RECOMMENDATIONS FOR A SUSTAINABLE SPATIAL DEVELOPMENT OF THE OUDLAND POLDER

FOREWORD

This publication brings together the major **recommendations for the initial memorandum for the Spatial Implementation Plan (SIP) for the Oudland Polder (phase 1)** arising from the European **COASTAL Horizon 2020 project**. They are based on a far-seeing exploration of the future, up to 2100, in which a range of societal developments were explored. This means that we reviewed, for example, how the further urbanisation and population growth in this polder region could evolve. We also checked which agricultural practices we could expect in the Oudland Polder in the future.

This implies that we had to take into account a great many uncertainties when developing these recommendations. One of the ways to do this is to work with **scenarios**, whether or not supported by **modelling work**. This means each of the recommendations on the following pages is substantiated by the insights arising from this scenario work. Furthermore, we involved a diverse group of **stakeholders** living and/or working in the region in this exploration of the future. Through their expertise in relation to the Oudland Polder, they provided a valuable contribution to the debate on the future of this polder region. What they brought to the table helped to contextualise and interpret results. Thirdly, where possible, we also made the link between European and Flemish policy lines that are aimed at the longer term and present some clear objectives for the coming decades. This means the recommendations presented in this publication are a synthesis of research combining both qualitative and quantitative work, and in which modelling work builds upon a direct dialogue with stakeholders, but has also fed into it.

We would therefore like to expressly thank all the stakeholders and experts who have made us familiar with the Oudland Polder in recent years, in particular the staff at the VLM. We also extend our sincere thanks to everyone who took part in one of the workshops, gave feedback on publications or took the time to work with us on the various scenarios referred to in this publication.

What is the COASTAL project about?

COASTAL (h2020-coastal.eu) is a European research and innovation project in which the development of coastal areas and their hinterland is central. The project's main objective is to develop practical policy recommendations and/or business roadmaps that support the areas concerned in outlining a more sustainable and future-oriented development path. The focus here lies on the synergies that can be created in coastal areas, or to put it another way: the opportunities that exist for arriving at win-wins that contribute to the European sustainability objectives as formulated in the European Green Deal through investments in a wide range of fields, such as agriculture, industry, nature or tourism. In the Flemish case, we were working in line with the Oudland Polder land organisation project.

What was the most important input for these recommendations?

Insights from scenario work: With the Shared Socio-economic Pathways (SSPs) as a starting point, 4 future narratives were developed for the Oudland Polder. These narratives follow the logic from the SSPs as regards the dynamics that will determine the major developments in our society, and explain what these could mean in terms of spatial planning, agriculture, nature and recreation. These scenarios can be found in a separate publication, which can be consulted at this link. They fed into both the stakeholder dialogue and the modelling work. Some climate scenarios were also developed.

Stakeholder input: As a partner in the COASTAL consortium, the VLM was a major conversation and research partner. In addition, in order to bring in the vision from a wider group of stakeholders, a number of workshops were also organised. These workshops aimed to developed shared principles to be maintained as a guideline in the further development of the Oudland Polder. These are presented in a separate publication, which can be found at this link.

Modelling work: In order to be able to substantiate these recommendations quantitatively, the Flanders Spatial Model, different climate models and the Natural Value Explorer were used as well. More information on this can be found via the COASTAL deliverables (see website).

THE SIP OFFERS A GOLDEN OPPORTUNITY TO GIVE THE OUDLAND POLDER A CLIMATE-RESILIENT AND SUSTAINABLE FUTURE.

We are therefore making the following recommendations:

1. Maximum focus on the maintenance and restoration of high-quality open spaces

- Safeguard all remaining open spaces.
- Make infill development of existing centres in the urban coastal area and the city of Bruges a priority so as to accommodate the anticipated increase in residents and (economic) activities.
- Make use of the strong and shared societal support that seems to exist for preserving the traditional polder landscape in the Oudland Polder and restoring it where possible.

2. Make space for water

- Provide sufficient space (in the soil) for retaining rainwater in the polder for a long time. This water will be sorely needed in the agricultural and natural area during the dry summer months in the future.
- Plan for natural and agricultural areas from a vision that looks at the water challenges in the Oudland Polder in an integrated manner. Through the water system in both natural and agricultural areas, ensure that micro-climates can form where it temporarily remains more damp than in the surrounding area.

3. Give ecosystems the necessary room for recovery

- Plan nature and agriculture from core areas in an integrated manner, and provide permanent, natural corridors that connect the core natural areas with one another.
- Convert all bird and habitat guideline areas into natural areas.
- Invest in wet nature that can make a major contribution in terms of water retention and carbon storage.
- Link the SIP to a climate adaptation plan to the benefit of the nature in the Oudland Polder.

4. Provide sufficient buffering for logistical and port activities

- Investigate how the noise pollution caused by the port of Zeebrugge in the area surrounding Lissewege can be limited.
- Take account of the construction of a buffer strip in the agricultural area to the north of Lissewege.

EXPLANATION OF THE CLIMATE SCENARIOS USED

As the latest IPCC reporting convincingly shows, we will find that climatological determinants such as precipitation patterns, droughts, intensity of precipitation, etc., will change more and more in the coming decades (report can be consulted at this link). What we do not yet know, however, is the extent to which climate change will intensify. For this reason, in the context of the Intergovernmental Panel on Climate Change (IPCC), a number of reference scenarios were developed: the **Representative Concentration Pathways** (RPCs). These are scenarios that display the concentration of greenhouse gases in the atmosphere in 2100 relative to pre-industrial concentrations, which results in a certain 'radiative forcing' (W/m^2). This is the difference between the incoming and outgoing radiation in the upper layers of the atmosphere.

The modelling work upon which these recommendations are based makes use of **RCP2.6, RCP4.5, RCP6.0** and **RCP8.5.** This means from a climate scenario linked to an extensive climate policy (RCP2.6) to a climate scenario in which no significant action is taken to combat climate change. The table below summarises what these scenarios entail.

Scenario	Rise in average global temp. in °C (1995-2100)	CO_2 eq. conc. in the year 2100	% change in CO_2 eq. emissions compared to 2010	Chance of remaining below 2.0°C in 21st century	Chance of remaining below 3.0°C in 21st century
RCP2.6	1.0 – 2.8	430-480	-120 to -80	probable (chance > 66%)	probable (chance > 66%)
RCP4.5	1.5 – 4.5	580 – 720	-130 to -20	improbable (0% < chance < 50%)	probable (50% < chance < 66%)
RCP6.0	2.1 – 5.8	720 – 1000	-7 to 70	improbable (chance < 33%)	improbable (chance < 33%)
RCP8.5	2.8 – 7.8	> 1000	75 to 180	improbable (chance < 33%)	improbable (chance < 33%)

Table 1. Overview of the various RCPs. (Source: PBL and KNMI (2015) Climate change. Summary of the fifth IPCC assessment and translating this to the Netherlands.)

EXPLANATION OF THE SPATIAL SCENARIOS USED

As part of the COASTAL project, the entire polder region was a topic of research, including the urbanised coastal area, which means that our research was broader than the region for which the SIP process has presently been launched. Nonetheless, the findings arising from this research also apply to this sub-area.

This means the spatial scenarios on which these recommendations are based also refer to the entire Oudland Polder. These are all existing scenarios that were developed for the Flemish government, in which certain zones may or may not be additionally shaded as natural areas. There is a brief explanation of these below. Images 5 through 9 show how the land use in the Oudland Polder will look in 2050 according to these scenarios.

Anti-urban sprawl: This land use scenario attempts not only to reduce the extra amount of area occupied in Flanders to 0 hectares in 2035, but also to make some extra space for nature, agriculture and forests over time. This will lead to a relatively high density of villages and towns/cities. As part of the COASTAL project, this spatial scenario was linked to the socio-economic scenario 'full sustainability', with the result that it includes the creation of a relatively large area of additional nature. That means that this scenario focuses on the recovery of the original wetlands area, where this is still possible (reference: status in the 1950s). These wetlands are wet areas with high biodiversity, in accordance with the 'open (not forested) landscape scenario'*, which are kept open by means of more extensive agricultural techniques (e.g. extensive grazing) and conservation (e.g. mowing). The average groundwater level in these wetlands is close to ground level; no pesticides are used and there is only a minimum quantity of fertiliser.

Business as usual: The area occupied will increase in this scenario pro rata to population growth. In relative terms, more homes, business premises, catering establishments, etc., will be added in the centres than on the outskirts. Compared to growth as usual – the next spatial scenario – the

* Decleer, K. et al. (2016) Mapping wetland loss and restoration potential in Flanders (Belgium): an ecosystem service perspective. Ecology and Society 21(4): 46.

densities in the centres will therefore be somewhat higher. This scenario only includes expansions of nature that are already planned for in line with the preservation objectives.

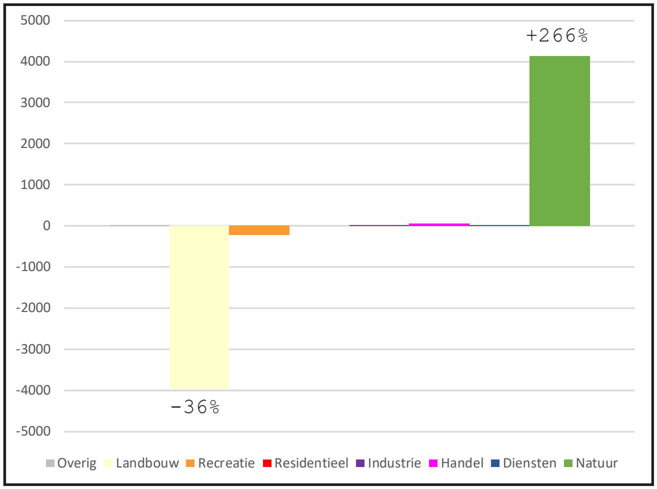

Figure 1. Change in spatial use (hectares) in the Oudland Polder in 2050 compared to 2013 in the 'anti-urban sprawl' scenario.

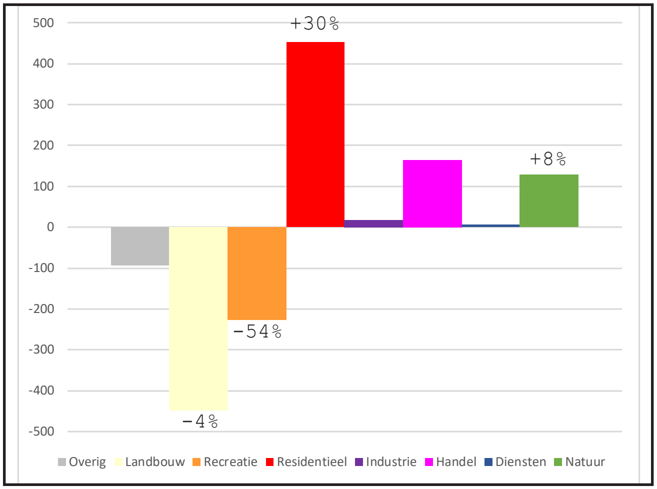

Figure 2. Change in spatial use (hectares) in the Oudland Polder in 2050 compared to 2013 in the 'business as usual' scenario.

Growth as usual: In this spatial scenario, we continue to occupy further open spaces at the present rate. This means that around 6 hectares of open space will disappear every day. This will cause a sharp rise in residential surface area. As regards additional development of nature, this scenario follows 'business as usual'. Here too, then, only expansions of nature already planned for in line with the preservation objectives will be implemented.

Flanders Spatial Policy Plan: This scenario assumes a sharp rise in density, based on the strategic vision for Flanders (approved on 13 July 2018), aiming to reduce the growth in area occupied to 0 hectares per day by 2040. This will lead to greater density in centres and well-placed locations, i.e. locations with greater intersection value and high provision value. Because this spatial scenario was linked, as part of the COASTAL project, to a socio-economic scenario in which ecosystems are separated from human society as far as possible, the expansion of nature is concentrated in 4 'islands' in this scenario: the Uitkerkse Polder, the Meetkerkse Moeren, the polder grasslands between Klemskerke and Vlissegem and ‘t Pompje. That means that if this scenario were to become reality, 34% of the wetlands area from the 1950s would return. In this scenario, these nature islands consist of the already existing nature reserves and all the adjacent plots to be found in the search areas identified as potential compensation areas for the expansion of the port of Zeebrugge. It is important to note that all the historically permanent grasslands outside the 4 nature islands in this scenario will be excavated and converted into production grasslands.

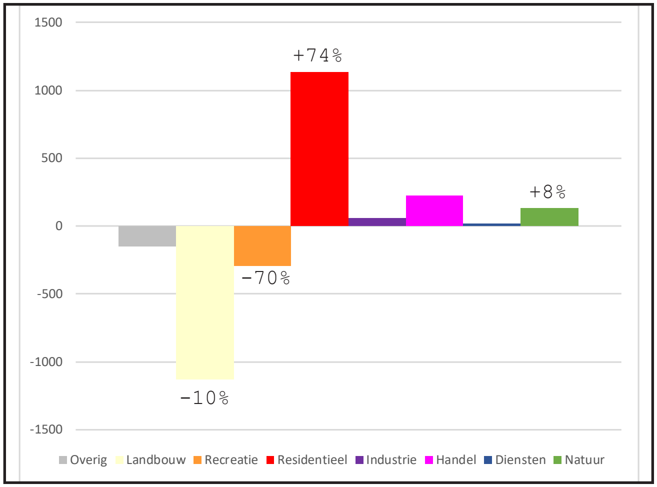

Figure 3. Change in spatial use (hectares) in the Oudland Polder in 2050 compared to 2013 in the 'growth as usual' scenario.

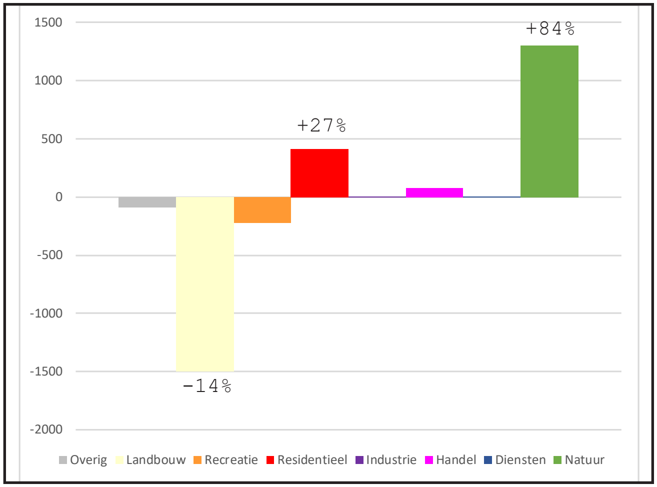

Figure 4. Change in spatial use (hectares) in the Oudland Polder in 2050 compared to 2013 in the 'Flanders Spatial Policy Plan' scenario.

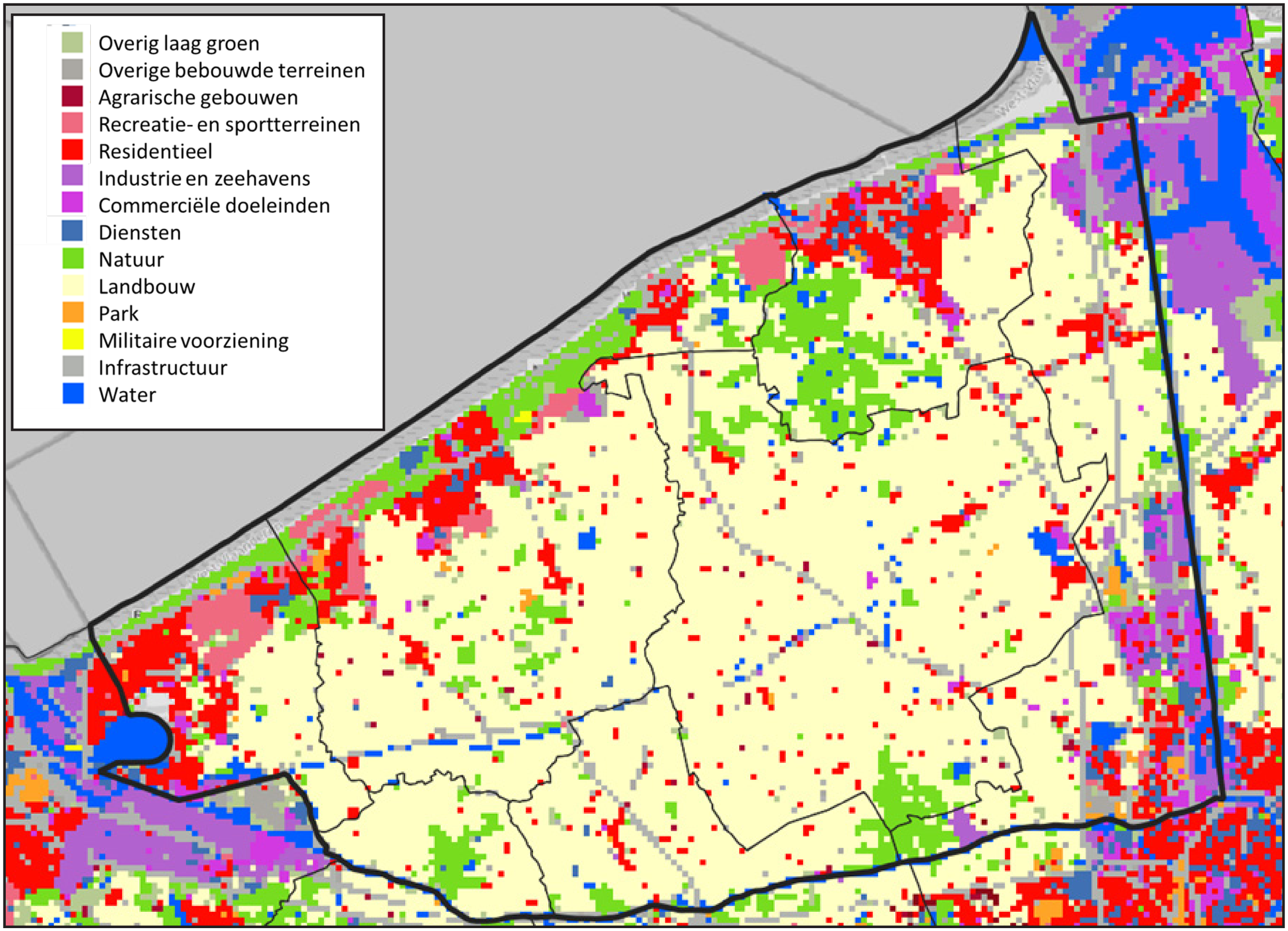

Figure 5. Spatial use in the Oudland Polder in 2013.

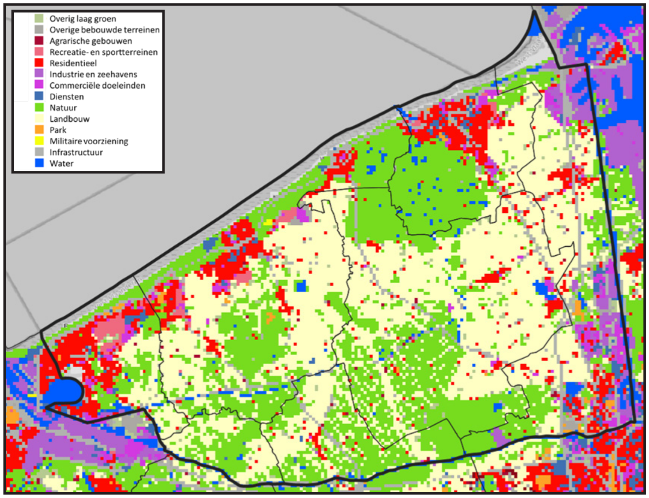

Figure 6. Spatial use in the Oudland Polder in 2050 in accordance with the Flanders Spatial Model in the 'anti-urban sprawl' land use scenario.

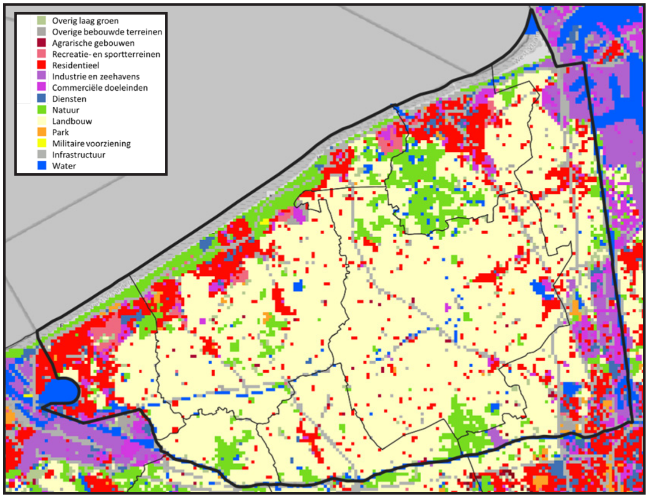

Figure 7. Spatial use in the Oudland Polder in 2050 in accordance with the Flanders Spatial Model in the 'business as usual' land use scenario.

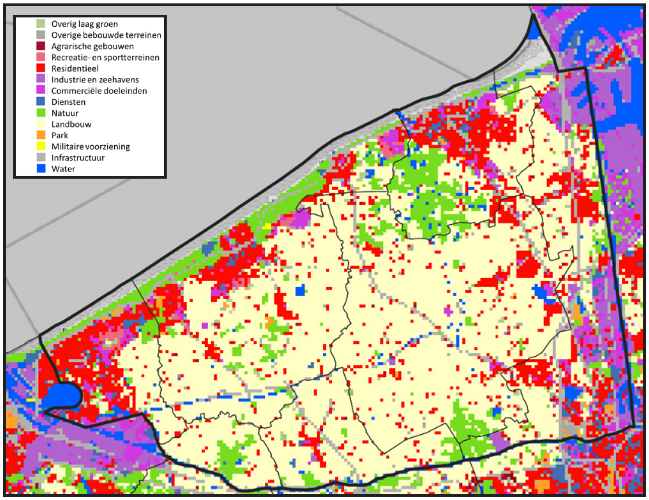

Figure 8. Spatial use in the Oudland Polder in 2050 in accordance with the Flanders Spatial Model in the 'growth as usual' land use scenario.

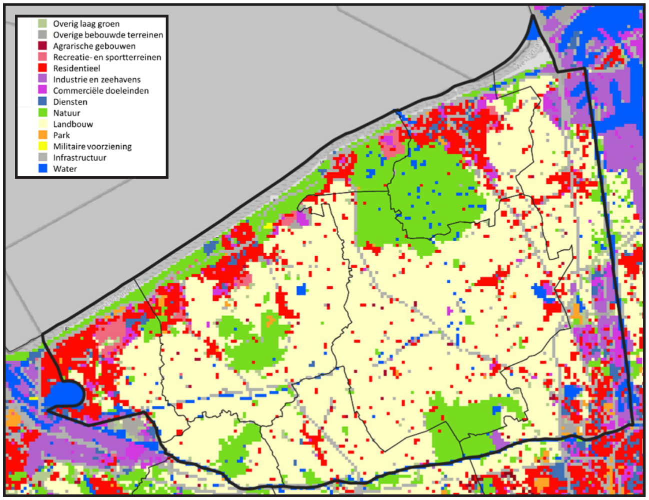

Figure 9. Spatial use in the Oudland Polder in 2050 in accordance with the Flanders Spatial Model in the 'Flanders Spatial Policy Plan' land use scenario.

RECOMMENDATION 1

MAXIMUM FOCUS ON THE MAINTENANCE AND RESTORATION OF HIGH-QUALITY OPEN SPACES

- **Safeguard all remaining open spaces.**
- **Make infill development of existing centres in the urban coastal area and the city of Bruges a priority so as to accommodate the anticipated increase in residents and (economic) activities.**
- **Make use of the strong and shared societal support that seems to exist for preserving the traditional polder landscape in the Oudland Polder and restoring it where possible.**

What did we learn from COASTAL?

1. The **number of residents** in the Oudland Polder, namely the area enclosed by the Boudewijn Canal, the Bruges-Ostend Canal and the North Sea, **will increase** by 2050 .

The aforementioned spatial scenarios were linked to a Shared Socio-economic Path (SSP) and the accompanying projection relating to population growth. This is because each SSP is characterised by a different type of urbanisation and spatial planning. Using the Flanders Spatial Model, we were then able to review how the anticipation population growth or decline would manifest spatially in each of the scenarios. This produces the following picture:

Full sustainability (SSP1) – anti-urban sprawl: This scenario takes account of a **population growth** of 63,771 residents in 2013 to 80,574 residents in 2050 (rise of **21%**). Most of this growth can be attributed to the towns/cities and the large coastal municipalities.

If you don't choose, you lose? (SSP2) – business as usual: This scenario assumes a **population growth** of 63,771 residents in 2013 to 73,612 residents in 2050 (rise of **11%**).

Structural inequality (SSP4) – growth as usual: This scenario takes account of a **population growth** of 63,771 residents in 2013 to 74,522 residents in 2050 (rise of **12%**). As a result of the ability to eat into more and more new open spaces, a relatively large proportion of this population growth can be ascribed to smaller municipalities such as Zuienkerke.

Technological optimism (SSP5) – Flanders Spatial Policy Plan: This scenario is also linked to **population growth:** from 63,771 residents in 2013 to 88,419 residents in 2050 (rise of **33%**). This population rise is largely situated in the larger towns/cities.

The population growth anticipated in each of the SSPs can also be found in the European Atlas of Demography, although it is less pronounced. These figures show a population growth for the towns/cities of Blankenberge, Bruges and De Haan of 8.7%, 8.1% and 9.7% respectively by 2050. Zuienkerke would remain roughly status quo (10 fewer residents). That means that, according to this projection, there would be 11,854 extra residents in these municipalities by 2050. Although the borders of these municipalities do not entirely correspond with the borders of the Oudland Polder, these figures do confirm a trend that also arises from the SSP-based modelling. These growth figures, however, are separate from any growth or decline in people with second homes and other tourists on the coast and in the polder, despite the fact that they also involve a certain spatial demand. This is why the spatial scenarios were calculated with a larger demand for residential developments (houses and flats) than the estimated number of additional residents. There was then a review of where these additional residential developments could take place within the 'rules' for each of the spatial scenarios. Given the existing density of flats, homes and holiday parks in the coastal region, this leads to greater density in the centres which, depending on the scenario, may persist in a more or less pronounced manner.

Finally, a number of targeted interventions were made in the spatial scenarios that have an impact on spatial demand from tourism. In 'anti-urban sprawl', for example, space was made for nature in the area of the Haerendycke holiday parks (Blankenberge) so that a wider corridor could be created between the marine, beach, dune and polder ecosystems. Additional natural areas were also planned for elsewhere in places with potential for tourism, both on the coast and in the polder behind it, in this scenario, as well as in others.

2. There is vocal demand, which is widely shared, to **preserve, and where possible restore**, the characteristic **open landscape** in the Oudland Polder.

In March 2021, we organised 4 workshops, each aiming to define 5 shared principles for the further development of the Oudland Polder. Each of these workshops focused on a theme that was central to the identity of this polder region: the polder villages, the dune-polder transition, the natural and agricultural areas. 26 organisations took part in total, with one or more participants in 1 or more of these workshops. (More information on this can be found in this publication.)

Only 1 shared goal can be found in the output of each of these workshops, namely to preserve the characteristic open polder landscape. The principles in question that were formulated by the participants read as follows:

- "*In the polder region, the main focus is to preserve an open, peaceful landscape*." (nature workshop)
- "*Expanding polder villages must be possible as long as the authenticity of the villages is respected*." (polder villages workshop)
- "*Preserving the open polder landscape in the Oudland Polder is crucial, and is linked to the development of the local regional identity, consciously addressing with the polder peripheries, and looking for synergy with recreation*." (agriculture workshop)
- "*All remaining open space in the dune-polder transition will be preserved and, where possible, expanded according to natural connections and agriculture*." (dune-polder transition workshop)

One conclusion that undoubtedly arises from the workshops is that the participants fully appreciate the historical growth of the polder landscape, which is marked by meadows, polder canals, natural brushwood and small polder villages alongside old agricultural roads. There was demand for a maximum focus on preserving – and restoring – this traditional landscape. Old canal structures, linear elements such as dikes and agricultural roads and panoramic views should therefore, according to the participants, act as the point of departure when tracing out new spatial interventions in the region.

There was no denial that this principle conflicts with certain developments in the polder, and this was discussed at length during the workshops. A significant proportion of the participants were able to agree with a spatial policy that removes existing built-up areas that cannot be reconciled with this principle, such as isolated villages in the greenery. This was about a standpoint that, during the various workshops, seemed to develop into a connecting element among participants taking part in the open spaces debate with a very wide range of concerns. On the one hand, it seemed able to provide an answer to the spatial demand coming from the angles of both nature and agriculture, but it also answered questions relating to the impact of such types of habitation on the local polder communities.

The latter, namely the future of the local polder communities, was a theme that featured most prominently in the discussions on the polder villages. It lent a distinct tinge to the exchange of thoughts on the restoration of the open polder landscape in this workshop. The participants were able to agree on the standpoint that the polder villages should not be expanded spatially any further. The polder villages should continue to develop and grow, but this should be within the area they already occupy. In practice, this means that development and growth would only then be possible in the form of more collective housing, e.g. in larger, more historical properties and on larger plots.

But such a model of using existing spaces naturally has its limits, meaning that spatial issues relating to the polder villages go hand in hand with discussions on the quality of life in the villages in the Oudland Polder: will it continue to be affordable for the villagers to live there in the future? Will it still be possible to find basic services, such as a shop, a post office, medical care or childcare? Will there still be any schools? The villages are gradually becoming 'dormitory villages' according to the participants, in which residents orient their lives around the urban area around Bruges and the coastal region. More and more residents no longer live or work in the villages, but only come home once they have been busy elsewhere. This is also causing the social and culture life in the polder villages to slowly die out, which is clearly being experienced as a negative development.

3. An exhaustive **densification of already built-up areas** will be of benefit to both natural and agricultural areas and is necessary to safeguard the open nature of the Oudland Polder.

In order to be able to link to the demand relating to the preservation and restoration of the open spaces in the Oudland Polder to the various spatial scenarios, we used the Flanders Spatial Model to analyse the size of the clusters of natural and agricultural plots. These are the plots that are linked to a land use that best supports the region's open nature. In addition, it is also the case that there is clear demand for large, adjacent clusters from both an agricultural and a natural angle.

The page opposite shows how large the adjacent clusters of agricultural ground will be in 2050 in each of the scenarios. This therefore involves blocks of adjacent agricultural grounds that are not separated from one another by large roads or waterways, built-up areas or plots intended for a different use, such as nature or recreation.

In this analysis, agricultural plots include the following land use categories: fields, production grasslands, orchards, non-registered agricultural grounds and plots containing agrarian buildings.

Based on these maps, we can conclude that an open landscape with a clearly agricultural character, based on large adjacent clusters of agricultural ground, is best guaranteed by a spatial policy in line with the spatial scenario 'business as usual'. The spatial scenario 'Flanders Spatial Policy Plan' also meets the demand for working towards large adjacent agricultural areas in the Oudland Polder. The major difference between these scenarios is the space freed up in the 'Flanders Spatial Policy Plan' for the development
of 4 relatively large centres of nature.

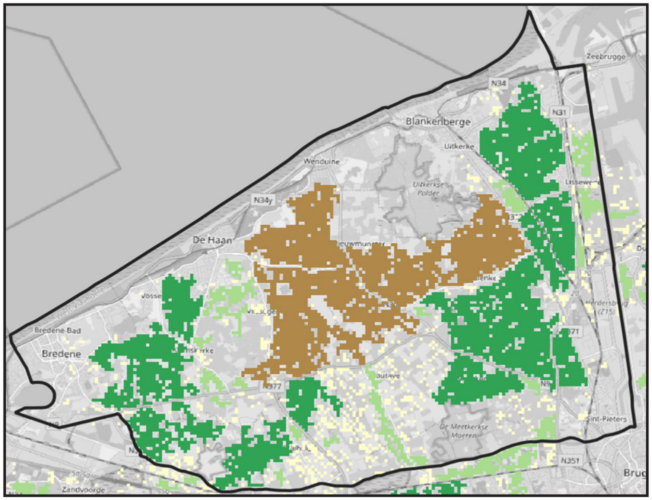

Figure 10. Agricultural cluster size in the Oudland Polder in 2050 in accordance with the Flanders Spatial Model in the 'anti-urban sprawl' land use scenario.

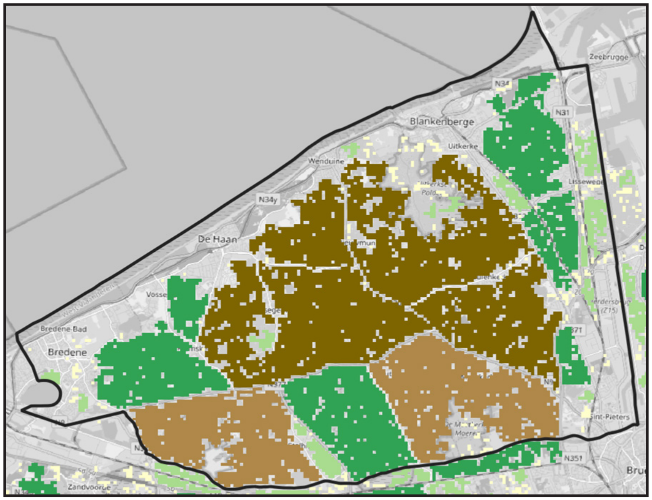

Figure 11. Agricultural cluster size in the Oudland Polder in 2050 in accordance with the Flanders Spatial Model in the 'business as usual' land use scenario.

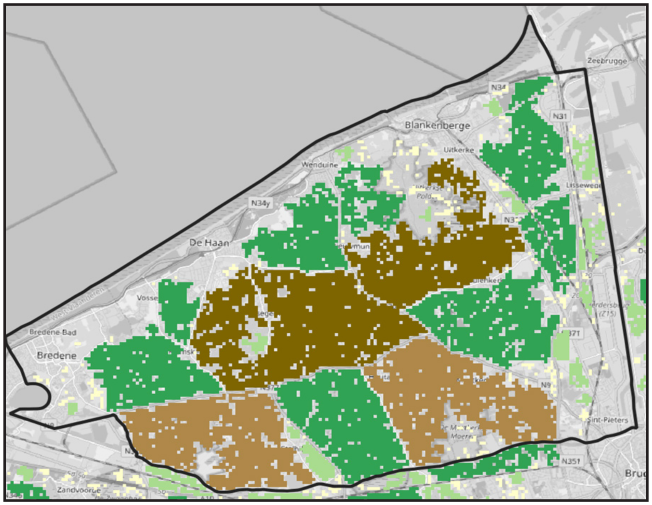

Figure 12. Agricultural cluster size in the Oudland Polder in 2050 in accordance with the Flanders Spatial Model in the 'growth as usual' land use scenario.

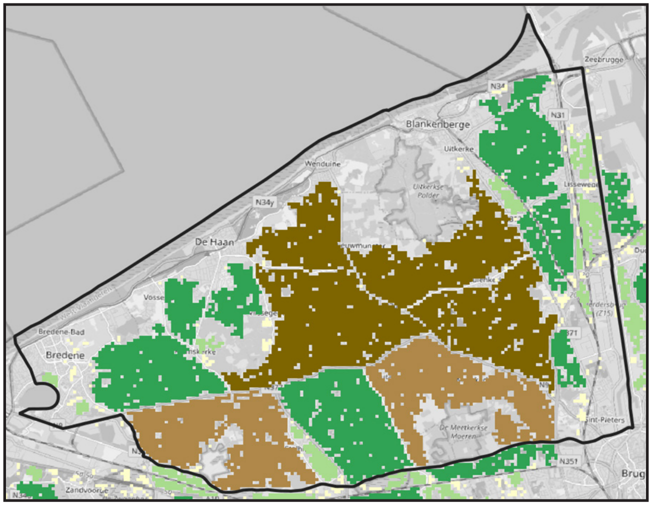

Figure 13. Agricultural cluster size in the Oudland Polder in 2050 in accordance with the Flanders Spatial Model in the 'Flanders Spatial Policy Plan' land use scenario.

We made this cluster analysis for the natural areas too. In doing so, the land use types 'forest', 'dunes', 'natural grassland', 'marsh', 'mudflats and salt marshes' were designated as nature. The result can be seen on the page opposite.

Just as with the analysis of the cluster size for the agricultural grounds, the spatial scenario 'Flanders Spatial Policy Plan' emerges as the *second*-best option from the analysis. The development of nature in line with the scenario 'anti-urban sprawl', however, makes the greatest contribution to an open landscape with a natural character. In this scenario, we based the location of additional nature on the wetland area that characterised the Oudland Polder until the 1950s (see description of spatial scenarios). It focuses on the creation of wet areas with high biodiversity, corresponding to an 86% restoration of the original wetland area. This means that the landscape there is kept open by means of agriculture (e.g. extensive grazing) and conservation (e.g. mowing). The average groundwater level in these wetlands is close to ground level; no pesticides are used and there is only a minimum quantity of fertiliser.

If we only look at the open, traditional character of the landscape, the conclusion that spatial development in line with the scenario 'Flanders Spatial Policy Plan' is preferable seems obvious. However, there is one important note in the margin there. The 'islands' of nature that this scenario focuses on are enclosed by large surface areas of agricultural ground, and are barely connected together. Resilient natural areas, with ecosystems that are resistant to the rising stress resulting from climate change, require permanent natural corridors between the remaining pieces of nature, so that species can migrate and populations can be restored after periods of intense stress (e.g. drought). (Recommendation 3 will address this in more detail.) From a nature perspective, then, 'anti-urban sprawl' is the preferred scenario.

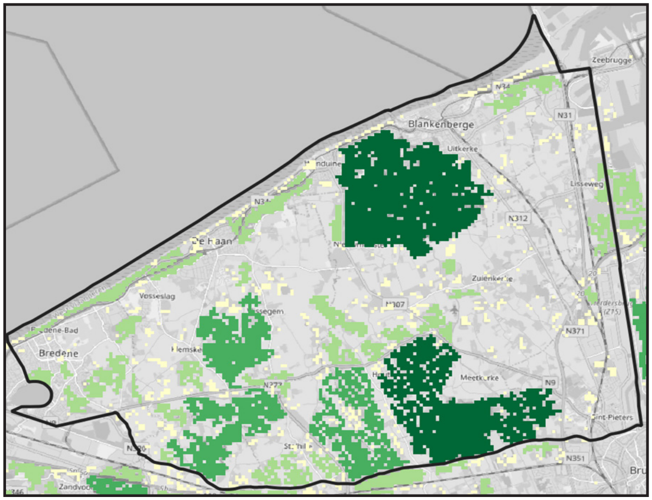

Figure 14. Nature cluster size in the Oudland Polder in 2050 in accordance with the Flanders Spatial Model in the 'anti-urban sprawl' land use scenario.

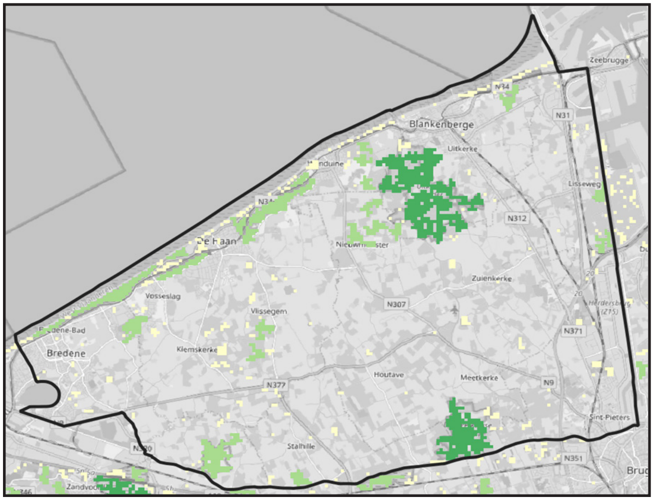

Figure 15. Nature cluster size in the Oudland Polder in 2050 in accordance with the Flanders Spatial Model in the 'business as usual' land use scenario.

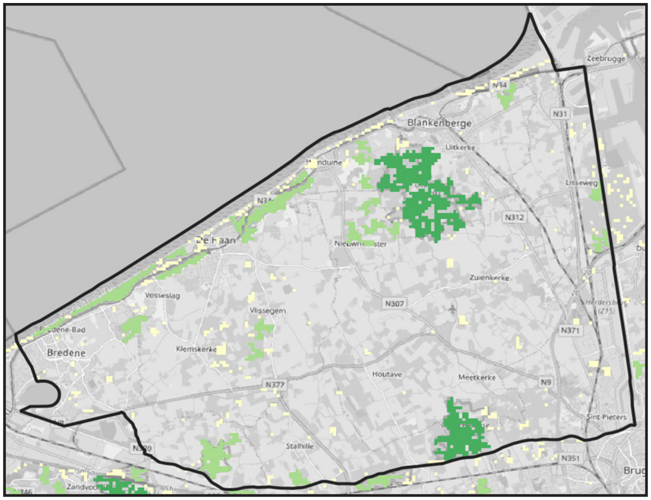

Figure 16. Nature cluster size in the Oudland Polder in 2050 in accordance with the Flanders Spatial Model in the 'growth as usual' land use scenario.

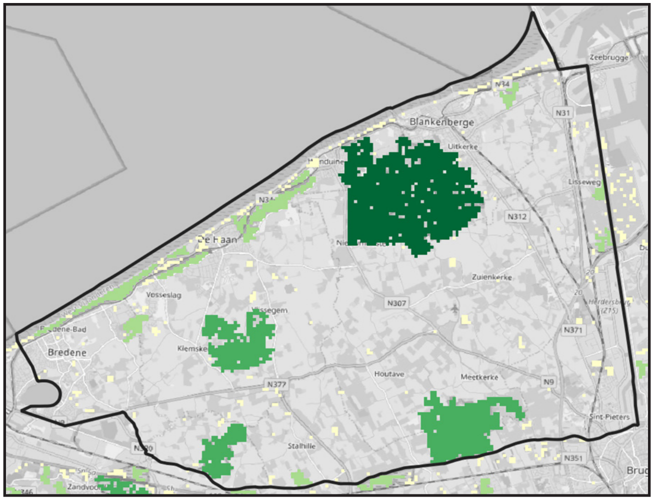

Figure 17. Nature cluster size in the Oudland Polder in 2050 in accordance with the Flanders Spatial Model in the 'Flanders Spatial Policy Plan' land use scenario.

RECOMMENDATION 2

MAKE SPACE FOR WATER

- Provide sufficient space (in the soil) for retaining rainwater in the polder for a long time. In the coming decades, dry periods will become more intense and result in extremely dry summer months.

- Plan for natural and agricultural areas from a vision that looks at the water challenges in the Oudland Polder in an integrated manner. Through the water system in both natural and agricultural areas, ensure that micro-climates can form where it temporarily remains more damp than in the surrounding area.

What did we learn from COASTAL?

It is anticipated that, as soon as this decade, we will be faced almost every year with summer periods in which the precipitation quantities in the Oudland Polder are nowhere near sufficient to meet the water demand for nature and agriculture. We see this pattern returning in each of the scenarios calculated. The more severe the climate scenario, the more severe the water shortage will be. Even in the most favourable scenario calculations, we see towards the end of the century that this structural drought will persist and will take on proportions that arouse a great many questions about the development potential for agriculture and nature in the Oudland Polder. Large-scale structural hydrological interventions, including the sustained retention of rainwater in the polder, will become necessary. These analyses also show that a well-thought out choice of cultivation schedules with a low water demand could play a limited role in a climate adaptation strategy for the Oudland Polder.

Background to the analyses

With the exception of the urbanised coastal region and the urban outskirts around Bruges, the Oudland Polder has a rural character. The landscape is characterised by agrarian regions, alternating with pieces of nature. Given that the rainwater that falls in the polder is not used for process water or drinking water production, so the tap water in the Oudland Polder comes from elsewhere, this means that the greatest demand for water there is linked to nature and agriculture.

We know from previous summers that the Oudland Polder struggles with water shortages during intensely dry periods. Natural areas dry out and there is not enough fresh water to keep the polder canals at a desirable level for agriculture. It is anticipated that the summers will be even drier on average in the coming decades. As a result, the question arises as to whether there will be **sufficient rainfall** in the Oudland Polder throughout the year **to meet the water demand for nature and agriculture**. A second question linked to this is **how the available quantity of rainwater will evolve in the future**. Answers to these questions may clarify whether the sustained retention of water in the polder, e.g. through creek ridge infiltration, buffer basins, general wetting of grounds and/or a more intricate system of polder canals could be a solution for handling the drought issues in the polder.

In order to find an answer to the questions above, we developed 4 **vegetation scenarios** that consist of a nature and an agriculture component, and which can be calculated in the various spatial scenarios. We based the agriculture component on the cultivation distribution from 2020*. In broad terms, this resembled the summary below in the agricultural area of the Oudland Polder. Because it is not necessary to identify all the crops being cultivated in the Oudland Polder in detail for the intended objective here, namely estimating how a potential future water demand relates to the rainwater available in the future, we took account of a single crop in each of the categories below. This crop is shown in brackets in the list below. For the nature component in the vegetation scenarios, i.e. the vegetation in the nature reserves, we assumed natural grassland.

* Source: Data requested from the VLM.

Distribution of cultivation in the Oudland Polder (2020):

- grassland: 42.23%
- grain crops (winter corn): 22.16%
- maize: 13.06%
- potatoes: 6.87%
- seeds and young plants (grass seed): 5.71%
- fodder crops (grass-clover): 3.85%
- beets (sugar beets): 3.13%
- fresh and industrial vegetables (onions): 1.84%
- flax: 1.15%

The vegetation scenarios themselves can be summarised as follows:

- **Crop SSP1:** SSP1 is characterised by a drastic swing in the nutritional pattern in rich regions like Flanders. There will be a switch to a largely vegetable-based diet. In this vegetation scenario, it is therefore assumed that more and more of the creek ridge grounds will be used for vegetable cultivation as we approach 2050. (The vegetables on which the analyses will calculated are peas and sprouts.)
- **Crop SSP2:** SSP2 stands for 'business as usual'. Continuing to walk the path set out upon in previous years. This scenario maintains the same cultivation distribution as could be found in the Oudland Polder in 2020.
- **Crop SSP4:** SSP4 is characterised by rising structural inequality. This scenario therefore follows the rationale that the high-quality agricultural grounds on the creek ridges will increasingly end up in the hands of large agro-industrial players targeting the international market. The proportion of agricultural commodities, in these analyses wheat, will thereby substantially increase by 2050.
- **Crop SSP5:** SSP5 is a development path that is characterised by technological development and regional specialisation. Given the proximity of the Ghent and Antwerp port industrial cluster, this cultivation scenario thereby presupposes strong growth in the bio-based economy, and therefore a constantly rising demand for vegetable carbohydrates. Consequently, a major proportion of the agricultural

area is used for the cultivation of sugar beets in this cultivation scenario.

In our analyses, we combined these vegetation scenarios with one of the spatial and climate scenarios were presented earlier each time. This way, we were also able to take account of potential developments in agricultural and natural areas when identifying the water demand in the polder, and link these consistently to a climate scenario.

The latter is necessary because we are calculating the water demand in the polder in these analyses from the **potential evapotranspiration** in both agricultural and natural areas, which is impossible without taking account of climate parameters such as ambient temperature. Evapotranspiration is the sum of (1) the evaporation of water in and on the soil and the soil cover, and of (2) the transpiration by plants taking up water from the soil through their roots. The evapotranspiration is equal to the total volume of water that is ultimately returned to the atmosphere. The potential evapotranspiration here indicates the evapotranspiration that would occur where there is sufficient water present to meet the total water demand. In the event of water shortages, the potential evapotranspiration will accordingly be higher than the current values. (The potential evapotranspiration values were calculated in accordance with the method proposed by the FAO* (see also this link).)

* Allen, R.G., Pereira, L.S., Raes, D. & Smith, M. (1998) Crop evapotranspiration - Guidelines for computing crop water requirements - FAO Irrigation and drainage paper 56, Food and Agriculture Organisation of the United Nations, Rome.

How are precipitation and potential evapotranspiration expected to develop in the most favourable climate scenario (RCP2.6)?

Figures 18, 19 and 20 show the results of the analyses in which the various vegetation scenarios were linked to the **spatial scenario 'anti-urban sprawl'** and a **climate scenario in accordance with RCP2.6**, which is linked to an exhaustive climate policy. Each of the figures covers a different decade: the current decade (2020-2030) (Figure 18), the middle of this century (2040-2050) (Figure 19) and the end of this century (2090-2100) (Figure 20). The following can be derived from these figures:

- On average, substantially more precipitation falls during the winter months than in the summer months. The volume of water absorbed by the polder drops in the spring, remains low during the summer months and then gradually rises from the early autumn (September).
- The average potential evapotranspiration values show the reverse pattern. The values, in proportion to the precipitation volumes, are very low during the winter months, before gradually rising as the summer months progress. Once the growth season begins to draw to a close in August-September, the potential evapotranspiration values drop off once more.
- When the potential evapotranspiration, and thus the water demand, is low, there is much rainfall in the Oudland Polder. During some months, this involves around 10 times more rainwater than nature and agriculture need at that time. During the **drier spring and summer months**, we see the reverse for the **current decade (2020-2030)**: the average potential evapotranspiration values for all cultivation scenarios are higher than the average precipitation values. There is therefore insufficient rainwater to guarantee optimum growth conditions. **In May**, this will be **a relatively small water shortage that**, depending on the vegetation scenario, **will fluctuate between 4,000 and 9,000m³ per day. In July, however, this will rise to an average water shortage of 109,000 to 112,000m³ per day**. Visually, this can be presented as follows: in May, according to these calculations, in addition to the precipitation, there would need to be around 2 to 4 Olympic swimming pools'* worth of water per day in order to guarantee ideal growth conditions for nature and agriculture. In July, this would be around 44 Olympic swimming

* Calculated at 2,500,000 litres of water per Olympic swimming pool.

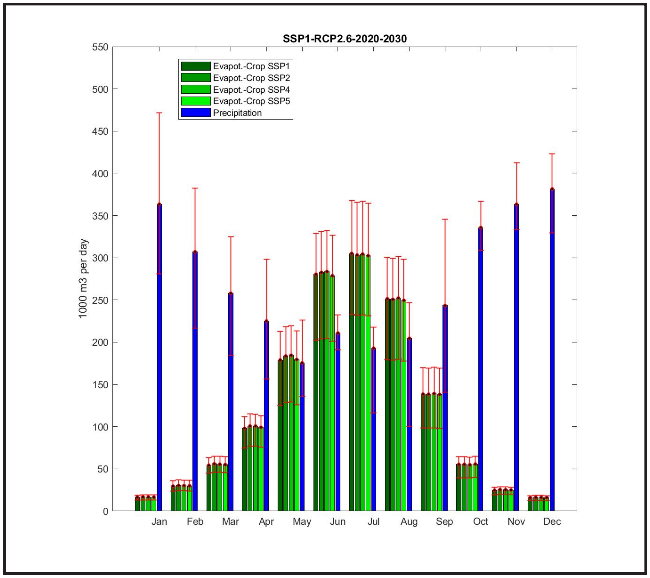

Figure 18.

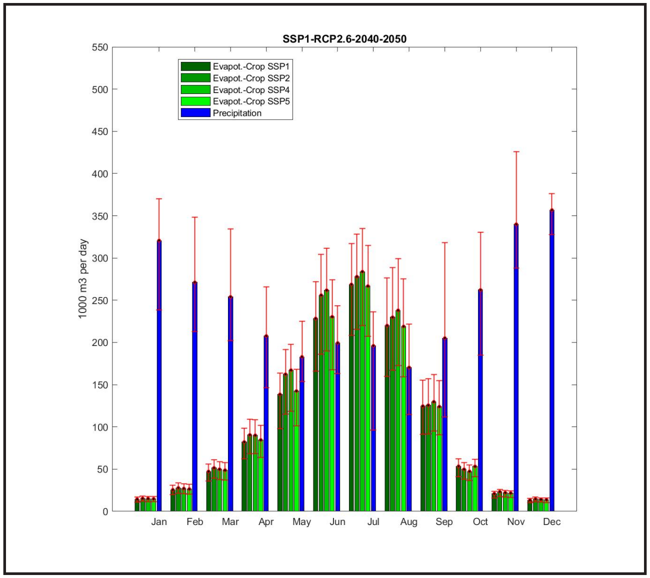

Figure 19.

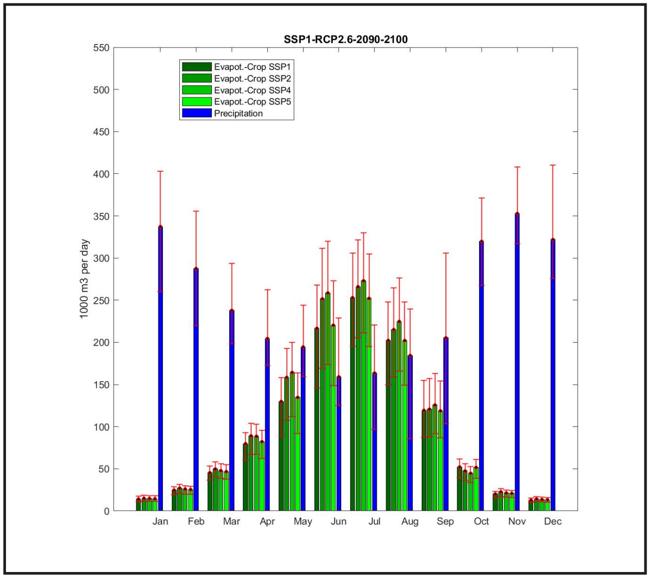

Figure 20.

Figures 18, 19 & 20: Presentation of the average water supply through precipitation in the Oudland Polder (precipitation) and the average water demand (potential evapotranspiration) calculated as a monthly average over 10 successive years. The spatial scenario used for these calculations is the **'anti-urban sprawl' scenario.** This was linked to a climate scenario in accordance with **RCP2.6.**

Figure 18: 2020-2030

Figure 19: 2040-2050

Figure 20: 2090-2100

pools per day. In these projections, this dry month of July is flanked by dry months in June and August in which, respectively, an average daily water shortage occurs of 68,000-73,000m³ and 45,000-47,000m³.

- By the **middle of the century (2040-2050)**, we will be seeing a precipitation pattern that, in the drier months of May through August, does not noticeably differ from the projections for the decade 2020-2030. Only in August do we see a clear further drop in the average quantity of precipitation in the Oudland Polder by 30,000m³ per day. At the same time, we also see a drop in the potential evapotranspiration values. On the one hand, this can be explained by the natural area having increased considerably by 2050 in this scenario, which contains the spatial scenario 'anti-urban sprawl'. The role played by nature can be derived from the difference in water demand in Crop SSP2 – the vegetation scenario in which the present cultivation distribution is continued*. Compared to the current decade, on a daily basis, the potential evapotranspiration by the middle of the century in July will then amount to around 25,000m³ of water per day less (= around 10 Olympic swimming pools less). On the other hand, the differences between the evapotranspiration values for the vegetation scenarios in 2040-2050 show that cultivation choices may also lead to a (limited) reduction in water demand. Crop SSP1 has the lowest water demand in June at 228,000m³ of water per day. Crop SSP4 has the highest water demand at 262,000m³ of water per day. This is an average difference of 34,000m³ of water per day, or around 14 Olympic swimming pools. According to these calculations, in 2040-2050 in June, the present cultivation choices would account for a daily water demand of 256,000m³, which is 28,000m³ per day more than the vegetation scenario with the lowest water demand in June. As can be seen in Figure 19, then, it is anticipated that, by the middle of the century, the **water demand in all scenarios will be significantly higher than the rainwater supply during the months of June, July and August. In a vegetation scenario with relatively low water demand** (Crop SSP1), **this means an average difference of 29,000m³ of water per day in June, 73,000m³ of water per**

* For the natural area, the potential evapotranspiration values for natural grasslands were used in the vegetation scenarios. However, the Oudland Polder contains a range of habitat types, including various types of grasslands, as well as mudflats and salt marshes, reed marshes and other habitats more rich in water. Because there is no reliable data available on the potential evapotranspiration values for all these various habitat types, a generic value for natural grassland was used for the entire natural area. However, this does mean that additional research into the evapotranspiration of various habitat types may lead to a need to review the results of these calculations.

day in July and 50,000m^3 of water per day in August.

- According to this most favourable climate projection, i.e. with an exhaustive climate policy that is in effect by the **end of the century**, in the last decade, compared to the period 2040-2050, there would be more precipitation again on average between the months of May and August. This concerns a rise compared to 2040-2050 by, respectively, an average of 13,000m^3 and 14,000m^3 per day. During the dry months of June and July, however, the average quantity of precipitation will continue to fall by, respectively, an average of 40,000m^3 and 32,000m^3 per day. When offset against the potential evapotranspiration values, this means that **sufficient precipitation will generally fall in May to meet the water demand for nature and agriculture. In the months of June, July and August, however, we will still be facing serious water shortages** that, respectively, will mount up to an average of 58,000-100,000m^3 per day (June), 88,000-109,000m^3 per day (July) and 18,000-41,000m^3 per day (August).

In summary, this means that, if an exhaustive climate policy were to be pursued, and future climate developments thus follow an RCP2.6 course, a solution will need to be found for the structural water shortages during the dry summer period. These will often begin in May and run through August. **These analyses suggest that these water shortages can be reduced if a significant proportion of the Oudland Polder becomes natural, extensively managed grassland, and also if cultivations are chosen that have a low water demand during the dry summer months. Such interventions, however, form only part of a possible solution and will not be sufficient to bring the water demand into line with the rainwater available in the coming decades. Structural interventions in the water system in the Oudland Polder will consequently be needed, so that very high volumes of rainwater can be retained in the polder for long periods.**

It is necessary to provide the following clarification for a good understanding of the figures cited here:

1. The precipitation projections upon which these analyses were based are 10-year averages that were generated from long-term precipitation prospects. Such climate modelling takes no account of incidental heavy rainfall, one (extreme) example of which being the water bomb that fell in the region around Liège last summer. These analysis results thus form just 1 piece of the puzzle that is the water issue in the Oudland Polder.
2. The climate-related data used for these analyses was generated with the aid of 8 climate models. The graphs included in this publication show the average values (and margins of uncertainty) as calculated based on the results from these 8 models.

How are precipitation and evapotranspiration expected to develop in the less favourable climate scenario RCP4.5?

We next looked at the development of the average precipitation and potential evapotranspiration values in a more severe **climate scenario**, namely a climate projection in accordance with **RCP4.5**. In analyses (e.g. IPCC reporting), this climate scenario is often linked to the socio-economic scenario SSP2, which we also did in this analysis. This means that in Figures 21, 22 and 23, this climate scenario was linked to the **spatial scenario 'business as usual'**.

Compared to the previous, more favourable scenario combination, these figures show the following:

- **Over the current decade, the summer drought is expected to become more severe during the driest months.** In June, July and August, we see in Figure 21 a difference between the average precipitation and potential evapotranspiration values of 94,000-100,000m^3 water per day (June), 98,000-100,000m^3 water per day (July) and 39,000-42,000m^3 water per day (August), respectively. In addition to the anticipated precipitation, there will therefore be around 40 Olympic swimming pools of extra water needed per day during the driest

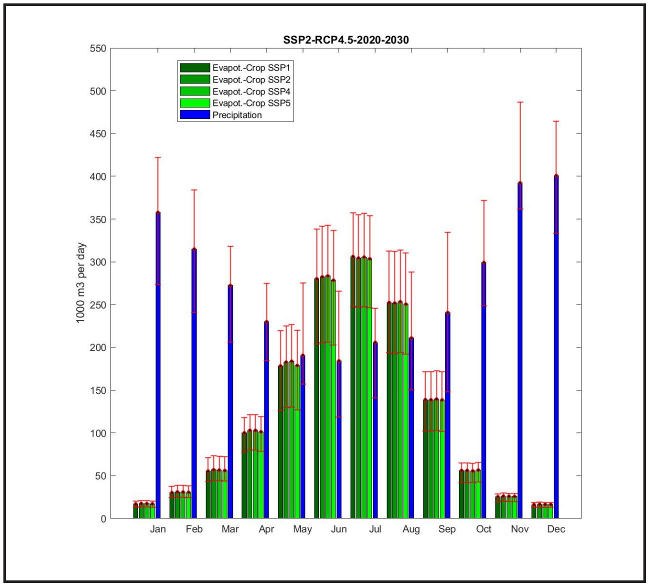

Figure 21.

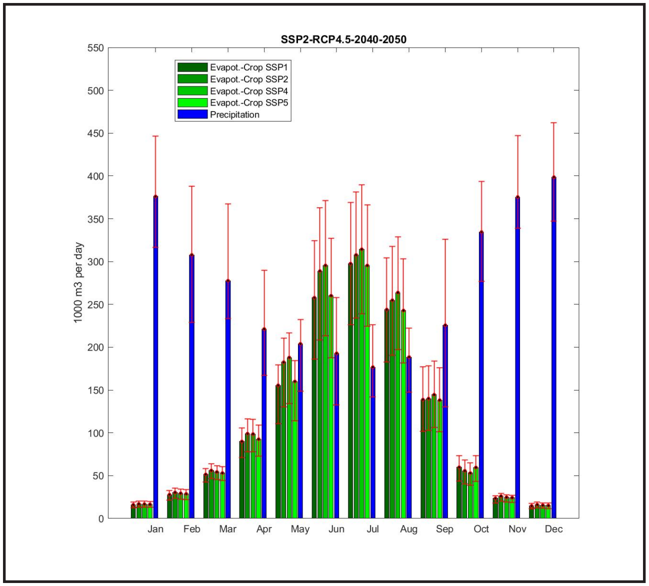

Figure 22.

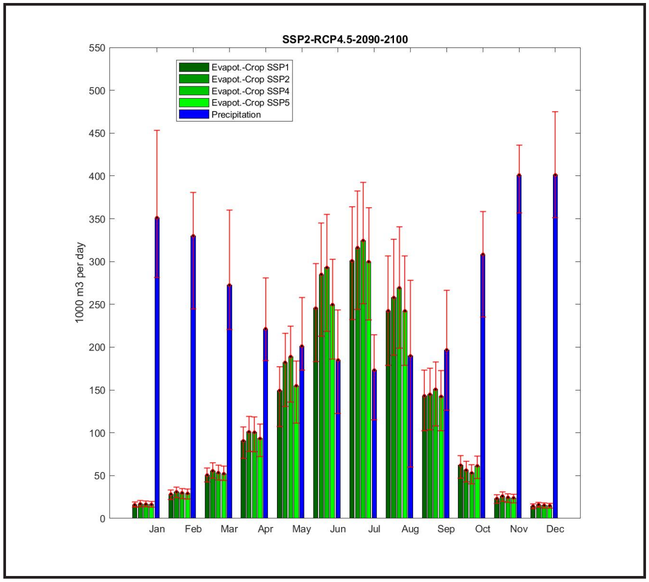

Figure 23.

Figures 21, 22 & 23: Presentation of the average water supply through precipitation in the Oudland Polder (precipitation) and the average water demand (potential evapotranspiration) calculated as a monthly average over 10 successive years.
The spatial scenario used for these calculations is the **'business as usual' scenario**. This was linked to a climate scenario in accordance with **RCP4.5**.

Figure 21: 2020-2030

Figure 22: 2040-2050

Figure 23: 2090-2100

months to guarantee ideal growth conditions in the Oudland Polder by the end of this decade. In August, this is the equivalent of 16 Olympic swimming pools every day.

- **This trend will persist into the middle and the end of the century.** Figure 22 shows how the estimated average water shortage will grow even further in July. According to this project, this shortage will then, depending on the cultivation scenario, amount to between 118,000 and 137,000m^3 of water per day (= around 47 to 55 Olympic swimming pools). By the end of the century (Figure 23), there are anticipated to be shortages in July of 127,000 to 151,000m^3 of water per day, depending on the cultivation scenario, or 51 to 60 extra Olympic swimming pools of water that will be needed every day.
- Just as in RCP2.6, by the middle of the century (Figure 22), a clear difference begins to emerge between the vegetation scenarios as regards their average potential evapotranspiration values. This can be explained by the fact that the switch to other cultivations is a process that cannot be carried out overnight. We have therefore done this step by step in the modelling too, such that the end result is achieved by 2050. What we learn from these differences in potential evapotranspiration is that a well-thought out cultivation choice certainly can cause the water demand in the polder to drop. In order to clarify this, we added Figures 24-27. In a spatial use that is relatively close to the present one (business as usual), in each case during the same decade (2090-2100), these show the potential evapotranspiration for various cultivation choices. We can see from these figures that the scenarios Crop SSP1 and Crop SSP5 have a lower water demand than Crop SSP2 and Crop SSP4 in each of the climate scenarios. A comparison of a cultivation scenario with a high water demand (Crop SSP4) and a low water demand (Crop SSP5) shows that, in July, this involves a difference of, on average, 23,000m^3 per day in RCP2.6, 24,000m^3 per day in RCP4.5, 27,000m^3 per day in RCP6.0, and 28,000m^3 per day in RCP8.5. This is therefore a difference of around 10-11 Olympic swimming pools of water per day. If we look at the difference in potential evapotranspiration between RCP2.6 and RCP4.5 at the level of each of the cultivation scenarios in July, we see that this difference amounts to 19,000m^3 of water per day for Crop SSP1, 21,000m^3 for Crop SSP2 and Crop SSP4, and 20,000m^3 of water per day for Crop SSP5. This means that **the difference in potential**

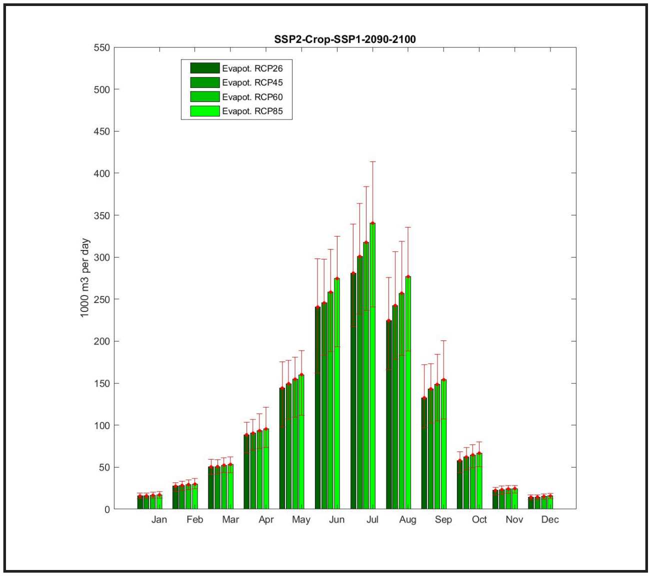

Figure 24. Crop SSP1: Estimated potential average evapotranspiration (2090-2100) in the spatial scenario 'business as usual'.

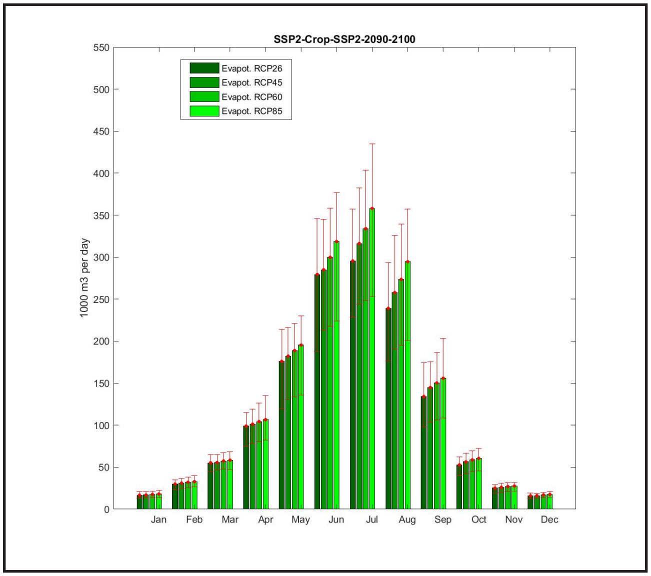

Figure 25. Crop SSP2: Estimated potential average evapotranspiration (2090-2100) in the spatial scenario 'business as usual'.

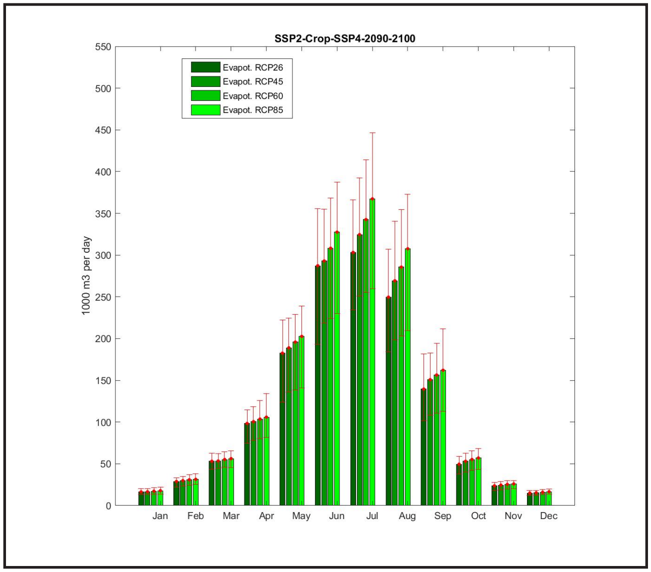

Figure 26. Crop SSP4: Estimated potential average evapotranspiration (2090-2100) in the spatial scenario 'business as usual'.

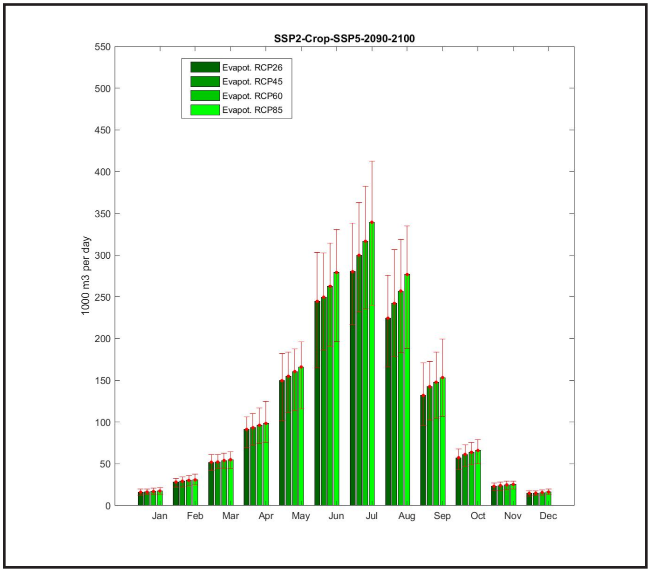

Figure 27. Crop SSP5: Estimated potential average evapotranspiration (2090-2100) in the spatial scenario 'business as usual'.

evapotranspiration between cultivation scenarios is therefore greater than the difference in potential evapotranspiration between the climate scenarios RCP2.6 and RCP4.5. It therefore follows that it would be only logical to make cultivation schedules with a low water demand part of the plans to make the Oudland Polder more climate-resilient.

How are precipitation and evapotranspiration expected to develop in the least favourable climate scenarios RCP6.0 and RCP8.5?

Finally, we also conducted the same analysis in the 2 most severe climate scenarios. Figures 28 through 30 show the results in a **climate projection** in accordance with **RCP6.0** and the **spatial scenario 'growth as usual'** linked to it. Figures 31 through 33 then show the results linked to a climate scenario in accordance with **RCP8.5** and the spatial scenario **'Flanders Spatial Policy Plan'**. The following can be derived from these figures:

- By the end of this decade, we will generally be facing summer months (June, July and August) in which serious water shortages will occur. In RCP6.0, the water shortage is the most pronounced during the month of July. Depending on the cultivation scenario, it varies between an average of 105,000 and 108,000m^3 of water per day (roughly equivalent to 43 Olympic swimming pools of water). Figure 31 shows that this water shortage is expected to be even more pronounced in July in RCP8.5, and will be between 110,000 and 112,000m^3 of water per day. In the months of June and August too, there will be far too little precipitation on average to meet the polder's water requirement.
- Towards the middle of the century, these water shortages will become even more severe in both climate scenarios. In RCP6.0, we will see the difference between the potential evapotranspiration and the anticipated precipitation rise in July from an average of 116,000 to 135,000m^3 per day (= 46 to 54 Olympic swimming pools per day). In RCP8.5, by the middle of the century, depending on

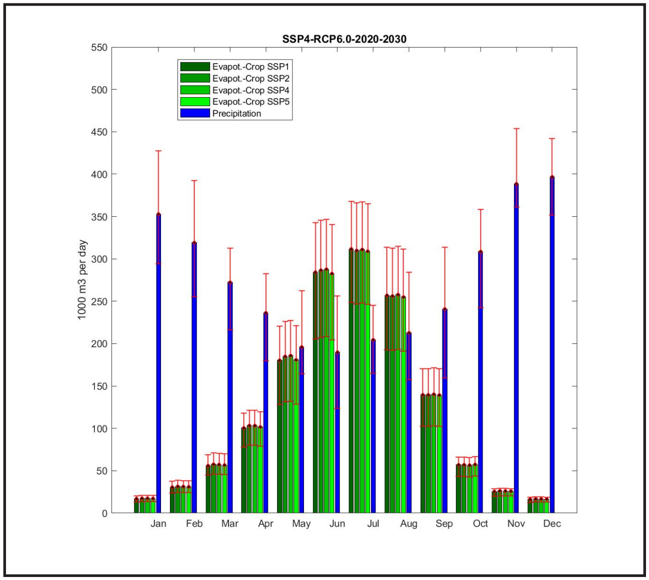

Figure 28.

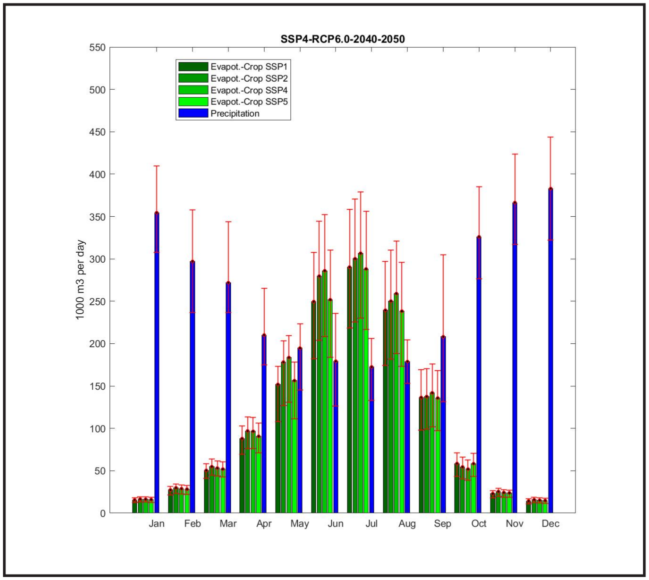

Figure 29.

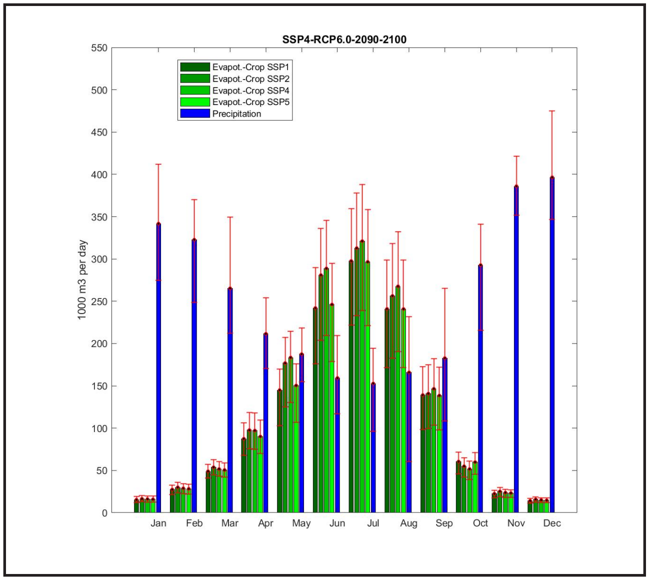

Figure 30.

Figures 28, 29 & 30: Presentation of the average water supply through precipitation in the Oudland Polder (precipitation) and the average water demand (potential evapotranspiration) calculated as a monthly average over 10 successive years.
The spatial scenario used for these calculations is the **'growth as usual' scenario.** This was linked to a climate scenario in accordance with **RCP6.0.**

Figure 28: 2020-2030

Figure 29: 2040-2050

Figure 30: 2090-2100

the cultivation scenario, this difference rises from an average of 105,000 to 122,000m^3 per day, i.e. from 42 to around 49 Olympic swimming pools per day.

- Towards the end of he century, we see strong persistence of the drought issues in RCP6.0. Depending on the cultivation scenario, we will see a difference between the potential evapotranspiration and the anticipated precipitation in July of an average of 144,000 to 168,000m^3 per day (= 58 to 67 Olympic swimming pools per day). In this climate projection, RCP8.5 even shows difference values that vary between 174,000 and 199,000m^3 of water per day for July.

2 clarifications have already been given for these analyses above. This is to position their contribution within the broader picture of the water issues in the Oudland Polder. These were about the climate models used and the fact that extreme events in the climate data presented here, such as a water bomb, are averaged out, and so the realistic challenge of dealing with the changing climatological circumstances in the polder is being underestimated. Finally, and supplementary to the aforementioned, we would also like to point out the following:

1. Sea levels will rise as a result of global warming. For the Oudland Polder, which now largely drains gravitationally, the consequence of this will be that the discharge window will get smaller, and in the most severe climate scenarios during the 2nd half of this century, may even disappear. This means that the polder will be facing (serious) drainage problems. The risk of flooding that this involves should certainly be added to the insights presented here.
2. The same applies for the development of the water quality in the Oudland Polder in various climate scenarios, and salinisation in particular. After all, besides flooding and drought, this is a third dimension affecting the water issues in the polder, which can therefore be considered a guiding one for the future spatial organisation of this polder region.

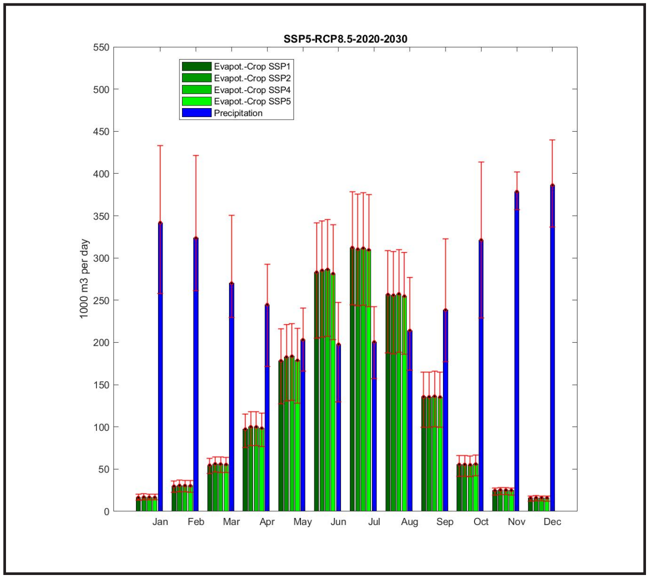

Figure 31.

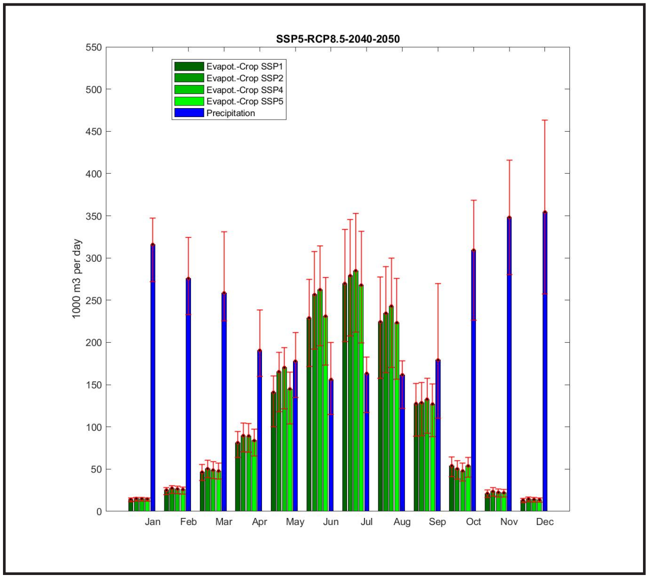

Figure 32.

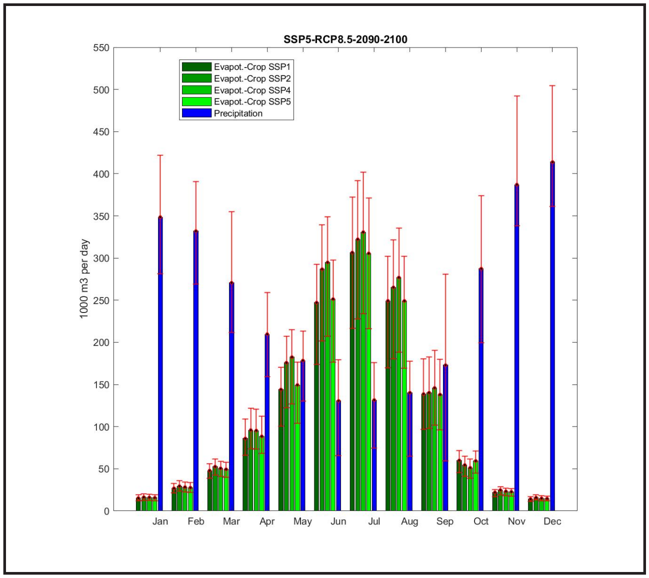

Figure 33.

Figures 31, 32 & 33: Presentation of the average water supply through precipitation in the Oudland Polder (precipitation) and the average water demand (potential evapotranspiration) calculated as a monthly average over 10 successive years.
The spatial scenario used for these calculations is the **'Flanders Spatial Policy Plan' scenario.** This was linked to a climate scenario in accordance with **RCP8.5.**

Figure 31: 2020-2030

Figure 32: 2040-2050

Figure 33: 2090-2100

GIVE ECOSYSTEMS THE NECESSARY ROOM FOR RECOVERY

- **Plan nature and agriculture from core areas in an integrated manner, and provide permanent, natural corridors that connect the core natural areas with one another.**
- **Convert all bird and habitat guideline areas into natural areas.**
- **Invest in wet nature that can make a major contribution in terms of water retention and carbon storage.**
- **Link the SIP to a climate adaptation plan to the benefit of the nature in the Oudland Polder.**

What did we learn from COASTAL?

1. On both the agriculture and nature side, a spatial vision is supposed in which the delineation of the natural and agrarian structures in the Oudland Polder is based on **core areas of nature** and **core areas of agriculture.** These core areas are strictly protected nature reserves and zones in which agriculture has primacy, respectively. From an ecological perspective, it is recommended that these core areas are mutually connected via **natural corridors** that are permanently managed as nature and are protected under nature legislation, which fits in which the European biodiversity strategy for 2030.

As to the spatial organisation of the natural and agricultural areas in the Oudland Polder, many people have strong opinions. This was clearly shown in the discussions during the COASTAL workshops. Although the opinions differ sharply at times on a range of points, it was also noted that there is **consensus on the following matters**:

1. The delineation of the natural and agrarian structures in the Oudland Polder should take place through a thoroughly **substantiated long-term vision**. All the affected parties, on both the agricultural and the natural side, are asking for clarity and certainty. On the one hand, as to the route to be charted in the coming years and decades, as well as to the steadfastness with which the route charted will be followed. Among nature managers as well as farmers, the need for a long-term perspective and **legal certainty** rang out clearly. They want to be able to plan for the future and make decisions whose implications will at times be felt down the generations.
2. The delineation of the natural and agrarian structures in the Oudland Polder should be based on **core areas of nature and core areas of agriculture**. These are large, adjacent clusters of ground in which only 1 type of land use is permitted. In other words, these are core areas of agriculture in which only agriculture is practised and core areas of nature that are strictly managed as natural areas.

As regards the latter, i.e. the core areas of nature, the nature workshop considered an **expansion of the cores in the existing nature reserves** in the first instance. Within the contours of the area of the Oudland Polder covered by the current SIP process, this is mainly the Uitkerkse Polder and the Meetkerkse Moeren. The opinion of the participants was that, in order to achieve climate-resilient ecosystems in the Oudland Polder, the areas of nature with only limited accessibility should be enlarged. The regions in which nature 'can do its thing' undisturbed – which does not mean there would be no management work done in these regions (e.g. extensive grazing) – i.e. the cores of these nature reserves, should be enlarged.
It automatically follows from this that the borders of the nature zones surrounding these centres need to shift. The pieces of **nature in which a more multi-functional use of space is possible** also require expansion

given the rise in cyclists, walkers and other recreational users in the current reserve zones in recent years. Pieces of nature where tourist and recreational purposes can be combined with the management of nature are in our thoughts here, such as nature with walking and cycling routes crossing through it, waterways accessible to canoeists, areas of nature for camping, etc. Investing in **extra nature in the Oudland Polder** could give the tourism and recreation sector in the region a major boost, which then creates opportunities for farmers seeking to expand their activities with farmstead tourism, farmhouse shops or a catering establishment.

'Islands of nature', however, are not sufficient for achieving resilient natural areas. As has become clear in the past few years, climate change will ensure that natural areas will face more and more stress, and for longer periods, as a result of drought, heavy storms or flooding. Isolation and fragmentation of natural areas will hinder the migration of species, especially plants and less mobile (small) animal species. Isolated populations are at greater risk as they will find it difficult or impossible to recover following drought, pollution or disease. (More information on the impact of fragmentation in Flemish nature can be found in the 2020 Nature Report from the INBO). The recommendation is therefore to connect the core areas of nature in the Oudland Polder together through **natural corridors that are guaranteed to be managed as nature based on a substantiated long-term vision**, such that a permanent **natural network** can be built up.

Maintaining the traditional **'provincial nature'** should be central to the areas of nature in the Oudland Polder. Since time immemorial, it has been an environment created by people, where agriculture was only made possible by gradually recovering land from the sea. This process, over the centuries, has resulted in the development of specific flora and fauna, a significant proportion of which are dependent upon agriculture. Birds such as black-tailed godwits, avocets and skylarks, or herbaceous plants growing in fields, poppies and cornflowers, cannot survive without (extensively managed) fields and grasslands. **The management of nature in the Oudland Polder will therefore go hand in hand with (extensive) agriculture. This automatically means that more nature in the Oudland**

Polder does not have to be in conflict with the interests of the farmers in the polder, and that more sustainable development of agriculture in this region is possible. There are already some signs of this in the Oudland Polder (e.g. farmers sharing responsibility for grassland management) and the rapprochement between e.g. Natuurpunt and the General Farmers' Syndicate shows that major steps can probably be taken in the coming years as regards new forms of collaboration and innovation (e.g. carbon farming) as well.

The development principle encompassing all of this during the nature workshop, namely '*Natural structures based on 4 large core areas connected by an uninterrupted network of natural elements*', **is a close fit with a major objective formulated in the European Biodiversity Strategy** (which can be consulted at this link). Central to this is that Europe's biodiversity must be on the road to recovery by 2030 at the latest. To make this possible, at least 30% of the land will be protected. One third of this surface area, i.e. 10% of the land, will be strictly protected. In the first instance, the following will be looked at:

1. areas of very high biodiversity value or very high potential, and
2. ecosystems that absorb carbon from the atmosphere and store significant carbon stocks, such as peatlands, grasslands and wetlands.

The natural areas in the Oudland Polder meet both of these criteria. For example, the habitat type 'Identified dunes with herbaceous vegetation' (2130), which is present in the dunes in the project region, has been established as a European priority habitat. This means it concerns a habitat that is in danger of disappearing (see also the Nature Report 2020). Flanders is very important for the preservation of this habitat within the European Atlantic region. Furthermore, it can also be noted in this context that a major proportion of the area subject to the present Oudland Polder SIP has been identified as a Habitat and/or Birds Directive area, and is therefore part of the European Natura 2000 network. In addition, the Biodiversity Strategy also emphasises the importance of ecological corridors.

2. Both the conclusions of nature managers on the ground and European and Flemish policy lines indicate that more stringent measures are necessary for a favourable state of conservation for the flora and fauna in **Birds and Habitat Directive areas** in the Oudland Polder. It is therefore self-evident that these regions should be identified as **natural areas**.

In order to combat a further decline in the European flora and fauna, Europe issued 2 directives: the Habitat Directive and the Birds Directive. Both directives oblige the Member States to take measures to protect the native European flora and fauna. One of these measures is the delineation of **Special Protection Zones (SPZs)**, also known as the **Birds and Habitat Directive areas**, which together form the European Natura 2000 network. These SPZs comprise the most suitable areas for protecting wild European plants and animals, including their specific habitats. For each of the SPZs, specific conservation goals were formulated so as to achieve a 'favourable state of conservation' for the plant and animal populations there. During the COASTAL workshop on nature, a **clear call was made to respect the conservation goals for the Birds and Habitats Directive areas in the Oudland Polder.** However, this does have some clear spatial implications:

- The surface area of saline grasslands would need to grow (by extension or conversion) by 20 hectares. Since only 7% of a plot actually consists of saline grassland, this de facto amounts to an additional 285 hectares of saline grassland.
- There would need to be further development of 5 to 10 hectares of reed marshes and large sedge vegetation in order to preserve the spotted crake as a breeding bird in the Oudland Polder.
- 8,000 to 10,000 hectares of permanent grassland with ditches and micro-relief would need to be protected throughout the East Coast polders to guarantee the wintering of sufficiently large populations of species such as the white-fronted goose, the pink-footed goose and the Eurasian wigeon in the future as well. In these grassland areas, core areas need to be delineated near the Uitkerkse Polders and the Meetkerkse Moeren where these birds will see as little disturbance as possible, which is a clear fit with the conclusion formulated in point 1 of this recommendation.

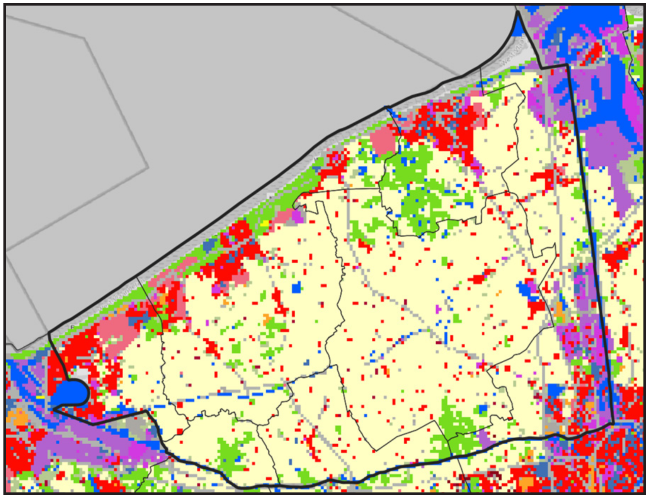

Figure 34. Natural areas (light green) in the Oudland Polder in 2013 according to the Flanders Spatial Model.

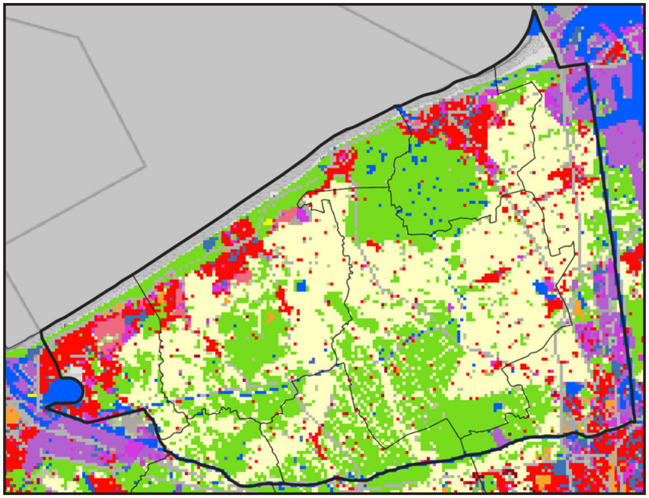

Figure 35. Natural areas (light green) in the Oudland Polder in 2050 in accordance with the Flanders Spatial Model in the 'anti-urban sprawl'

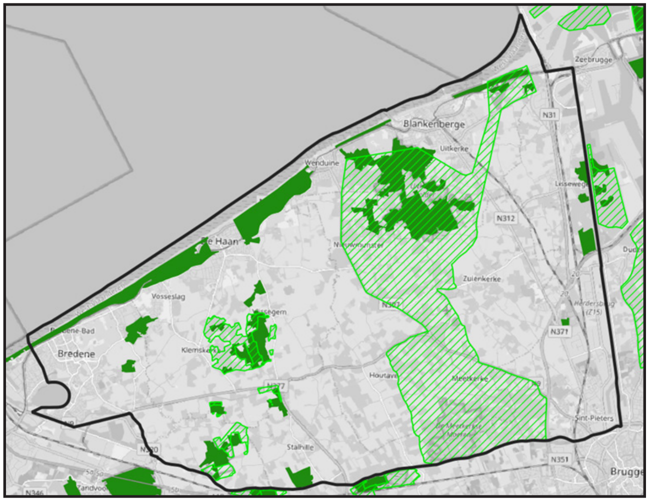

Figure 36. Birds and Habitats Directive areas in the Oudland Polder shaded in light green and dark green, respectively.

Figure 37. Wintering barnacle geese on polder grassland.

It is not yet clear exactly where these desired 8,000 to 10,000 hectares of permanent grasslands should be located in the East Coast Polders. Given the delineation of the Birds and Habitats Directive areas in Flanders (see also Figure 36), it is clear that a major proportion of these permanent grasslands will be localised in the Oudland Polder. **A total of 5,636 hectares of land has the legal status of special protection zone (Birds and/or Habitats Directive area) in this region. It would seem self-evident to look to these zones first for implementing the mandatory and necessary expansion of grasslands with ditches and micro-relief.**

Aside from the objectives in the European Biodiversity Strategy, as referred to in the first point in this recommendation, and this obligation to expand the area of permanent extensive grasslands under the conservation objectives, the recently concluded Flemish nitrogen agreement forms a third factor that supports the demand for converting all Birds and Habitats Directive areas in the Oudland Polder into nature.
This **nitrogen agreement** that was reached in February 2022 in the Flemish government stipulates that there will be a **fertiliser ban** coming into force in 2028 **in the SPZs and in areas of the Flemish Ecological Network, both those intended for nature and forests.** (More information can be found at this link.) Although, at the time of writing, this nitrogen agreement has not yet been converted into concrete legislation, it does indicate the direction in which agricultural policy in these terms will most likely develop in the future.

This direction is rather analogous to the one set out in the **European Water Framework Directive** . This **stipulates that the ground and surface waters in Flanders must be of good quality in 2027.** As can be seen through this website from the European Environmental Agency, none of the Flemish surface waters assessed currently get a good report. This then makes it de facto impossible for Flanders to achieve this objective in 2027. This can, and most likely will, have consequences as well. The Wezer judgement, a verdict from 2015 by the European Court of Justice, has already demonstrated that the Water Framework Directive can be used as legal grounds to prohibit interventions in waterways if these would lower the quality of this waterway. In Flanders too, then, there is a risk that individuals or organisations will take to the courts and appeal against activities that have a negative impact on the quality of bodies of water. Therefore, in all likelihood, the Water Framework Directive will lead to certain points of agricultural policy, among other things, being tightened up in Flanders as well, including the fertiliser standards in SPZs.

It should also be noted, as a 5^{th} point in support of the demand for converting all the Birds and Habitats Directive areas in the Oudland Polder into nature, that the preparatory phase of the **European Nature Restoration Law**, which will contain binding provisions relating to nature restoration in Europe, also has regard to these SPZs. Indeed, the European Parliament approved a resolution last summer in which the following points were ratified (the full resolution can be found at this link):

- The extent of the existing European network of legally protected natural areas is not sufficient to safeguard European biodiversity.
- The management of nature in the existing Natura 2000 network is falling short.
- All the species and habitats protected under the European Birds and Habitats Directive must be brought to a favourable conservation status as soon as possible.
- The European Parliament "strongly supports" the European objectives for protecting nature on at least 30% of the land and strictly protecting 10% of the European land area.
- The European Parliament supports the initiative for laying down binding provisions relating to nature restoration, in particular with regard to ecosystems that play a key role in both driving down biodiversity loss and climate mitigation and adaptation.

At both a Flemish and a European level, we are therefore seeing a development towards more stringent measures and legislation in support of the management of nature in SPZs. Along with the finding that further efforts will be needed to achieve the conservation goals already in force in the Oudland Polder, and the fact that a SIP is a critical tool for implementing long-term policy, it therefore seems advisable to us to **develop towards a clear status for the SPZs in the Oudland Polder, namely natural areas**. In accordance with the previous point in this recommendation, it would seem advisable here to designate a considerable area of the Uitkerkse Polder and the Meetkerkse Moeren as a core area. Beyond these core areas, nature objectives can then be combined with other land use functions. We are primarily thinking of tourism and recreation here. Finally, we would like to point out the importance of a natural corridor between the Uitkerkse Polder on the one hand, and the Zeebos and the Oudemaars Polder on the other. Given the location of the N335 and N371, we will need to investigate how such a connection can best be made.

As the above summary of policy lines and legislation clearly shows, several themes come together in challenges linked to ecosystem and biodiversity restoration: nitrogen reduction, soil restoration, water quantity and quality, climate adaptation and mitigation, etc. This was why the Netherlands recently decided to switch to a **regionally focused, integrated approach in which nature, water and climate are addressed cohesively** (Government communication to be found at this link). Where possible, measures will be smartly combined to improve nature, the soil and the water quality and to achieve the climate task. Binding objectives will also be established per region at a national level, after which lower-level authorities and actors involved can decide on the way to achieve these. This is how the Netherlands aims to use the available resources as efficiently and effectively as possible, so as to offer long-term certainty and security. Although a SIP should certainly not be equated with such a large-scale, regionally focused approach, the tool does lend itself to a more integrated way of looking at societal challenges. It is therefore our recommendation that the Oudland Polder SIP be approached with a future-oriented view and that steps be taken that allow for the current fragmentation in the climate, agriculture, nature and environment policy to be overcome.

3. Analyses with the Nature Value Explorer indicate that **larger nature reserves** in the Oudland Polder will offer **added value for nature and society**. Not only can more nature of very high quality develop this way. Such an intervention will also lead to a clear improvement in the water quality in the polder, help with achieving the climate objectives and raise the region's potential for recreation. The added value of these natural areas could be even higher if we choose a considerable area of wet nature.

When natural areas expand and ecosystems are given the chance to recover, this not only has a favourable effect on biodiversity, but also a broader societal impact. If the air quality rises, for example, the health conditions for local residents will also improve. Such ‘services’ provided by nature to our society are known as **ecosystem services**.

In order to gain a better understanding of the impact that nature restoration in the SIP project region in the Oudland Polder could have on such ecosystem services, we calculated a number of nature restoration measures with the Nature Value Explorer (NVE), a tool developed to identify ecosystem services in Flanders (More information on the Nature Value Explorer can be found at this link. Further explanation of the various indicators included in the Nature Value Explorer can be found in the annex.) Specifically, we looked at the effect of the following measures:

- Expansion and restoration of the Meetkerkse Moeren
- Expansion of the Uitkerkse Polder
- Expansion of the natural area in the Oudemaars Polder

We will discuss below the impact of each of these interventions separately. We will assume that these examples can help create a clearer picture of the advantages and disadvantages linked to nature restoration in the Oudland Polder, as well as how these advantages and disadvantages relate to one another. Once a final description is available of the nature restoration envisioned in the SIP region (e.g. organisation plans), a more extensive set of measures can be calculated in a later phase, perhaps in more detail.

Photo: Meetkerkse Moeren (Outskirts of Bruges)

Expansion and restoration of the Meetkerkse Moeren

The starting point for this analysis was the expansion and restoration of the Meetkerkse Moeren as provided for in the spatial scenario 'anti-urban sprawl'. (The map cut-out on the previous page shows exactly which area this relates to.) In this analysis, we compared the future situation in 2050 in this scenario to the current state of the area. In doing so, we assumed that the nature already present in the area, such as surface waters, reed belts and thickets, will be preserved. The buildings and infrastructure falling within the perimeter were also preserved. However, we have converted all other grounds into grasslands rich in flowers or other species.

A further wettening of the region has not yet been carried out as it is thus far not time to do so. The average groundwater states can be adjusted through the Nature Value Explorer, as can the dominant vegetation types, meaning that e.g. the further development of reed and marsh vegetation in wetlands can be calculated. Once the study into the desired ground and surface water levels in the Oudland Polder is complete, such an analysis could then be carried out. But even without this additional study, we can already say for certain that a further wettening of the area will definitely have a positive impact on the values for ecosystem services such as water retention and carbon storage in soils.

In terms of recreation, we have kept the area's accessibility the same. The number of paths and roads running through it, for example, remain the same. We have, however, taken account of extra benches and information signs.

In summary, this analysis with the Nature Value Explorer provides the following insights:

- This nature development will cause a drop in food production corresponding to a loss of income of €551,000 to €811,000 as calculated against the prices from 2019. No account was taken of any income from e.g. management agreements for grazing or meadowland in these figures, nor with the investments that farmers must make in order to make these cultivations possible. If e.g. such management agreements are concluded, the loss of income for farmers in this

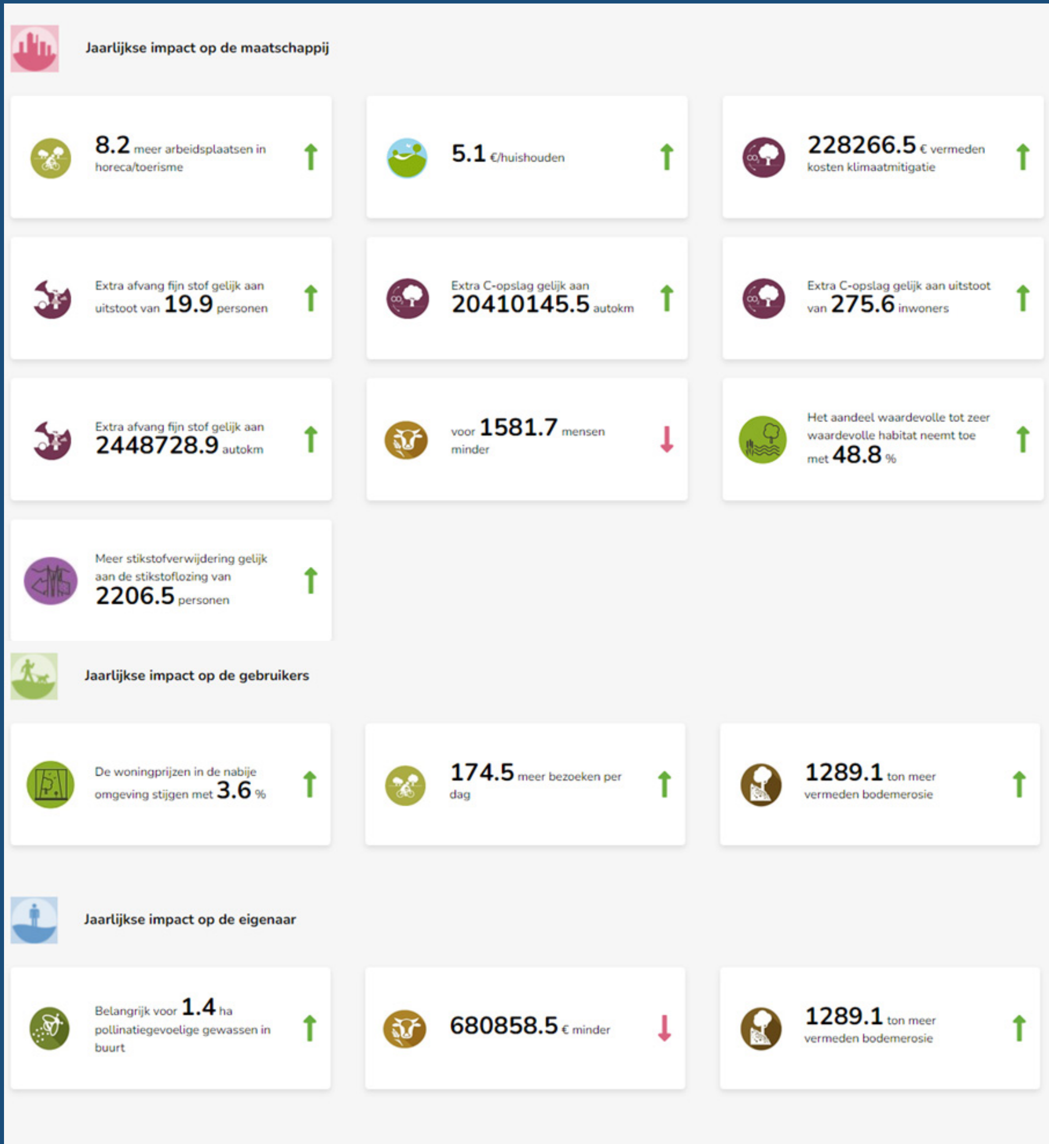

Figure 38. Expansion and restoration of the Meetkerkse Moeren: overview of scores for the various indicators included in the analysis of the ecosystem services before and after implementation of nature restoration measures in line with the scenario 'anti-urban sprawl'.

area will then be lower and they will not need to incur certain cultivation costs. This implies that this loss of income will not automatically lead to a reduction of farmers' net income.

- Because fields will be replaced by permanent grassland, the air quality will rise to the tune of the capture of around 100kg of particulate matter (PM10) per year.
- There will be less erosion. It will be possible to avoid around 2,600 tons of ground being washed away per year.
- Carbon storage in the soil will rise dramatically by 980 tons per year, which equates to the emissions from 276 people or 20 million kilometres driven in a car. In addition, the area will store a further 1.8 tons of carbon in biomass every year, just as it does now.
- The water quality in the area will rise because fewer fertilisers from agricultural grounds will be washed into the watercourses. There would be an annual decrease of around 7,800kg of nitrogen (N) in the surface and groundwater, which equates to a nitrogen discharge of 2,200 people.
- Recreation will increase by an estimated 64,000 visitors per year (an average of 175 visitors per day). This estimate also includes daily strolls by local residents. After all, nature restoration leads to greater appreciation of the scenery, meaning people are generally more inclined to stretch their legs outdoors or walk the dog.
- The increased recreation will lead to the creation of an estimated 8 extra jobs in catering and tourism.
- The biological value of the area will rise considerably. The proportion of valuable to highly valuable habitats will rise by 49%. High-quality nature that is rare for Flanders will be created. However, this will cause the Meetkerkse Moeren to be more vulnerable to human disturbance.

A more comprehensive overview of both the quantitative and qualitative analysis results on which this summary for the Meetkerkse Moeren is based can be found in Figures 38 through 41.

Figure 39. Expansion and restoration of the Meetkerkse Moeren: overview of scores for the ecological parameters before and after implementation of nature restoration measures in line with the scenario 'anti-urban sprawl'.

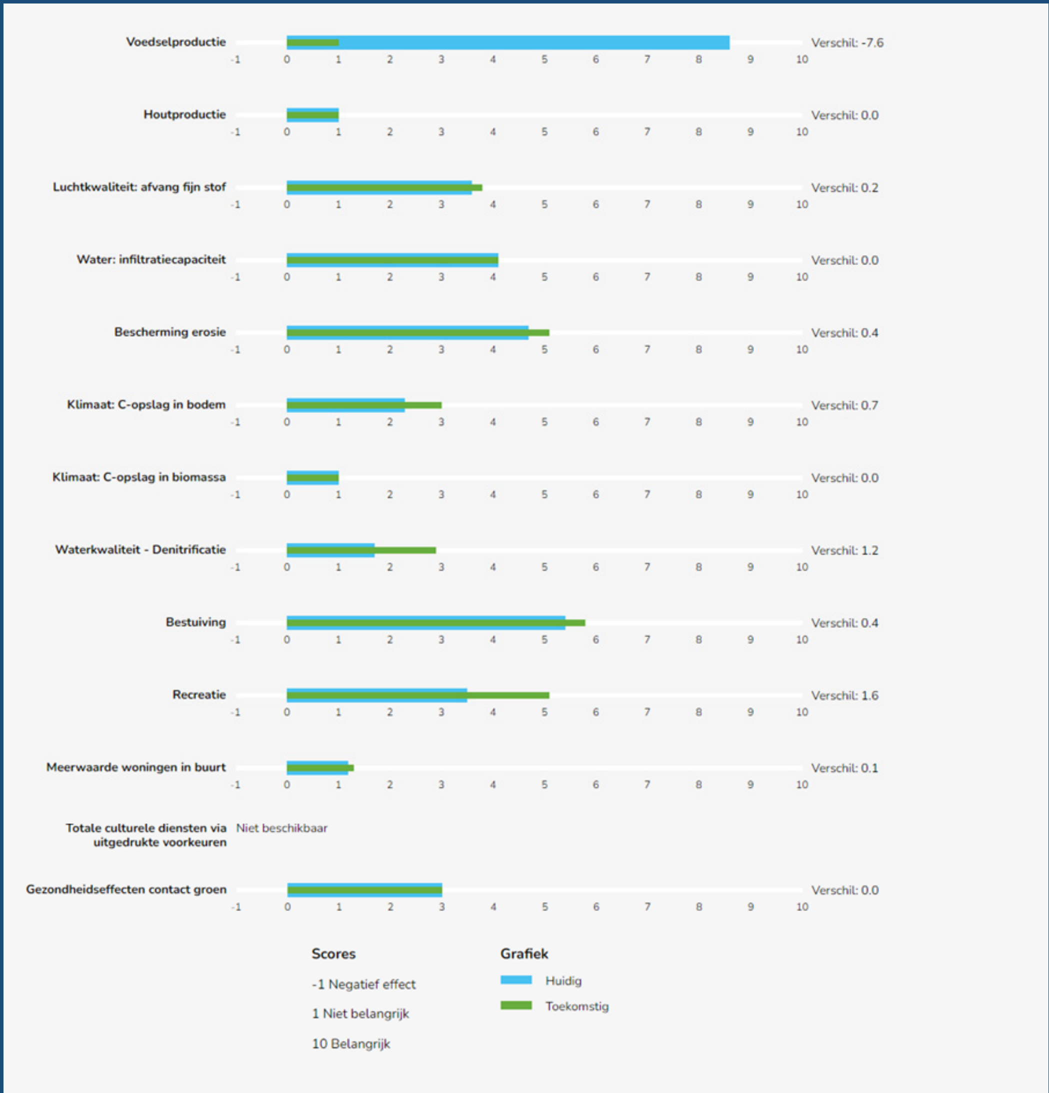

Figure 40. Expansion and restoration of the Meetkerkse Moeren in accordance with the scenario 'anti-urban sprawl': qualitative score that indicates (1) how important the area is for a particular ecosystem service compared to other areas in Flanders, and (2) how ecosystem services develop after the implementation of nature restoration measures compared to the current situation.

Kwantitatieve waardering	Eenheid	Huidig		Toekomstig		Verschil	
		Laag	Hoog	Laag	Hoog	Laag	Hoog
Voedselproductie	€ toegevoegde waarde productie / jaar	553669.5	814955.4	2630.0	4277.5	-551039.5	-810677.9
Houtproductie	m³ geoogst hout / jaar	10.0	10.0	10.0	10.0	0.0	0.0
Luchtkwaliteit: afvang fijn stof	kg PM10 / jaar	2666.3	2666.3	2764.0	2764.0	97.7	97.7
Water: infiltratiecapaciteit	m³ / jaar	723488.6	723488.6	723488.6	723488.6	0.0	0.0
Bescherming erosie	ton vermeden erosie / jaar	0.0	-3062.7	0.0	-484.6	0.0	2578.1
Klimaat: C-opslag in bodem	ton C / jaar	1591.7	1591.7	2571.4	2571.4	979.7	979.7
Klimaat: C-opslag in biomassa	ton C / jaar	1.8	1.8	1.8	1.8	0.0	0.0
Waterkwaliteit - Denitrificatie	kg N / jaar	2310.5	2310.5	10122.8	10122.8	7812.3	7812.3
Bestuiving		-	-	-	-	-	-
Recreatie	Aantal bezoeken / jaar	139729.1	139729.1	203433.3	203433.3	63704.2	63704.2
Meerwaarde woningen in buurt	% waardestijging woning	7.3	7.3	10.9	10.9	3.6	3.6
Alternatieve methode berekening culturele diensten							
Totale culturele diensten via uitgedrukte voorkeuren	Aantal huishoudens	86208.0	208753.0	236148.0	822983.0	149940.0	614230.0
Gezondheidseffecten contact groen	DALY/jaar	15.0	15.0	15.0	15.0	0.0	0.0
Niet gebruikswaarde	ha natuur en bos	49.4	49.4	444.9	444.9	395.5	395.5

Figure 41. Expansion and restoration of the Meetkerkse Moeren in accordance with the scenario 'anti-urban sprawl': comparison of quantitative scores for various ecosystem services before and after the implementation of nature restoration measures.

Expansion of the Uitkerkse Polder

We also carried out the same analysis for a set of nature restoration measures that could lead to a considerable expansion of the Uitkerkse Polder nature reserve. In this analysis, the present reserve is expanded with natural grasslands rich in species. Tall greenery, water features and built-up areas that are currently present in the area were retained here. Furthermore, in line with the need for recreational infrastructure, the number of walking and cycling paths in the area was increased.

In summary, this may lead to the following development in terms of ecosystem services:

- If fields and pastures are converted into natural grassland, the food production in the area will drop sharply. This will involve an estimated total loss of income of 1.3 to 2 million euros and corresponds with the loss of an agricultural area allowing 4,000 people to be fed. As previously explained, this does not necessarily mean a net loss of income of this magnitude for the farmers affected. Certain investments (e.g. sowing seeds or fertilisers) will not need to be made and various mechanisms exist that allow farmers to generate an income from the management of nature.
- The air quality in the area will rise to the tune of the capture of around 270kg of particulate matter (PM10) per year.
- There will be less erosion. It will be possible to avoid around 14.600 tons of ground being washed away per year.
- Because the soil will see less work, more carbon will be stored in the soil. This involves an estimated increase of 2,800 tons per year, which is comparable to the emissions of 800 people or 59 million kilometres driven by a car.
- 25,500kg of nitrogen (N) fewer will be washed out into the ground and surface water annually. This is equivalent to the emissions of 7,000 people.
- Because the recreation options in the area will increase, it is estimated that more than 370,000 extra visitors per year can be anticipated, or an average of around 1,000 more visitors on a daily basis. This would create an extra 48 places of employment in the surrounding catering and tourism sector.
- The share of valuable to highly valuable habitat will rise by 33%.

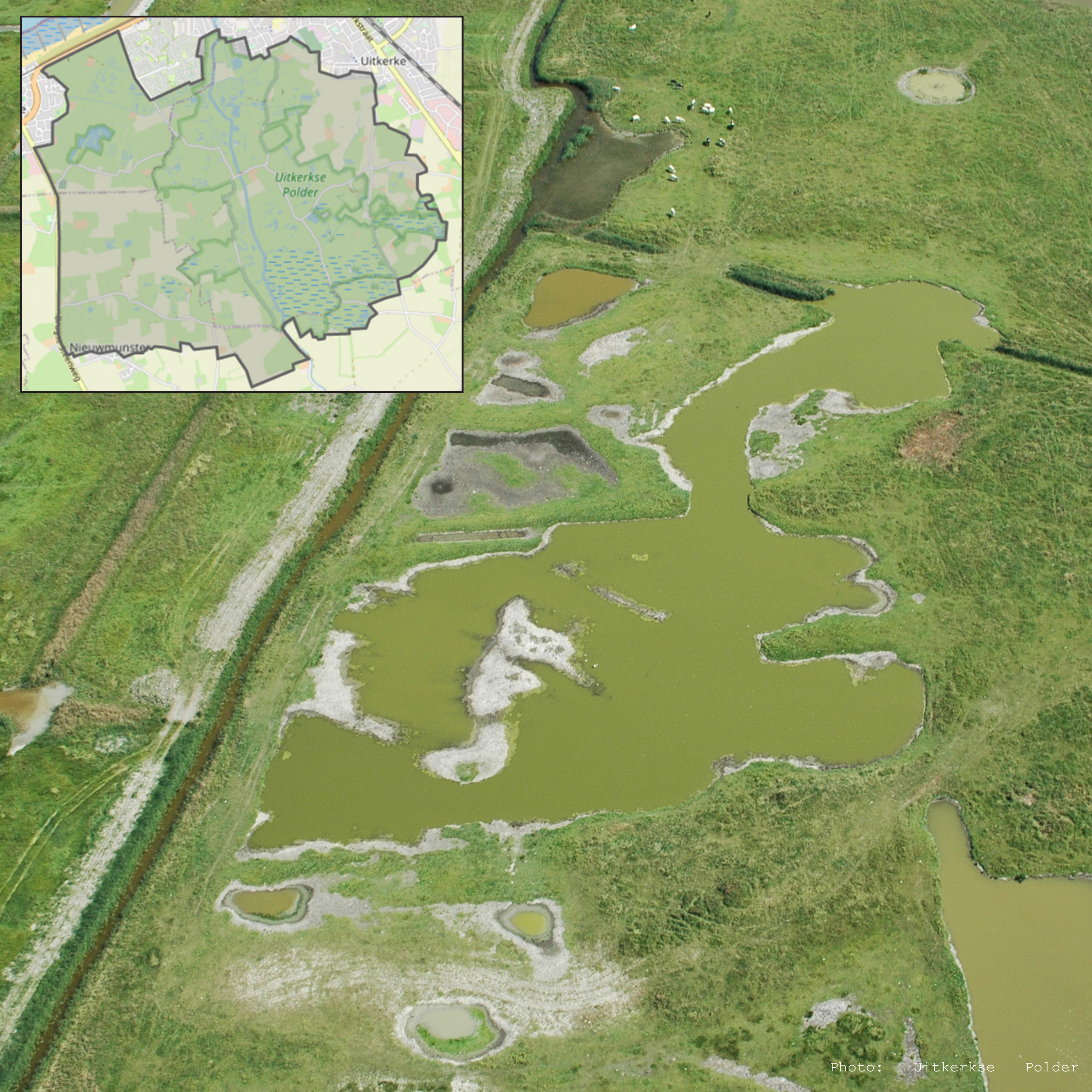

Photo: Uitkerkse Polder

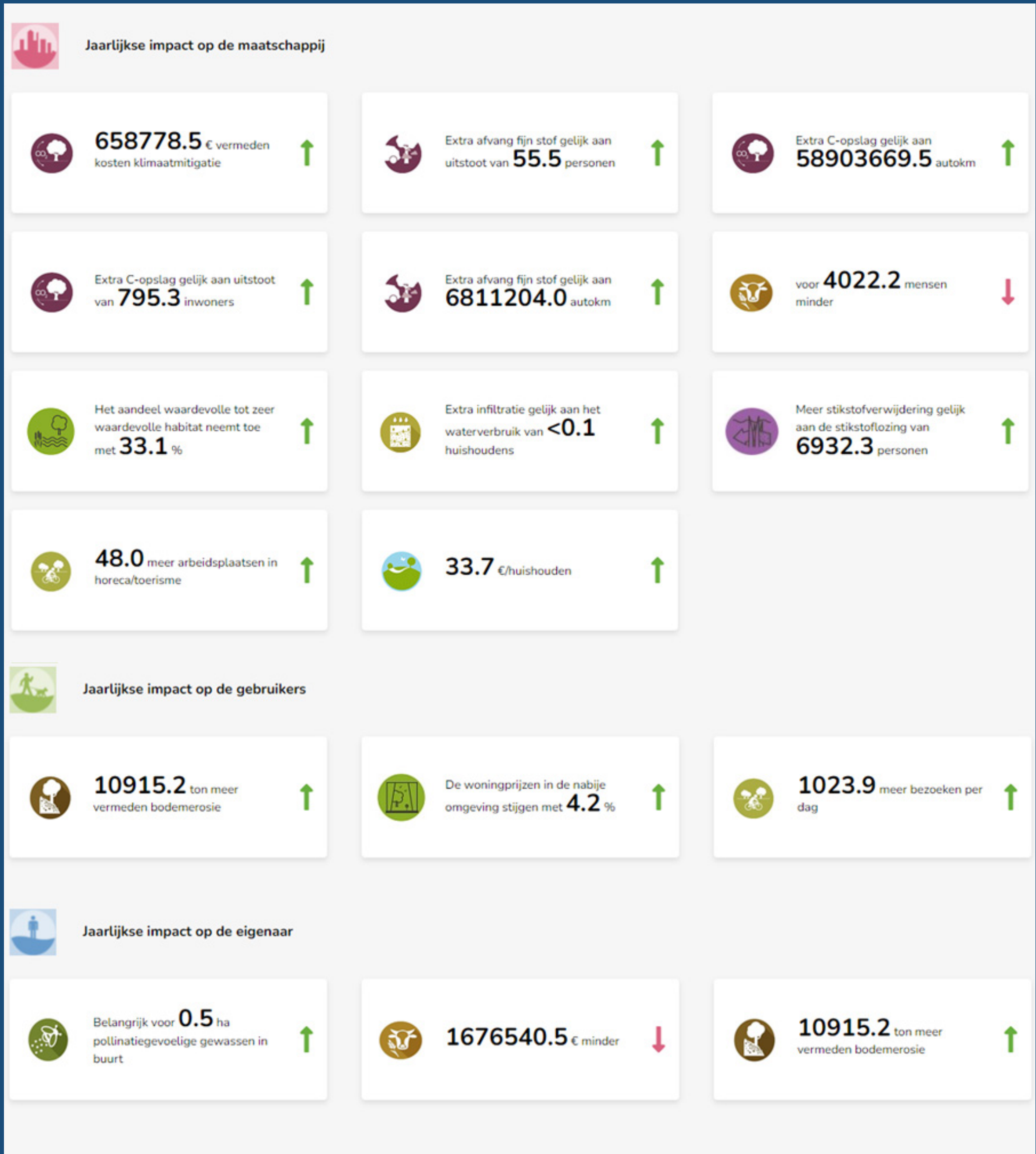

Figure 42. Expansion and restoration of the Uitkerkse Polder: overview of scores for the various indicators included in the analysis of the ecosystem services before and after expansion of the nature reserve in accordance with the scenario 'anti-

Figure 43. Expansion of the Uitkerkse Polder: overview of scores for the ecological parameters before and after expansion of the natural area in accordance with the scenario ‘anti-urban sprawl’.

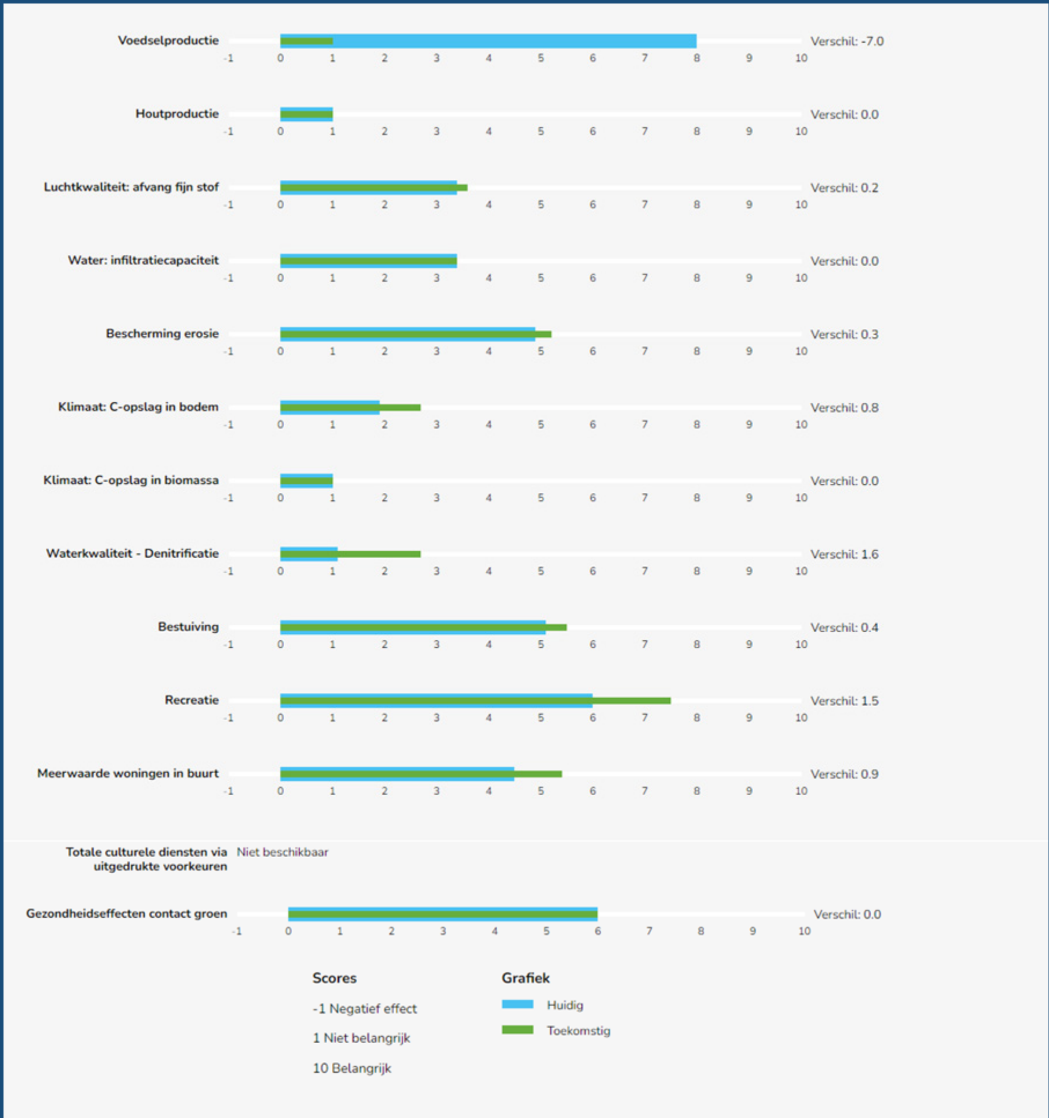

Figure 44. Expansion of the Uitkerkse Polder in accordance with the scenario 'anti-urban sprawl': qualitative score that indicates (1) how important the area is for a particular ecosystem service compared to other areas in Flanders, and (2) how ecosystem services develop after the expansion of the area.

Kwantitatieve waardering	Eenheid	Huidig		Toekomstig		Verschil	
		Laag	Hoog	Laag	Hoog	Laag	Hoog
Voedselproductie	€ toegevoegde waarde productie / jaar	1346611.2	2006469.6	0.0	0.0	-1346611.2	-2006469.6
Houtproductie	m³ geoogst hout / jaar	1.7	1.7	1.7	1.7	0.0	0.0
Luchtkwaliteit: afvang fijn stof	kg PM10 / jaar	6125.2	6125.2	6396.9	6396.9	271.7	271.7
Water: infiltratiecapaciteit	m³ / jaar	1561061.8	1561061.8	1561062.3	1561062.3	0.5	0.5
Bescherming erosie	ton vermeden erosie / jaar	-10580.3	-21160.7	-3303.6	-6607.1	7276.7	14553.6
Klimaat: C-opslag in bodem	ton C / jaar	3217.7	3217.7	6045.1	6045.1	2827.4	2827.4
Klimaat: C-opslag in biomassa	ton C / jaar	0.5	0.5	0.5	0.5	0.0	0.0
Waterkwaliteit - Denitrificatie	kg N / jaar	518.2	518.2	25062.2	25062.2	24544.0	24544.0
Bestuiving		-	-	-	-	-	-
Recreatie	Aantal bezoeken / jaar	1516345.8	1516345.8	1890070.8	1890070.8	373725.0	373725.0
Meerwaarde woningen in buurt	% waardestijging woning	9.6	9.6	13.8	13.8	4.2	4.2
Alternatieve methode berekening culturele diensten							
Totale culturele diensten via uitgedrukte voorkeuren	Aantal huishoudens	387498.0	696996.0	696996.0	696996.0	309498.0	0.0
Gezondheidseffecten contact groen	DALY/jaar	115.7	115.7	115.7	115.7	0.0	0.0

Figure 45. Expansion of the Uitkerkse Polder in accordance with the scenario 'anti-urban sprawl': comparison of quantitative scores for various ecosystem services before and after the expansion of the natural area.

A more comprehensive overview of both the quantitative and qualitative analysis results on which this summary is based can be found in Figures 42 through 45.

Expansion of the natural area in the Oudemaars Polder

In this analysis, the vegetation in the Zeebos and the original Oudemaars Polder was retained. The current situation was also maintained for watercourses, pools, built-up areas and minor landscape elements. Fields and pastures in use for agriculture, however, were converted into natural grassland.

In summary, the expansion of the natural area in the Oudemaars Polder could lead to the following development in ecosystem services:

- The food production in the area will drop sharply, because fields and pastures are being converted into natural grassland, corresponding to a loss of income between around €90,000 and €150,000 (2019 prices). This would be equivalent to the food requirements of 288 people. (Just as with the previous analyses, no account was taken here of expenditure avoided or any income related to the management of nature.)
- The air quality in the area will rise to the tune of the capture of around 36kg of particulate matter (PM10) per year.
- There will be less erosion. It will be possible to avoid around 750 tons of ground being washed away per year.
- Carbon storage in the soil will rise by an estimated 145 tons per year, which is comparable to 3 million kilometres driven by a car or the carbon emissions of 41 people.
- Because fields will be converted into natural, unfertilised grassland, this will avoid nitrogen washing out into ground and surface water. This will ensure that around 2,160kg of N per year, or a quantity of nitrogen equating to the emissions of 609 people, will not end up in the water.
- The habitat for pollinators will expand.
- Recreation will increase by an estimated 21,200 visits per year or

Photo: Zeebos (Glenn Vanderbeke)

an average of 58 extra visits per day. On the one hand, the area for soft recreation will be enlarged, and increase the experience of the landscape. On the other, we presupposed that there will be more walking paths, more seating will be installed and information signs will also be placed here and there (e.g. on meadow birds).

- The additional recreational possibilities are estimated to provide 3 extra jobs in recreation and catering.
- Practically the entire region could develop into a complex of biologically valuable and highly valuable elements.

A more comprehensive overview of both the quantitative and qualitative analysis results on which this summary is based can be found in Figures 46 through 49.

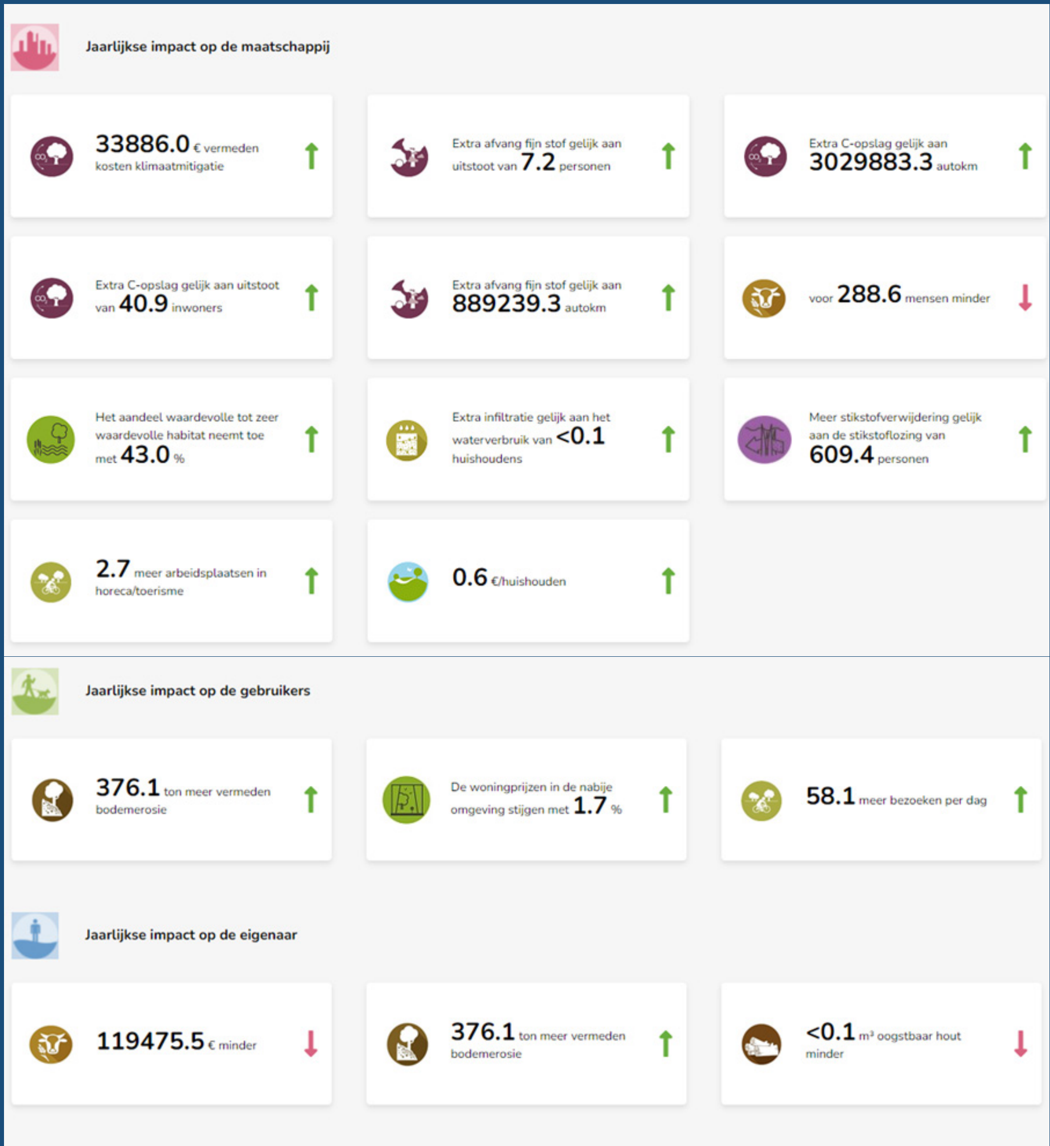

Figure 46. Expansion of the Oudemaars Polder: overview of scores for the various indicators included in the analysis of the ecosystem services before and after expansion of the nature reserve.

Figure 47. Expansion of the Oudemaars Polder: qualitative score that indicates (1) how important the area is for a particular ecosystem service compared to other areas in Flanders, and (2) how ecosystem services develop after the expansion of the area.

Figure 48. Expansion of the Oudemaars Polder: overview of scores for the ecological parameters before and after expansion of the natural area.

Kwantitatieve waardering	Eenheid	Huidig		Toekomstig		Verschil	
		Laag	Hoog	Laag	Hoog	Laag	Hoog
Voedselproductie	€ toegevoegde waarde productie / jaar	89440.9	149510.3	0.0	0.0	-89440.9	-149510.3
Houtproductie	m³ geoogst hout / jaar	23.7	23.7	23.7	23.7	0.0	0.0
Luchtkwaliteit: afvang fijn stof	kg PM10 / jaar	658.0	658.0	693.5	693.5	35.5	35.5
Water: infiltratiecapaciteit	m³ / jaar	255232.0	255232.0	255232.0	255232.0	0.0	0.0
Bescherming erosie	ton vermeden erosie / jaar	0.0	-827.4	0.0	-75.2	0.0	752.2
Klimaat: C-opslag in bodem	ton C / jaar	349.7	349.7	495.1	495.1	145.4	145.4
Klimaat: C-opslag in biomassa	ton C / jaar	7.6	7.6	7.6	7.6	0.0	0.0
Waterkwaliteit - Denitrificatie	kg N / jaar	70.9	70.9	2228.5	2228.5	2157.6	2157.6
Bestuiving		-	-	-	-	-	-
Recreatie	Aantal bezoeken / jaar	71535.8	71535.8	92730.4	92730.4	21194.6	21194.6
Meerwaarde woningen in buurt	% waardestijging woning	5.2	5.2	6.9	6.9	1.7	1.7
Alternatieve methode berekening culturele diensten							
Totale culturele diensten via uitgedrukte voorkeuren	Aantal huishoudens	14425.0	28322.0	20633.0	60937.0	6208.0	32615.0
Gezondheidseffecten contact groen	DALY/jaar	0.0	0.0	0.0	0.0	0.0	0.0

Figure 49. Expansion of the Oudemaars Polder: comparison of quantitative scores for various ecosystem services before and after the expansion of the natural area.

4. Future-oriented nature management and expansion of living areas can no longer take place without taking account of the impact that climate change will have. This means that a way of dealing with the structural uncertainty that is becoming more and more characteristic for the continued existence of species and ecosystems must be found. The IPCC is therefore recommending that adaptation plans be drawn up allowing for targeted intervention in natural systems so as to promote the continued existence of species and ecosystems.

The contribution to the Sixth Assessment Report from the IPCC's Working Group II was released in late February 2022. This report looks at the impact that climate change may have on ecosystems, biodiversity and human society. The general conclusion is harsh: if climate change persists as it is now, one third of all plant and animal species globally will have died out by 2070. The main reason for this is that many species are unable to adapt at the same rate as the changes they are (or will be) facing in their living environment. However, the section 'Terrestrial and freshwater ecosystems and their services' does contain a number of valuable insights as regards short-term actions that may help to improve the chances of survival for (vulnerable) species and ecosystems (see Will species go extinct with climate change and is there anything we can do to prevent it?). Although these insights are not unknown, we will summarise those that may also be relevant in the context of the Oudland Polder SIP here once more.

1. Protect

Plants, animals and entire ecosystems are under pressure. The consequences of climate change, such as water shortages, more frequent outbreaks of disease and new invasive species, are major stress factors, but not the only ones. The disappearance of habitats due to urbanisation and agriculture, pollution, disruption and other consequences of human activities, are putting nature under pressure. Moreover, research has clearly demonstrated that the degradation of natural ecosystems is worsening the impact of climate change on both nature and humanity. Protection of species and habitats by driving down pollution, disruption, fragmentation and other stress factors induced by humanity must consequently play a major role in conservation programmes. Just as in the EU Biodiversity Strategy, this IPCC report also proposes 30% protection of the land surface area as a minimum.

2. Connect

Species need to be able to move from one natural habitat to another. This includes places where they were not to be found historically (passive assisted colonisation). By providing natural corridors between (protected) natural areas, species facing pressure from the changing climatological conditions will be given the opportunity to gradually migrate to more northerly latitudes or higher areas (climate-driven translocation). The natural corridors addressed in previous sections of this publication are therefore also proposed as part of the solution in this IPCC report.

3. Restore

Research indicates that species can survive in places where the conditions are more favourable thanks to a local micro-climate, whereas they would die out elsewhere. In such 'places of refuge', the climatological conditions are more moderate (e.g. cooler or more humid) than in the surroundings owing to specific local factors. Human interventions can also create such places of refuge, such as places where soils remain moist during intensely dry periods due to hydrological interventions, or places where it remains cooler during heatwaves. Populations that can survive with the aid of such places will migrate back to other places over time, once the conditions are more favourable.

Due to the more frequent occurrence of quite extreme weather conditions in recent years, things are becoming harder and harder for natural systems. They are getting less and less time to recover and adapt. The IPCC is therefore pointing out the importance of **adaptation plans** that take account of potentially unavoidable and irreversible changes in ecosystem structures and processes. These are primarily aimed at actions that attempt to prevent such changes in natural systems.

RECOMMENDATION 4

PROVIDE SUFFICIENT BUFFERING FOR LOGISTICAL AND PORT ACTIVITIES

- **Investigate how the noise pollution caused by the port of Zeebrugge in the area surrounding Lissewege can be limited.**

- **Take account of the construction of a buffer strip in the agricultural area to the north of Lissewege.**

What did we learn from COASTAL?

Although the activities at the port of Zeebrugge are anticipated to grow, no spatial interventions have yet been made to reduce the noise pollution resulting from the port activities for the residents of Lissewege. Nonetheless, there does appear to be great support for this.

During the workshop in which the future of the polder villages was discussed, the participants unanimously voted for the principle that 'The liveability of polder villages and hamlets such as Zwankendamme, Bredene-dorp and Lissewege should be secured by sufficient buffering against industrial and logistical port activities'. This principle was not even discussed. It was immediately acknowledged by all those present that the logistical and industrial activities at the North Sea ports has a considerable impact on the residents of the surrounding polder villages, and that something needs to be done about this. It is simply that, as far as anyone knows, no research has yet been done into potential measures (e.g. an embankment) for limiting this inconvenience.


Photo: Port of Zeebrugge and Dudzeelse Polder (VLM)

ANNEX – MEANING OF NVE INDICATORS

The overview analysis from the Nature Value Explorer are presented using a number of indicators. The meaning of these indicators will be explained here.

Climate mitigation costs avoided: Estimate of the costs that would be incurred for emission reduction measures needed to guarantee that the average temperature at a global level rises by a maximum of 2°C compared to pre-industrial levels.

Emissions by people: In order to get an idea of the quantity of pollutants (e.g. carbon and particulate matter) captured by natural habitats, or stored in soils and biomass, we compare this quantity to the emissions into the air by the average Fleming (e.g. through heating).

Emissions from car kilometres: The same as above, except the comparison is with kilometres driven by a car in this indicator.

Food needed for people: We compare the number of hectares of agricultural ground that will disappear with the necessary surface area for food provision for an average Fleming (between 1,448m² and 2,500m² per resident (Dankaert et al. 2013)). We should note here that this necessary surface area is calculated on the basis of the current food pattern (2013) of the average Fleming. If this pattern changes due to e.g. lower meat consumption, the necessary surface area may go down.

Household water use: In order to get an idea of the quantity of water infiltrating, we compare this quantity to the tap water consumption of an average family (2.3 people) in Flanders. This is 73m³/year (VMM Water Book 2020).

Nitrogen discharge by people: In order to get an idea of the quantity of nitrogen removed by natural vegetation or no longer washed out into surface water, this quantity is compared to the nitrogen in a Fleming's wastewater.

Jobs in the catering/tourism sector: We know from research how much a holiday-maker spends on average on a visit to catering establishments, shops, overnight stays, etc. The number of full-time jobs created per million expenditures (lever) is also known. This is used to estimate the number of extra jobs that are created by a growth in the recreation sector.

€/household: Based on surveys as to preferences and willingness to pay for the development of nature, we calculate how many € a Flemish household is willing to pay for the development of nature in line with the distance to the area.

Soil erosion avoided: The quantity of soil that would wash away less easily as a result of heavy rainfall and/or wind compared to the current scenario.

Added value of agriculture: The gross balance that the farmer earns by selling their crops/meat/milk, multiplied by the number of hectares of a particular crop or hectares of pastures / fodder crops.

Pollination: We look at how many hectares there are of crops dependent on pollination in a radius of 1km around the area. If a better living environment is created for pollinators, the production of these crops will see a positive effect. If the living environment disappears, a negative one. Sometimes, this ecosystem service can also drop because fields of crops dependent on pollination or orchards are converted into nature.

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