen-open, Meebewegen¹⁹

	food and an increased desire to spend time in nature and engaging with the local community. There is a large decrease in agricultural land (62% of surface area in 2050), largely due to decreasing pasture area (following stricter environmental regulations and reduced meat demand) but there is also a reduction in arable farming (thanks mostly to increasing productivity per unit area from technological advances but also due to increasing salinisation in coastal regions). Some peat meadows in the Randstad are given over to housing while in other areas more room is created for nature. Less profitable farmland is given back to nature or used for more nature-inclusive agriculture. Several new large nature areas are created in Drenthe, Twente, North Brabant and South Limburg and these are increasingly popular areas for recreation. The total land for nature covers 21% of total surface area by 2050. There is a move to make nature more accessible and to ensure that everyone lives within a short distance of a well-maintained natural area for recreation. To adapt to rising sea-levels, the Netherlands initially takes a 'protected open' approach, whereby the major estuaries are kept open, although the <i>Maeslantkering</i> (storm surge barrier on the <i>Nieuwe Waterweg</i> in South Holland) will have to be closed more often. Higher dykes are built around the estuaries and along the major water courses, along with adapted construction. This work is complete by 2050. It is hoped that this approach will prove sufficient since the world is on a low-emissions pathway, however if it is not then the plan will be to switch to a 'living with water' approach, with a combination of artificially raised areas, floating infrastructure and moving activity to higher areas in the east of the country. In 2050 there are detailed plans in place in case this proves necessary and some preliminary steps have been taken.	
Socio-economic inequality	With the government moving towards the left, it makes efforts to respond to the many societal challenges, including the reduction of inequality. This involves measures such as implementing a universal basic income and	- SSP1¹ - EurSSP1⁹ - Delta: Druk² - Stakeholder workshop - Just Transition Fund^{20,21}

	supporting low-income households in the sustainable transition, such as providing help to purchase heat pumps. Everyone has access to good healthcare and a good education. Health inequality is reduced by making healthy foods cheaper and supporting those in hardship so that stress levels are reduced. Economic disparities between regions are lower than in other scenarios and there are concerted efforts to ensure that no region is left behind by the transition to a circular economy. This is particularly relevant for areas which were previously heavily invested in the fossil-fuel industry such as Groningen. They receive additional support from the EU for reducing greenhouse gas emissions, developing alternative economic sectors and upskilling and reskilling workers.	
Environment	Ambitious international agreements to mitigate climate change are quickly reached and countries are committed to meeting their targets. The Netherlands rapidly shifts to renewable energy sources, as well as nuclear fusion which is providing electricity by 2050. It meets the requirements of the EU Green Deal to reduce greenhouse gas emissions by 55% by 2030 (compared with 1990) and to have zero net emissions by 2050. This includes a 90% reduction in transport-related emissions, which is achieved by a widespread shift to electric road vehicles, increased cycling, and a combination of electric and hydrogen power for shipping and aviation. Following EU policy, the Dutch government introduces strict environmental legislation on pollutants and by 2050 soil, water and air pollution have all been reduced to levels which are safe for human and ecosystem health. The Netherlands meets all its Natura2000 goals, improving and expanding existing areas. Nature areas are managed with a view to promoting resilience, encouraging biodiversity and minimising the impacts of human recreational usage. There are some negative impacts on nature from salinisation in coastal regions, but this is less bad than in other scenarios as sea-levels do not rise as high. The threat of	- SSP1^{1,15} - EurSSP1^{9,16} - OmdT: Groenrijk¹⁷ - WLO2015: Hoog^{5,22} - Delta: Druk² - Stakeholder workshop - EU Green Deal¹⁰ - EU Zero Pollution Action Plan^{23,24} - Natura2000²⁵ - Agenda Natuurinclusief¹² - Aanpak Stikstof²⁶ - Programma Mooi Nederland¹⁸ - Deltaplan Ruimtelijke Adaptatie²⁷

	salinisation to drinking water is recognised and measures are put in place to ensure a sufficient supply of high quality drinking water. There is a requirement to consider nature and social inclusivity for all new building and infrastructure projects. Technological advances mean that nitrogen emissions from construction are greatly reduced and eventually eliminated. There is a switch to bio-based building materials and eco-houses become the norm. Urban areas become greener, incorporating plant-life into building design (e.g. green roofs and living walls). Although cities become more compact, space is also made for parks and recreation, and urban areas generally becoming more nature-inclusive, while also creating more opportunities for social cohesion. There is also increased urban water storage. Nature-based solutions are implemented to combat flooding and there are agreements that agricultural areas near cities can be used as temporary water storage in the event of floods. Overall the Netherlands is climate-proof and water-robust by 2050.	
Governance	The government moves progressively to the left and its priority is sustainable development. It is effective both nationally and internationally and has good relationships with other countries. National policy is increasingly dominated by EU policy but within this there is room to take local circumstances into account. The government works closely with both business and social organisations, but the polder model of consensual decision-making is increasingly focused on innovation rather than drawn-out negotiations. There are many public-private partnerships for projects promoting nature inclusivity. There is a high level of social cohesion and participation and the government makes great efforts to engage the public on sustainability. It is also not unusual for people to take a 'community sabbatical' to work on improving their local environment or supporting their local neighbourhood.	- SSP1¹ - EurSSP1⁹ - Delta: Druk - Toerime2030: Resilience²⁸ - Stakeholder workshop - Agenda Natuurinclusief¹²
Agriculture	Total agricultural production is slightly reduced, as across Europe there is a preference for locally	- SSP1^{1,14,15,29,30} - EurSSP1^{9,16}

	produced products, which impacts the export market. There is also increasing demand for organic products which tend to be lower yielding. On the other hand, productivity per unit area greatly increases (outside the organic sector), thanks to technological innovations and increasing mechanisation, particularly precision farming, and also because less profitable land is returned to nature. This increase in productivity is partly necessitated by the increasing land prices following the expansion of protected nature areas. There is much research on improving the salt-resistance of crops to allow continued arable farming in coastal regions as salinisation increases. Livestock numbers are reduced as meat demand drops among sustainability-conscious consumers and also thanks to stricter environmental regulations. Increased productivity per animal and reduced food waste also play a role here. They are further reduced once synthetic meat products reach the market and become popular. By 2050 there is a 50% reduction in cattle relative to 2019, a 44% reduction in pigs and a 42% reduction in chickens. Livestock management practices are changed to reduce N emissions and increase animal welfare, for example cattle spend more time grazing, low-emission animals are bred, different feed is used and adjustments are made to housing. Fertiliser use drops by 25% as technological advances increase efficiency. Nitrogen-fixing plants are increasingly used in grasslands. Pesticide use is reduced by 50% by 2030. On the other hand, there is an increase in irrigation, but also in irrigation efficiency. Ecosystem approaches to agricultural land and water management lead to integrated agro-ecosystems that deliver a wealth of ecosystem services in addition to providing food. There is increased investment in high-value products, such as greenhouse horticulture and fruit cultivation, as well as a large increase in agro-forestry. There is also considerable growth of small organic farms, particularly in Drenthe, Twente, North Brabant, South Limburg and Betuwe.	- Delta: Druk² - OmdT: Groenrijk¹⁷ - WUR2050: Natuurinclusief strikter³¹ - WLO2015: Hoog^{5,32} - Toekomstverkenning Agrofood: Alles in Balans³³ - Stakeholder workshop - Aanpak Stikstof²⁶ - Agenda Natuurinclusief¹² - Programma Mooi Nederland¹⁸ - EU Green Deal¹⁰ - Expert consultation
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	Overall, agriculture becomes both more sustainable and more efficient. The government provides support to farmers to use nature inclusive practices and to switch to circular agriculture. By 2030, 25% of agricultural land is used for organic farming. The impact of farming on natural areas is massively reduced. Peat meadows are re-wetted and there is considerably less nitrogen and phosphorus run-off to local water sources. Agriculture and nature become more integrated.	
Lifestyles	While there is a high level of technological innovation, this is mainly concentrated in sustainability, agriculture and healthcare, rather than in the creation of new consumer products. On the contrary, consumption levels are relatively low and Dutch citizens turn away from a throw-away culture and have a high level of environmental awareness, largely thanks to government awareness campaigns. They understand the importance of biodiversity and nature inclusiveness and they are willing to use their free time to improve their local environment and engage in social work. Healthy eating and physical activity form an important and integral part of education, as does environmental awareness. This leads people to eat healthier diets with a lot less meat and food waste is reduced. There is also a reduction in the price of healthy foods (e.g. fruit and vegetables) and increase in the price of unhealthy foods (e.g. sugary items and fast food). People also spend more time outdoors, whether that be while travelling (e.g. walking and cycling) or for recreation or caring for their local environment. Cities are built around walking and cycling. For longer distance travel within the Netherlands, people initially travel slightly less than at present and there is a preference for public transport and car-sharing. Travel increases as low-energy options (such as electric cars) become more affordable. International travel is initially reduced and train travel is preferred to air travel. Once clean air travel becomes widely available (and affordable) this becomes widely used.	- SSP^{1,3,14,29} - EurSSP1^{9,16} - OmdT: Groenrijk¹⁷ - Toerisme2030: Resilience²⁸ - Stakeholder workshop - Agenda Natuurinclusief¹² - Programma Mooi Nederland¹⁸

Health and Healthcare	There is high investment in healthcare, which is recognised as a priority given the aging population, leading to considerable technological innovation. This includes investment in health promotion and prevention. Gene editing (for medical reasons) is introduced and it is common for people to have implants tracking their health and providing an early-detection system of health issues. People tend to live healthier lifestyles than at present, partly due to improved education, partly due to having more time for recreation (as everyone has a universal basic income), and partly because the living environment becomes less ‘obesogenic’ and facilitates healthy choices (e.g. healthy, sustainably produced foods are affordable and readily available and there are more green spaces for recreation). Cigarettes are no longer sold, people are more active and there are significant reductions in smoking, obesity and alcohol consumption. There are programmes in place for the prevention of mental health issues, and more support available for people who suffer from such issues. The aging population brings many challenges for the healthcare industry, but in this scenario many efforts are made to address these. Technological advances and increased automation, as well as an enlarged workforce bolstered by the high number of migrant workers, relieve some of the pressure on healthcare services. It also helps that the population is relatively healthy and the stricter environmental regulations and climate adaptation measures mean that there are fewer environmental stressors affecting peoples’ well-being. Everyone has easy access to healthcare. Life expectancy is increased, health-related socio-economic inequalities are reduced and people continue to be healthy and active later in life.	- SSP1¹ - EurSSP1⁹ - WLO2015: Hoog^{5,6} - OmdT: Groenrijk¹⁷ - Stakeholder workshop - Nationaal Preventieakkoord^{34,35}
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SSP3: Our town first (*Ons dorp eerst*)



Variable	Description	Sources
Global context	Increasing global tensions and economic uncertainties lead countries to focus more on security and self-sufficiency. The world becomes separated into regional blocks with little interaction between them and China and the US have an increasingly hostile relationship. Existing authoritarian regimes are strengthened and new authoritarian leaders come to power in some countries. Global institutions become weaker due to a lack of cooperation and consensus, as do international NGOs. In Europe, there is a growing divide between the northern and southern countries and between the eastern and western countries, making it increasingly difficult for the EU to function as a block. The power of the EU diminishes relative to the US and China. A rise in extremism leads to increasing terrorist attacks all around the world.	- SSP3¹ - Delta: Warm² - Stakeholder workshop - Expert consultation
Demographics	The population will steadily decrease to 15.9m in 2050 and then 11.3m in 2100. This is driven by low fertility combined with high mortality, as well as high outmigration and heavy restrictions on immigration. It is predominantly highly educated working-age people who emigrate, as the Netherlands becomes a less appealing place to stay. By 2050, 10.7% of the population are over 80. There is increased homelessness and life expectancy is reduced. Urbanisation is relatively low and is poorly managed. By 2050, around 83% of the population lives in urban areas. Some cities initially grow, such as those with knowledge centres or which are important for business or finance (e.g. Amsterdam, Den Haag, Utrecht and Eindhoven), especially if they are in the Randstad, though even these begin to decline in the second half of the century. Cities built on trade or industry, such as Rotterdam, will shrink. Rural and more peripheral areas will see a large reduction in population; this is most notable in Zeeland, Limburg and Drenthe. Urban areas have clear divisions, for example a Moroccan district, a Turkish district, etc. There is little mixing between groups of different backgrounds.	- SSP3^{1,3,4} - EurSSP3⁹ - WLO2015: Laag^{5,6} - Delta: Rust, Warm² - Stakeholder workshop
Economy and Technology	Economic growth is slow at around 1% per year or less. The world is becoming less globalised and international trade is reduced. The economy is also affected by the shrinking working-age population. The Netherlands becomes increasingly focused on national security and protectionism. It is less open to	- SSP3^{1,3,36} - EurSSP3⁹ - WLO2015: Laag⁵ - Delta: Rust, Warm² - OmdT: Eigenwijk¹⁷

	international cooperation and tries to reduce its dependence on imports. Around 2030 it leaves the Eurozone and returns to using Guilders. Manufactured capital is reduced and there is a large decrease in Dutch exports, leading to the reduced importance of both Rotterdam and Schiphol. By 2050, inflation is at a record high level and staple products become increasingly difficult to afford for many people. The outmigration of highly skilled workers leads to a reduction of Dutch input to the global knowledge-based economy. Over time the knowledge-centres start to shrink and there is little investment in research. Technological development is slow and there is little sharing of new technologies. The Netherlands is increasingly insular and around 2050 it implements the <i>Digitale Dijk</i> (Digital Dike), which uses a combination of legislation and technology to regulate domestic internet and block access to selected foreign websites.	- Toerisme2030: Hosility, Resistance²⁸ - Stakeholder workshop
Land use	Some cities expand a limited amount (e.g. Amsterdam, Utrecht and Eindhoven, see 'Demographics'), but mostly there is little change in the amount of urban area (15% of surface area in 2050). Since the population is shrinking, there is little need for new housing. New construction generally occurs on the outskirts of cities and tends to be quite spread out. This is partly because demolition and restructuring are seen as expensive or superfluous. As a result, there is considerable vacancy and impoverishment within cities, particularly in older and less attractive districts. These areas develop a slum-like character. In the more peripheral parts of the country, depopulation leads to many empty properties in towns and villages and fewer facilities for the remaining people. There is a reduction in the amount of agricultural land (65% of surface area in 2050) as a result of the poor economic conditions, reduced migrant labour force and the challenges of climate change and salinisation. Increased trade restrictions also have a large effect on the agricultural export market. The land lost tends to be of the poorest quality and becomes unmanaged natural areas. Natural areas increase in this scenario (20% of surface area in 2050). These often develop spontaneously and are not managed in any way, nor are they easily accessible. They are 'junk zones', for which no-one takes responsibility. There is some effort to create nature reserves near cities for the purpose of	- SSP3^{1,3,14,15,36} - EurSSP3^{9,16} - Delta: Rust, Warm² - WLO2015: Laag^{5,32,37} - OmdT: Eigenwijk¹⁷ - Stakeholder workshop

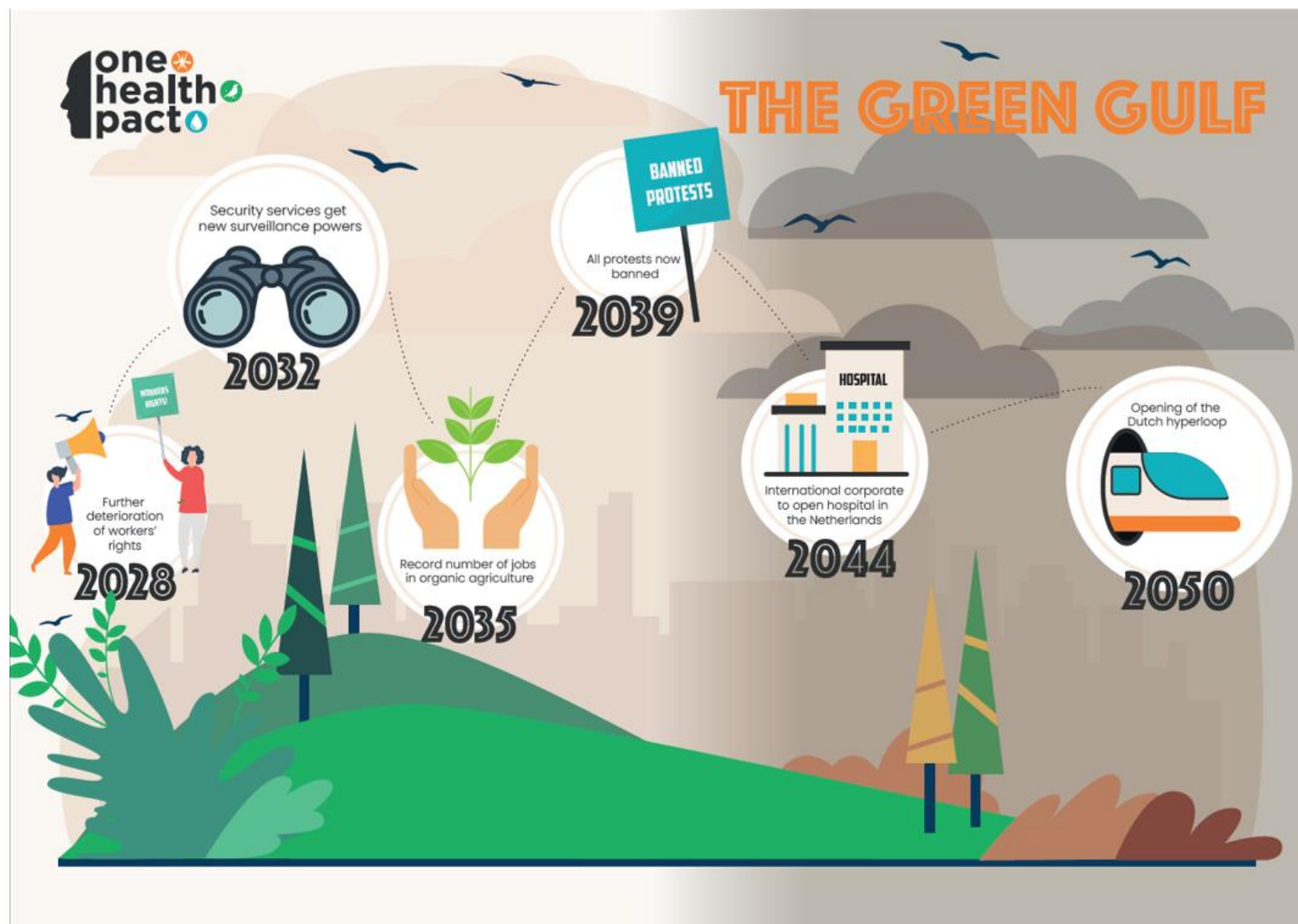
	recreation, but there is little money available to maintain them and they deteriorate in the second half of the century. While there is concern about the threat of sea-level rise, lack of cooperation on a national scale means that no major projects are implemented. This leads to widespread flooding.	
Socio-economic inequality	Inequality is at a high level. The richest elements of Dutch society do well and become more isolated from the rest of the population, for example by sending their children to private schools. As sea-levels rise and little is done in the way of adaptation, income becomes strongly correlated with the altitude of one's home. There is considerable regional inequality. This largely stems from a deterioration in inter-regional trust and cooperation. There are increased tensions between the regions and they prioritise their own needs. For example, local waterboards focus on their own requirements, with less attention paid to the effects their decisions will have on neighbouring areas. Those regions with more resources or which are better suited to deal with the challenges of climate change, rising sea-levels and salinisation are more prosperous than other areas. Also, large cities which are able to maintain or even grow their current population do better than smaller urban areas or rural areas.	- SSP3¹ - Delta: Rust, Warm² - OmdT: Eigenwijk¹⁷ - Stakeholder workshop
Environment	Globally there is little effort spent on mitigating climate change, due to lack of both interest and cooperation. In the Netherlands, protecting the environment is seen as a low priority and there is little regulation. The Netherlands mostly continues to use fossil fuels, since switching to renewables would require new infrastructure and the lack of regional cooperation makes this difficult. A new gas field is created in the Waddenzee. This leads to increasing air pollution. There is increased flooding as flood protection is not always well maintained. It is also hard to implement new large-scale flood adaptations due to the lack of regional cooperation. Increasing salinisation threatens fresh water supplies and there are occasionally drinking water shortages. There is more pollution, due to lack of regulation and lack of environmental respect. There are considerable amounts of plastic in water bodies and biodiversity is severely reduced.	- SSP3^{1,15} - EurSSP3^{9,16} - Delta: Rust, Warm² - OmdT: Eigenwijk¹⁷ - Stakeholder workshop

	Natural areas grow under this scenario but are generally not well maintained. Sometimes these are combined with very extensive agriculture, where more intense farming is no longer profitable (e.g. low moor areas, seepage areas near dunes and areas which frequently flood). In low moor areas where the water table is no longer lowered, peat formation starts again. These new natural areas are often not easily accessible and have a low experiential value. In more prosperous areas, there are new nature areas set up for recreation, but these deteriorate in the second half of the century as there is no money to look after them.	
Governance	The government's main priority is national security. It is mostly concerned with defence and independence. International cooperation is weak and there is a lack of trust. Government investment is primarily focused on defence, with less for education or healthcare. Military service is introduced for young people and migrants. The population is increasingly polarised and there are many different political parties representing the different ethnic and social groups; by 2040 there are 50 different parties represented in the <i>Tweede Kamer</i> (House of Representatives). This leads to a fragmented and ineffective central government. Regional governments acquire more powers and eventually most decisions happen at a regional level. While this helps local areas to some extent, it makes it harder to deal with problems which require larger-scale solutions. Social cohesion and participation are very low. People tend to stay within their own groups, often divided by nationality. There is increasing unrest as the economic situation worsens. Violence increases and public figures are targeted. There is tension and lack of trust between the different regions.	- SSP3¹ - EurSSP3⁹ - OmdT: Eigenwijk¹⁷ - Stakeholder workshop
Agriculture	There is a large decrease in total agricultural production, mainly affecting exports as the focus shifts more towards the domestic market. This is due to a variety of factors, including reduced labour supply (due to restrictions on immigration), trade restrictions and decreased productivity (due to land degradation from poor management, climate change and salinisation). The government is increasingly concerned with self-sufficiency and they impose a 10% import tax on all agricultural products.	- SSP3^{3,14,15,29} - EurSSP3^{9,16} - Eur-Agri-SSP3³⁸ - Delta: Warm² - Eurostat: Agricultural trade data³⁹ - Expert consultation

	There are very few environmental regulations, leading to increased use of fertilisers and pesticides. There is also a considerable increase in the use of irrigation systems. There is very little interest in nature-inclusive agricultural practices. There is little technological innovation or investment and farmers continue to use old methods and machinery. In areas where the soil is of poor quality or where farms are particularly sensitive to climate change and salinisation, farming becomes considerably more extensive or may be abandoned entirely. Farms on good agricultural land are able to maintain themselves better, but there is still a trend towards more extensive practices. This follows from a reduction in land prices as there are fewer protected areas. There is an approximately 20% reduction in cattle and a 15% reduction in pigs and chickens (compared with 2019). This is mostly driven by the reduction in exports, but the shrinking population also reduces demand. On the other hand, there is no decrease in individual meat consumption, little to no gain in productivity per animal and high levels of food waste, which all limit the reductions in livestock numbers. There is a greater reduction in cattle than in other livestock due to the difficult economic situation. Cattle are more expensive and less efficient than other livestock, leading farmers (and consumers) to favour cheaper options.	
Lifestyles	There is a medium to low level of consumption. Low environmental awareness means there is little interest in living sustainably, but the poor economic situation and high inflation mean that most people have limited disposable income. Diets tend to be unhealthy and there is no reduction in meat consumption compared with current levels. Food waste is also high. People spend less time outdoors, thanks to the need to work long hours (from high inflation leading to high prices) and the lack of access to (appealing) nature areas. People travel less than at present, both within the Netherlands and abroad. There is little investment in transport links between regions (as this would require inter-regional cooperation) and people tend to stay within their own area. As the country becomes more inward-focused, distrust in foreigners increases and	- SSP3^{1,3,14} - EurSSP3⁹ - OmdT: Eigenwijk¹⁷ - Toerisme2030: Hosility²⁸ - Stakeholder workshop

	there is less interest in travelling abroad; it is also becoming increasingly unaffordable for many people. Incoming tourism is reduced for similar reasons and is also affected by increasing restrictions on travellers.	
Health and Healthcare	There is very little investment in healthcare and very little technological development. In areas where there are high levels of depopulation, services are reduced and people have to travel long distances to receive treatment. In cities, while healthcare services are available, there are not enough personnel and patients often have to wait a long time to be seen. Many people struggle to pay the premiums on healthcare and so may not receive necessary treatments at all. Because of the stress caused by economic uncertainties, poverty and unrest, there is a rise in unhealthy habits such as smoking and alcohol consumption. Obesity also increases due to unhealthy diets. Antibiotic resistance is a major problem. The lack of technological innovation means that there is very little progress made in combatting this. People become more vulnerable to infectious diseases. The aging population is a major issue. A high proportion of the population is unable to work and must be supported by the remainder. The lack of technological innovation, poor healthcare provision and increased health risks combine to cause very high levels of illness among the elderly. This increases the burden on society due to the high demand for informal care and lowers the living standard for all. The poor state of the environment affects people's health, with problems due to the increased pollution. Flood events also lead to disease outbreaks and in general there is a higher prevalence of illness. The government's response to outbreaks is slow and ineffectual. There is a reduction in life expectancy.	- SSP3¹ - EurSSP3⁹ - WLO2015: Laag⁶ - Delta: Rust² - Stakeholder workshop

SSP4: The green gulf (*De groene kloof*)



Variable	Description	Sources
Global context	Inequalities are increasing all around the world, both within and between countries. Technological advancements reduce the demand for unskilled labour and there is little support available for those who are unable to participate in the new high-tech economy. At the same time, (higher) education becomes less accessible as fees are increased. Those who are wealthy enough to afford a good education can get good jobs, but for others opportunities are increasingly limited. This trend favours those countries with well developed tech industries (US, China, South Korea, Japan, Germany, etc.), or at least the wealthy elite in these countries. Countries without a strong tech industry are increasingly left behind and development in low-income countries slows. There is less foreign aid available and international institutions mostly serve the interests of the global elite. The need to reduce greenhouse gas emissions is recognised and given a high priority. Measures to reduce emissions are often forced on populations, particularly in more autocratic regimes, of which there are many in this scenario. In China, the Social Credit System is expanded to include individuals' emissions and this system is adopted by several other countries. Under such systems, sustainability is enforced on poorer communities through power and suppression. There is little concern for human rights in other countries. If it is economically beneficial to trade with a country then it will go ahead, regardless of how people are treated in that country.	- SSP4¹ - Stakeholder workshop - Expert consultation
Demographics	The population will stay roughly constant until around 2050 (17.4m), then will steadily decline to 14.6m in 2100. Fertility is low and there is a medium level of mortality. In 2050, 58.5% of the population are between 20 and 65, 22.2% are over 65, and 9.4% are over 80. Immigration is selective and highly-skilled workers are prioritised. Society is increasingly divided into two levels: the elite and the working class. The elite have a higher life expectancy, thanks to having better healthcare and healthier lifestyles. There is a high level of urbanisation. By 2050, 87% of the population lives in urban areas. This is	- SSP4^{1,3,4} - EurSSP4⁹ - Delta: Rust² - NIDI: Krimp^{7,8} - Stakeholder workshop

	mainly concentrated in the Randstad and in areas with knowledge and business centres.	
Economy and Technology	There is medium economic growth (around 2% per year). There is a high level of globalisation and moderate international trade. The ports of Amsterdam and Rotterdam are able to maintain their competitive position. Large, innovative, internationally-oriented companies do particularly well. The minimum wage is set at a low level and workers' rights are diminished. It is common for the working classes to have two jobs, but limited opportunities mean they often need to travel long distances. There is a growing number of 'nomadic' workers who travel around Europe for seasonal work, mostly in agriculture. Technological development is rapid in high-tech sectors but there is less innovation in more labour-intensive areas. This is justified as a means of preventing automation from taking the jobs of the working class. The working class often have jobs in agriculture (particularly the growing organic sector) and healthcare. There is increasing use of AI for both military and civilian purposes, which also limits the jobs available to the working class.	- SSP4^{1,3} - EurSSP4⁹ - WLO2015: Hoog⁵ - Delta: Druk, Stoom² - Stakeholder workshop - Expert consultation
Land use	There is a small increase in urban areas (17% of surface area in 2050), primarily in the Randstad and in centres of knowledge and business. The port cities of Amsterdam and Rotterdam grow as exports increase. It is around these successful areas where the elite live. Urban development is neither compact nor sprawled. Within cities without knowledge centres, there is little money for renovation or demolition. Older areas become impoverished and unappealing. In the more peripheral parts of the country, depopulation leads to many empty properties in towns and villages and fewer facilities for the remaining people. There is a large decrease in agricultural land (63% of surface area in 2050). As farming becomes dominated by a small number of large companies, land which is of poorer quality, subject to salinisation or is otherwise unprofitable is abandoned. Some farmland in the Randstad in areas near where the elite live is converted to nature areas.	- SSP4^{1,3,15,40} - EurSSP4^{9,16} - Delta: Rust² - Stakeholder workshop - Sea-level rise adaptation paths: Beschermen-gesloten¹⁹

	The total land for nature covers 20% of surface area by 2050. New nature areas for recreation are created close to areas where the elite live and are well maintained. In more peripheral areas, land that is no longer used for farming is given over to nature but is not looked after. There is no attempt to make it accessible and it has little experiential value. Initially, there are no major, national-scale adaptations to respond to rising sea-levels. Instead, local flood defences are strengthened, particularly in areas where the elite live. As sea-levels rise further they become a threat to business and the elite and the Netherlands gradually moves towards a 'protected closed' approach. In 2050, initial steps have been taken towards replacing the <i>Maeslantkering</i> (storm surge barrier on the <i>Nieuwe Waterweg</i> in South Holland) with a dam with a lock complex. This will require new pumping systems and will create a new inland lake. It is likely that during periods of high river discharge the pumping capacity will be exceeded, leading to localised flooding. The elite will be largely protected from such occurrences, but it will cause problems for the working class.	
Socio-economic inequality	There are high levels of inequality. The elite tend to be employed by high-tech companies and have high salaries. They are well educated, often in private schools, and they live in green, well-maintained suburban areas. The working class have low-paid, labour-intensive jobs. They are often poorly educated and they live in compact, poorly-maintained urban areas. The two classes have minimal interaction. There is social cohesion within, but not between, them. There is also inequality between different regions. The move to renewable energy sources generates widespread impoverishment in those areas which centred around the fossil fuel industry, particularly Groningen. Nothing is done to support these areas in developing new industries or to retrain workers.	- SSP4^{1,3} - Stakeholder workshop - Just Transition Fund²¹
Environment	There is strong international cooperation for climate change mitigation. In the Netherlands there is a rapid shift to renewable energy sources; large-scale energy solutions are prioritised, such as offshore wind farms, and there is increased use of nuclear power. There is also increased focus on energy efficiency,	- SSP4^{1,15} - EurSSP4^{9,16} - Eur-Agri-SSP4³⁸ - OmdT: Beursplein¹⁷ - Delta: Rust² - Stakeholder workshop - EU Green Deal¹⁰

	particularly for new buildings, infrastructure and technologies. The Netherlands does not quite meet the EU Green Deal target of net zero by 2050, as transport emissions are still relatively high, but it does achieve a 90% reduction in emissions (relative to 1990). In areas near where the elite live, the environment is well maintained and new nature reserves are created for recreation. There is also more green-blue infrastructure. However, in more peripheral areas there is less consideration for nature. There is increased pollution and a reduction in biodiversity as environmental regulations are weakened. Nature areas become degraded and unappealing and natural resources are increasingly overused. Nature areas near the coast are also affected by increasing salinisation as sea-levels rise. The threat of salinisation to drinking water is recognised and some measures are put in place, but drinking water shortages are possible. In this case, ensuring a supply of high-quality drinking water to the elite is prioritised.	
Governance	The government operates for the benefit of business and the elite. It is centralised and effective at achieving its goals, but it makes no attempt to reduce inequality. Business has a lot of lobbying power. There is less social support available and unions have less power. There is strong international cooperation and the EU is a leader on the global scale. International cooperation is mostly based around trade but also reducing carbon emissions. The high level of inequality leads to increased civil unrest. This in turn leads to increased surveillance and the Intelligence and Security Service (<i>AIVD</i>) gets more powers. There is ultimately a ban on organised protests.	- SSP4¹ - EurSSP4⁹ - OmdT: Beursplein¹⁷ - Stakeholder workshop
Agriculture	Agriculture mostly becomes the domain of a small number of large companies. These make use of very intensive, highly-efficient systems and technological advances lead to large increases in productivity. There is a high level of mechanisation and increased use of precision farming. There is a slight increase in the use of fertilisers and pesticides, but they are used much more efficiently. The same goes for irrigation.	- SSP4^{1,3,15,40} - EurSSP4^{9,16} - Eur-Agri-SSP4³⁸ - Delta: Stoom² - Stakeholder workshop - WUR2050: Productiviteit voorgenomen /

	At the same time, there is more small-scale organic production. This is labour-intensive and focuses on high-value 'luxury' products and mostly exists for the environmentally-conscious elite. This is one of the few growing sources of employment for the working class. Cattle numbers are reduced by around 50% (compared with 2019) as part of the drive to reduce emissions. The remaining cattle are bred for low methane emissions and they receive methane-reducing food additives, they also spend considerably less time grazing. In contrast there is very little reduction in pig or chicken numbers (around 5%), since the main focus is on reducing emissions rather than reducing consumption of animal products in general. There is a relatively large increase in productivity per animal, at the expense of animal welfare. Synthetic meat products become common. Agricultural policies are aimed at supporting economic growth. Environmental standards are reduced, except in selected areas which are also used for recreation. Greenhouse gas emissions from agriculture are reduced as part of the government's drive to meet its international commitments, but local environmental impacts of agriculture are mostly ignored.	Productiviteit Strikter / Natuurinclusief strikter³¹ - Expert consultation
Lifestyles	The elite generally live high consumption lifestyles but they are also more environmentally aware and will choose sustainable options where possible. The working class have low consumption levels but mostly do not have the financial resources to choose sustainable options. The elite have healthier diets than the working class. There is little change in the amount of meat consumed but there is a move towards synthetic meats. The elite spend more (non-working) time outdoors than the working class. They have more free time and have easy access to well-maintained nature areas for recreation. The elite travel a lot for recreation and often go abroad. The working class must often travel long distances for work but have few holidays abroad. Low emission travel options are introduced such as hydrogen-powered aeroplanes and a hyperloop is constructed connecting Dutch business centres to	- SSP4^{1,3} - EurSSP4^{9,16} - OmdT: Beursplein¹⁷ - Stakeholder workshop

	similarly wealthy areas across Europe. These are expensive however and are primarily used by the elite. The working class mostly continue to use petrol- and diesel-powered cars, since upgrading to electric vehicles is expensive and there is no support for this. While this is not in line with the government's drive to reduce emissions, it mostly restricts itself to implementing standards for business and industry rather than private individuals. It tries to encourage people to cycle or to take public transport, but there is little funding to support this and the working class often have to travel long distances to work, making cycling impractical. Public transport is also reduced in less populated areas.	
Health and Healthcare	There is good quality healthcare available but at a high price. Healthcare becomes more commercial and there are hospitals run by global conglomerates. High investment in research and innovation leads to new breakthroughs but they are expensive. The healthcare sector is a major source of employment for the working class. As the population ages there is more demand for people to look after the elderly and many of the tasks this involves are not easily automated. The elite can afford the best care. They have a longer life expectancy and remain active later in life. For the working class, life expectancy is slightly reduced; locally they can only access basic healthcare and they have to travel long distances to see specialists. They are generally less healthy than the elite and have less time for active recreation. They have higher rates of smoking, alcohol consumption and obesity and extra fees are imposed for healthcare relating to these issues. As the population gets older, there is increasing strain on healthcare systems. The elite can afford good care, but among the working class, poor healthcare provision and increased health risks lead to high levels of illness. The elderly are particularly affected by this, and this imposes an additional burden on the working class as the demand for informal care increases, representing a growing burden on society. The poor state of the environment outside the wealthy areas affects people's health, with	- SSP4¹ - EurSSP4⁹ - OmdT: Beursplein¹⁷ - WLO2015: Laag⁶ - Stakeholder workshop

	problems due to the increased pollution. Flood events also lead to disease outbreaks and in general there is a higher prevalence of illness than at present among the working class. The government's response to outbreaks is ineffectual and disease spreads quickly.	
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SSP5: After us comes the deluge (*Na ons de zondvloed*)



Variable	Description	Sources
Global context	There are two main trends contributing to global development: (i) The success of emerging economies. These contribute to a growing global middle class and an increased demand for goods and services. (ii) The digital revolution, increasing global discourse and encompassing a large proportion of the global population. The World Trade Organisation succeeds in further liberalising trade and there is increasing focus on fostering competitive markets. This generally leads to more effective institutions and the opening of markets to disadvantaged population groups. There is increased equality and social cohesion in most world regions. The EU expands and is a major player on the world stage. Within Europe there is a new pan-European free trade zone, but trade with the rest of the world also increases, particularly with southeast Asia. European policy is predominantly focused on financial and economic governance, while other issues, particularly environmental policy, are dealt with at a national level. The effects of climate change are particularly strong in this scenario, but it's generally accepted that this is something that this is inevitable and that the solution is extensive adaptation measures based on modern technologies. There is a lot of support available to the low-income countries which are most affected by climate change and new ambitious Development Goals (as opposed to Sustainable Development Goals) are introduced.	- SSP5¹ - Delta: Stoom² - Stakeholder workshop - Expert consultation
Demographics	The population will steadily increase up to 21.5m in 2050 and then 28.4m by 2100. There is high fertility and low mortality. In 2050, 57.3% of the population are between 20 and 65, 20.2% are over 65, and 11.0% are over 80. Life expectancy increases thanks to healthcare innovations. The strong economy and generous social support make the Netherlands an attractive destination and migration is very high. The rapidly growing economy means there are many jobs available for high-skilled migrants. It is also easy for low-skilled migrants to find work, as many low-paid jobs are difficult to automate and difficult to fill by the incumbent workforce.	- SSP5^{1,3} - Eur-SSP5⁹ - NIDI: Groei^{7,8} - WLO2015: Hoog (high migration variant)⁶ - Delta: Stoom² - Stakeholder workshop

	There is a high level of urbanisation. By 2050, 91% of the population lives in urban areas. In the first half of the century this is mainly concentrated in the Randstad, but then spreads to other cities, particularly in North Brabant and the eastern part of Gelderland.	
Economy and Technology	There is high economic growth (around 3% per year) and the Euro is strong. There is a high degree of globalisation and reduced barriers to international trade; the world is increasingly connected. This is particularly good for the main Dutch ports (Amsterdam and Rotterdam) which see considerable growth. The greenports associated with them (Westland, Aalsmeer and the Bollenstreek) also flourish. Centres of knowledge and innovation (e.g. Eindhoven, Delft and Wageningen) thrive in this scenario, attracting new talent and investment. In the Netherlands, a universal basic income (UBI) is available to all citizens. This is financed by removing many existing benefits (as they are no longer necessary with a UBI) and increasing taxes, particularly for the higher income levels, which will also have the effect of increasing income equality. As summer temperatures in southern Europe become uncomfortably hot, tourism to the Netherlands increases, further boosting the economy. Technological development is rapid and new technologies are widely shared. Moreover, people strongly believe in the power of technology to solve all their problems. Virtual reality is widely used and there is widespread use of AI, particularly as a helper to people in their day-to-day lives.	- SSP5^{1,3} - Eur-SSP5⁹ - OmdT: Beursplein¹⁷ - WLO2015: Hoog⁵ - Delta: Stoom² - Toerisme2030: Global Village²⁸ - Stakeholder workshop - Kansrijke armoedebelid¹³ - Expert consultation
Land use	There is a large increase in urban areas (21% of surface area in 2050), at the expense of rural and nature areas. This is particularly the case for the Randstad up until 2050, but then spreads to other cities, particularly in North Brabant and the eastern part of Gelderland. People want to live in green areas near cities, and as a result the cities expand and develop more of a sprawled character. There are few environmental restrictions and housing development is permitted in places where it was previously restricted. The <i>Groene Hart</i> is increasingly built-up.	- SSP5^{1,3,15,30} - EurSSP5^{9,16} - Delta: Stoom² - WUR2050: Reference scenario³¹ - Stakeholder workshop - Sea-level rise adaptation paths: Zeewaarts¹⁹

	Rural areas decrease (64% of surface area in 2050) with particularly large reductions in arable farming and intensive grassland. It is predominantly land which is poor-quality, subject to salinisation or is otherwise unprofitable which is converted. Protected areas are reduced to make space to house the growing population. The remaining natural areas (15% of surface area in 2050) are given a park-like character and are seen as resources for recreation rather than nature-preservation. Their accessibility is increased and they are used more intensively. Some natural areas are lost to rising sea-levels since their protection is not seen as a priority (e.g. salt marshes and mud flats). To adapt to rising sea-levels, the Netherlands takes a 'seawards' approach. Planning begins in the 2020's and work is well underway by 2050. The idea is to create artificial islands along the coast, connected by dams and forming a peripheral lake. This provides temporary storage of high river discharges as well as additional space for housing and economic activities. In the event of extreme sea-level rise a dam across the North Sea is also an option in the future.	
Socio-economic inequality	There is high equity and inequality is strongly reduced. Economic disparities between regions are lower than in other scenarios. Everyone has access to good healthcare and good education. As migration increases there are increasing tensions. While there is social-economic equality there is not necessarily socio-cultural equality and there is a conflict between social cohesion and individuality.	- SSP5¹ - Delta: Stoom² - Stakeholder workshop
Environment	There is little concern for global issues and international cooperation for climate change mitigation is continually delayed. The Netherlands plans to use technological advancements to adapt to the effects of climate change, rather than pursuing mitigation. There is little environmental regulation and nature areas are reduced to make way for housing. Natural areas which are close to where people live and which have obvious well-being benefits are well-maintained, though with a focus on recreation rather than nature preservation. In other areas there is degradation of the natural	- SSP5^{1,15,30} - EurSSP5^{9,16} - Delta: Stoom² - Stakeholder workshop - Sea-level rise adaptation paths: Zeewaarts¹⁹

	environment and depletion of natural resources as well as increased pollution. Biodiversity is reduced. There is also a high level of sea-level rise in this scenario, and increasing salinisation is detrimental for nature in coastal areas. There is continued use of fossil fuels, leading to increased air pollution, though there are efforts to keep this to low levels in highly populated areas. Ultimately fossil fuels become scarcer over time and by 2040 there is a move towards renewables for economic reasons. Water quality is generally poor with extensive pollution, though considerable effort is made to ensure it is clean by the time it reaches consumers. There are more blue-green areas in cities, both to make them more appealing and to combat heat stress. Construction of the island chain along the coast takes a long time and meanwhile more short-term solutions are required. Local flood defences are increased, but areas vulnerable to flooding are increasingly built on to house the growing population (e.g. IJsselmeer polders and Zeeland) and flood events occur more frequently. There are also environmental consequences of the island chain approach as the sheer scale of the adaptation disrupts natural dynamics all along the coast.	
Governance	In the mid-2020's, the Dutch people elect a socialist, populist government. Its main focus is development, free markets and human capital. There is good (trade-based) international cooperation. The government is initially centralised and highly effective, but moving into the second half of the century the challenges of a high population, diminishing natural resources and flooding become harder to deal with. There is a high level of social-cohesion and participation. Citizens can vote on an online referendum platform on policy issues.	- SSP5¹ - EurSSP5⁹ - Toerisme2030: Global Village²⁸ - Stakeholder workshop
Agriculture	There are large increases in productivity and despite the reduced area available for agriculture, total production increases thanks to technological advances. The Netherlands becomes even more of an exporting powerhouse. This is largely due to	- SSP5^{1,3,15,30} - EurSSP5^{9,16} - Delta: Stoom² - Stakeholder workshop - Expert consultation

	increased global meat consumption (as incomes increase) and trade liberalisation. The sector as a whole becomes more intensive, concentrated and mechanised. There is a large increase in irrigation, but it also becomes more efficient. Fertiliser and pesticide use increase, thanks to a reduction in regulation. Livestock farming becomes more intensive and there is a large increase in productivity per animal. The growing Dutch population means that there is less space for agriculture and animal welfare is reduced. Livestock numbers originally remain fairly constant, before reducing as synthetic proteins become more popular (approximately 10% reduction across all livestock types by 2050 compared with 2019). There is increasing demand for luxury agricultural products and those with a higher added value (such as vegetable and fruit cultivation) are prioritised.	
Lifestyles	People live material-intensive lifestyles and there is a high amount of status consumption. In this scenario there is a focus on personal freedom, meaning that there is little to no social pressure to consume less, to choose sustainable options or to pursue healthy habits. Diets tend to be unhealthy with a large share of meat. There are also high levels of food waste. People are well-educated and know the risks of their choices, but there is a reliance on technology to solve all problems. People travel a great deal, both for work and recreation, as the population is more spread out due to the sprawling urban areas. Also, the rapid development of self-driving cars means that car travel is available to more people. These factors, as well as the high population growth, mean that congestion on the roads increases and more roads are built to connect urban areas within the Netherlands and to the rest of Northern Europe. Public transport is well funded, both as a way to support people and to reduce road congestion. Use of public transport increases and it is affordable for everyone. Initially nature areas near urban centres are well-maintained and easily accessible and so people spend a reasonable amount of time outdoors.	- SSP5^{1,3} - EurSSP5^{9,16} - WLO2015: Hoog (including high sprawl and limited climate policy variants)⁴¹ - Delta: Stoom² - Toerisme2013: Global Village²⁸ - Stakeholder workshop

	However, over time these areas come under greater pressure from environmental degradation and over-crowding and they become less appealing. Nature areas are also reduced due to the growing demand for space for housing. In the second half of the century virtual reality options see a large increase in popularity and people spend more time indoors. There is a great deal of tourism, both incoming and outgoing. There are no barriers to international travel and the number of flight routes expands. There are considerably more flights each year and by 2030 there are 63% more people flying to and from the Netherlands than there were in 2011. There is also an increase in the number of private jets.	
Health and Healthcare	There is considerable investment in healthcare. It is easily affordable and accessible to everyone and there are many new innovations. However, many people live unhealthy lifestyles, leading to rising levels of obesity and other health problems. The aging population also means that a greater proportion of people are suffering from age-related health issues. A lot of the healthcare innovations are focused on allowing people to live the life they want without worrying about the negative consequences, and also on prolonging the period in which people are fit and healthy, and these are effective up to a point. The healthcare system is also supported by the high migrant population, which provides many workers to support the elderly. However, the degraded environment and increased pollution also have effects on people's health and while there are short term increases in overall health, in the second half of the century there are too many pressures, there is too much strain on the healthcare system, and the overall health of the population decreases.	- SSP5¹ - EurSSP5⁹ - WLO: Hoog^{5,6} - NIDI: Groei⁷ - Stakeholder workshop

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