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RISKS & CHALLENGES TO WATER RESOURCES

and opportunities for sustainable management in the United Kingdom, Belgium and the Netherlands

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DISCLAIMER

COLOFON

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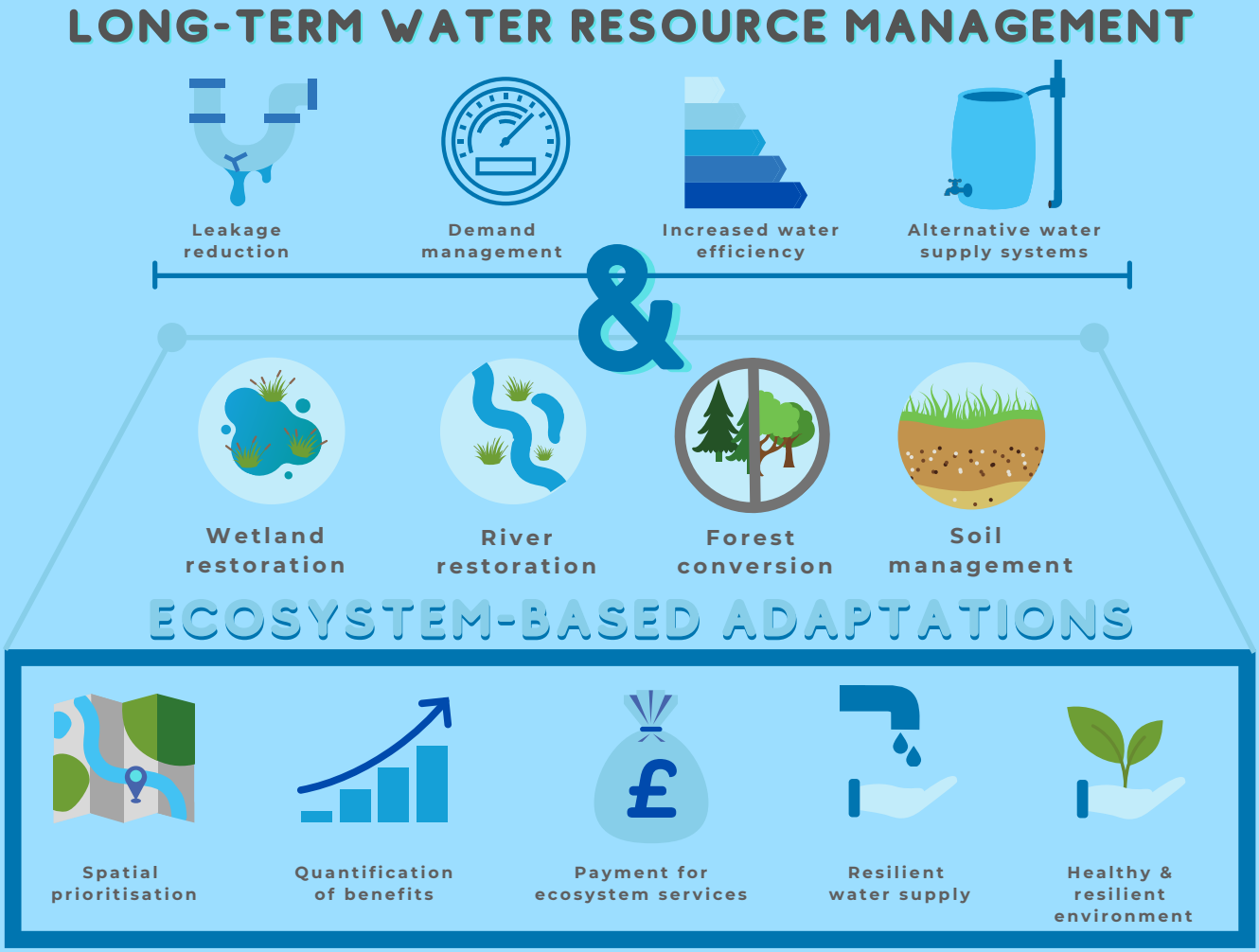
PROWATER

Climate projections for northern Europe show less precipitation in summer and increasingly erratic rainfall leading to a greater risk of both flooding and droughts. These changes put increasing pressure on water supplies alongside population growth and increasing demand for water from industry and individuals. Sustainable management of water starts at the top of the catchment. While water industry resource management traditionally focuses on the optimal allocation of available water resources through supply infrastructure and demand management, PROWATER looks into opportunities to increase water availability through Ecosystem-based Adaptations (EbA). These are a type of Nature-based Solution designed specifically to reduce vulnerability and build resilience to climate change (IUCN). We need to mitigate the historic changes we have incurred and increase the resilience of our landscapes and habitats and provide practical solutions to the increasing issue of water scarcity that we face now and in the coming years. If we are committed to a future with clean and plentiful water for all we need to fund EbA schemes that promote a system where the landscape stores, cleans and delivers good quality water for us. Funding measures such as wetland creation, river restoration, conversion of conifer plantations to natural habitats and good agricultural soil management allows the natural movement of water through the landscape. This provides a steady supply of clean water for use by both people and the environment. The added benefits of EbA measures are that once you begin to consider the environment as an integrated system, outcomes do not stand alone. Measures to support water resources also benefit recreation, local economies, carbon storage and biodiversity.



Long-term water resource management and the importance of Ecosystem-based Adaptation (EbA) measures for sustainable water resources and landscapes resilient to droughts and flooding. The Interreg 2 Seas PROWATER project focusses on EbA measures increasing the infiltration and water storage capacity of the landscape, including wetland restoration, river restoration, forest conversion and soil management.

OVERVIEW OF REGIONS

- Climate change increases the challenge to cope with (prolonged) dry periods and to improve the ecological quality of both surface waters and groundwater dependent terrestrial nature areas.

- Human modifications of the hydrological system in the landscape have impacted on water provisioning.

SOUTHERN ENGLAND

- Climate in the UK is very variable, and the South East and South West face markedly different situations with regards to water resources, economic status, population density and environment.

- The UK is perceived as a water-rich country, but this perception does not account for the high demand from a growing population, and the seasonal and spatial distribution of available water resources.

- Water Resources are already under pressure in parts of the country.

BELGIUM - FLANDERS

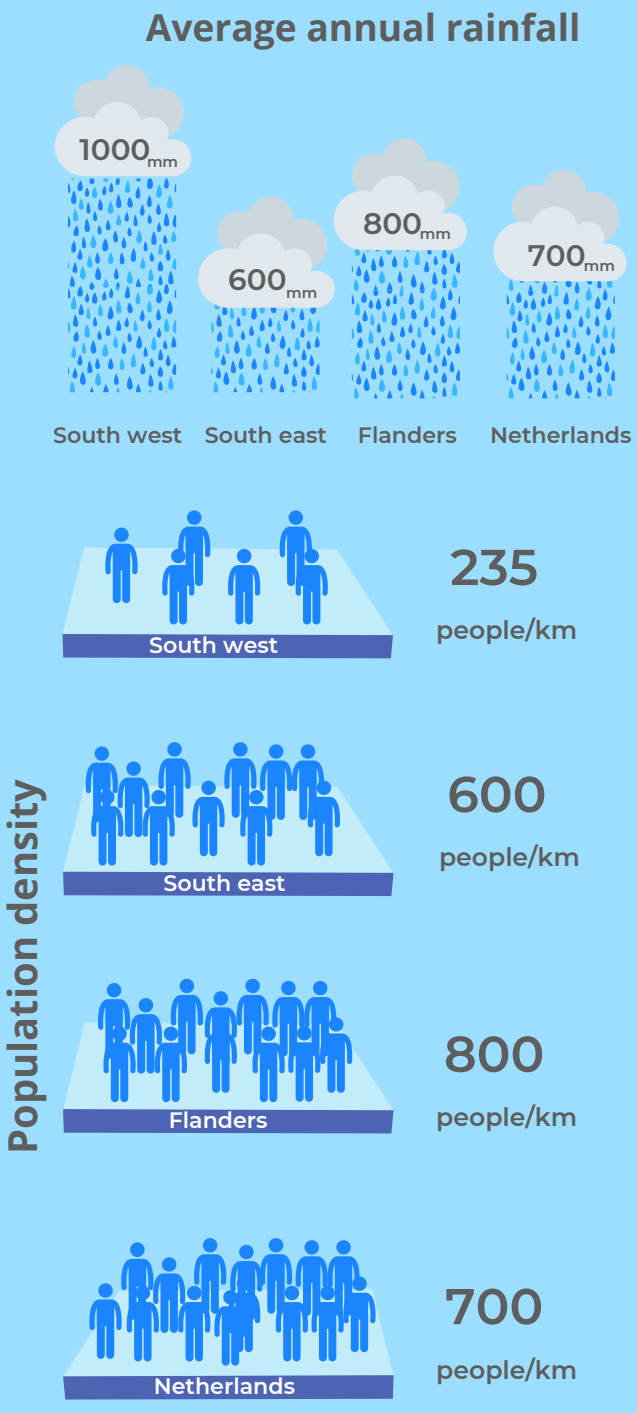
- Flanders is a water scarce region due to the high population pressure on a small surface area.

- Flanders is internationally labelled as a risk area for water scarcity and water shortages have already occurred.

THE NETHERLANDS – NOORD-BRABANT

- In the 20th Century, the hydrological system and related land use patterns have been developed to get rid of excess water in the landscape. Consequently, the capacity to store surface water and infiltrate water in the landscape has been reduced substantially.

- Noord-Brabant is a water scarce region due to the development of intensive agriculture and urban areas in the past century.



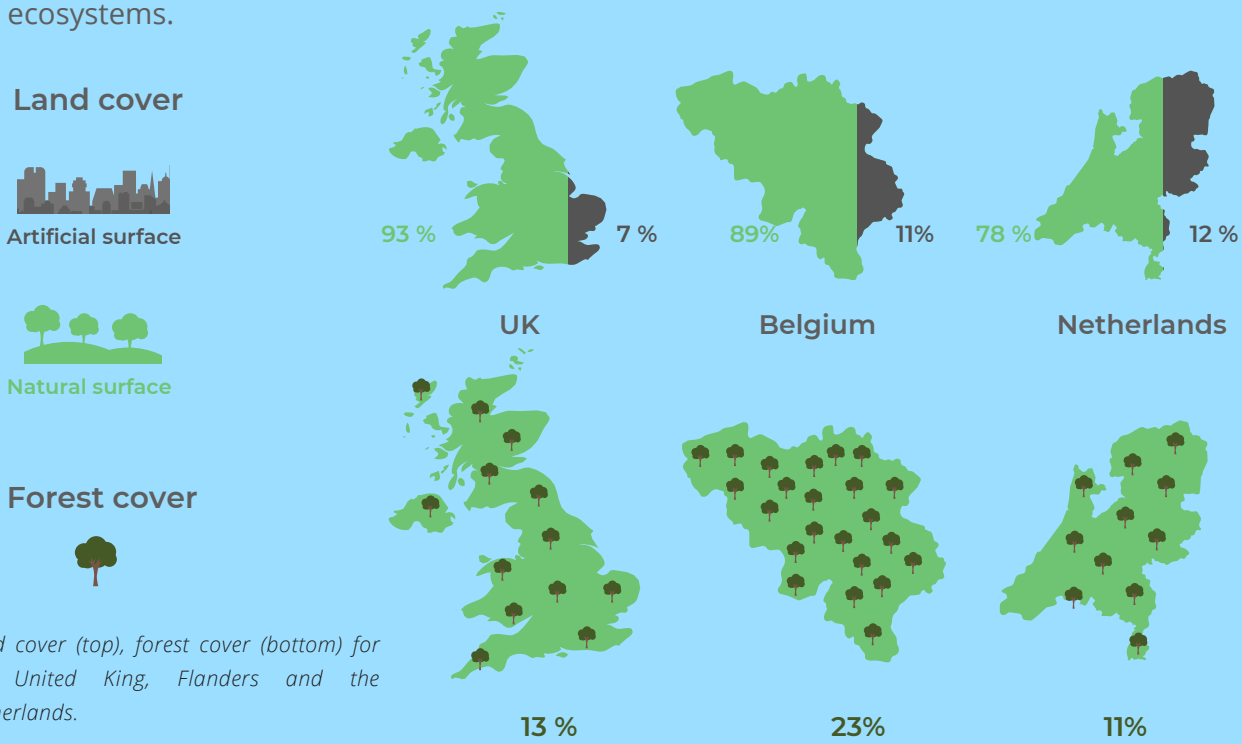
Average annual precipitation (top) and population density (bottom) for South West England, South East England, Flanders and the Netherlands.

CONNECTING NATURAL CAPITAL AND WATER RESOURCES

- Catchments and the wetlands and terrestrial habitats within them are natural capital. They play a key role in the regulation of the quantity and quality of water that is available to humans and the natural environment. Therefore, natural capital and economic capital cannot be detached from one another.

- Protecting, restoring, and connecting wetlands and terrestrial habitats and restoring linked hydrological processes on a catchment scale allows the mitigation of extreme weather events and increases the resilience of wetlands and terrestrial habitats to additional pressures such as abstraction and pollution.

- The hydrological functioning of catchments determines the approach to Ecosystem-based Adaptation that would improve their resilience of water resources. EbA measures should reflect the processes that would occur naturally in the landscape, taking account of geology, climate and ecosystems.



Land cover (top), forest cover (bottom) for the United King, Flanders and the Netherlands.

SOUTHERN ENGLAND

- Pressure from the development of land for agriculture and urbanisation has reduced the capacity of the UK's landscape to provide water-related ecosystem services (water quantity and quality).

- Southern England has a varied geology which results in a mixture of hydrological systems. This means that each catchment may require a different set of EbA measures to improve resilience of water resources, depending on the natural capital present.

- In the UK, there is increasing recognition of the importance of investing in EbA measures to increase resilience of catchments and communities against flooding, drought, and other pressures.

- Pathways for investment in EbA and systems to ensure outcomes are not yet mainstreamed, and demonstration projects are needed to enable further uptake.

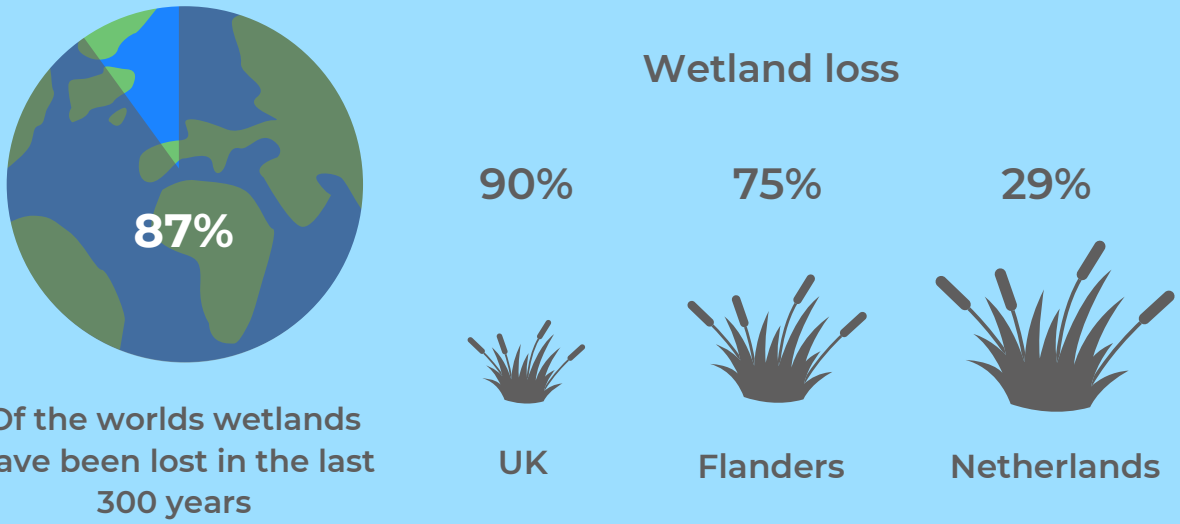
CONNECTING NATURAL CAPITAL AND WATER RESOURCES - KEY MESSAGES

BELGIUM - FLANDERS

- Land cover and land use changes have impacted the hydrological systems within Flemish catchments, affecting water availability and quality.
- Due to Flanders's degraded natural capital and the impact of climate change, the hydrological regime of many rivers has become more extreme with consequently increased peak flows (and associated runoff), increased flood risks as well as more extreme low flows and water levels.
- In the last 50 years, almost 75% of all wetlands have disappeared in Flanders, mainly due to urbanisation and intensification of agriculture. Upstream temporary wetlands have also disappeared at an alarming rate despite their importance for water flow regulation and aquifer recharge.

THE NETHERLANDS – NOORD-BRABANT

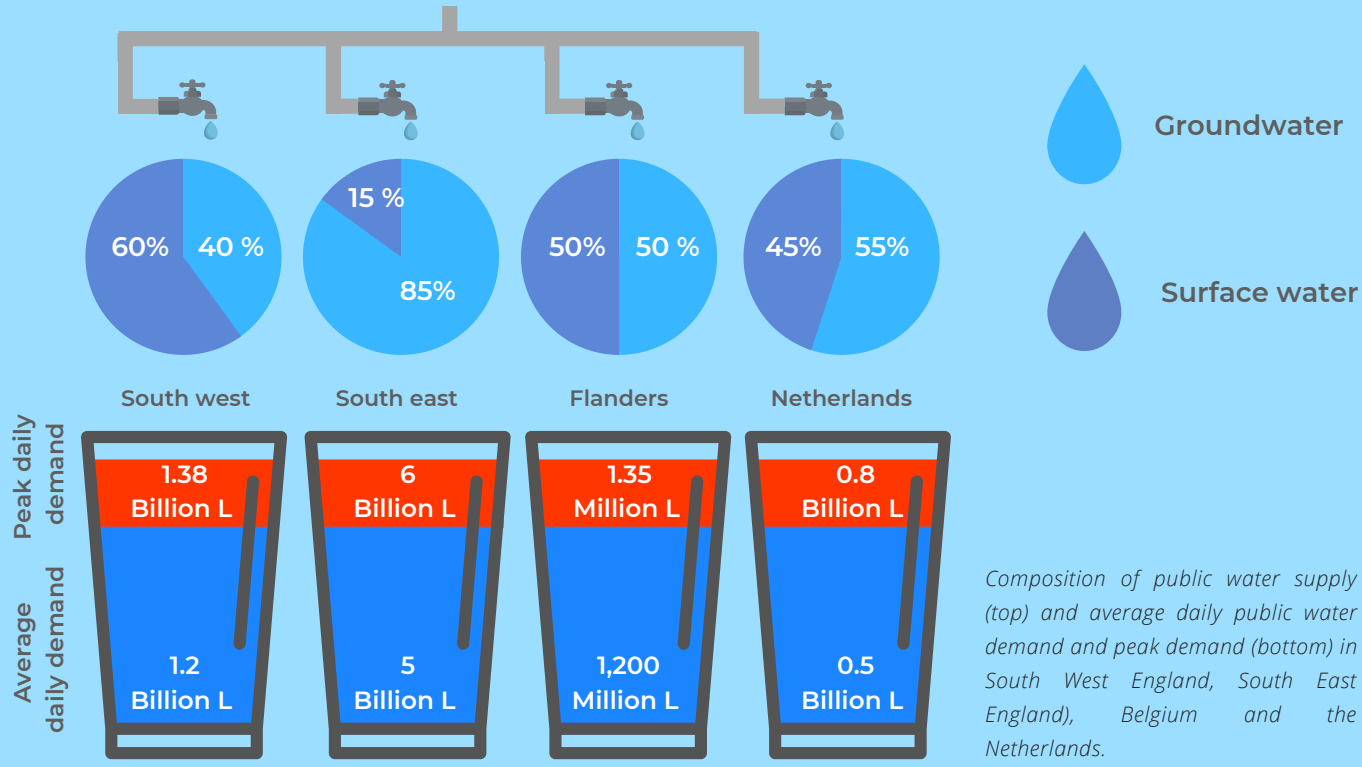
- Due to intensive land use and water abstractions, groundwater levels in the sandy soils in the Noord-Brabant province dropped dramatically between 1950 and 2010. Consequently, biodiversity is under pressure due to desiccation of nature reserves and decreased baseflows of surface water bodies.
- The effects of climate change and the expected increase in the demand for drinking water exacerbate the challenges of both freshwater demand and supply management in relation to biodiversity and good status of groundwater and surface water bodies.
- Climate resilient integrated land and water management requires greater levels of infiltration and retention in the landscape and a substantial decrease in peak flows following rainfall. This requires substantial modifications in the land and water use.



Wetland loss for the United King, Flanders and the Netherlands.

WATER RESOURCES

- Renewable water resources per person across Europe have shown a decreasing trend between 1960 and 2017.
- Demand for water is driven by the household use of private users, irrigation needs in agriculture, industrial processes (such as manufacturing or power generation) and navigation. Peaks in demand do not correspond well to when and where water resources are currently available.
- A growing need for water in agriculture presents an opportunity to drive efficiency and use of EbA approaches to ensure environmental as well as business resilience.



Composition of public water supply (top) and average daily public water demand and peak demand (bottom) in South West England, South East England), Belgium and the Netherlands.

SOUTHERN ENGLAND

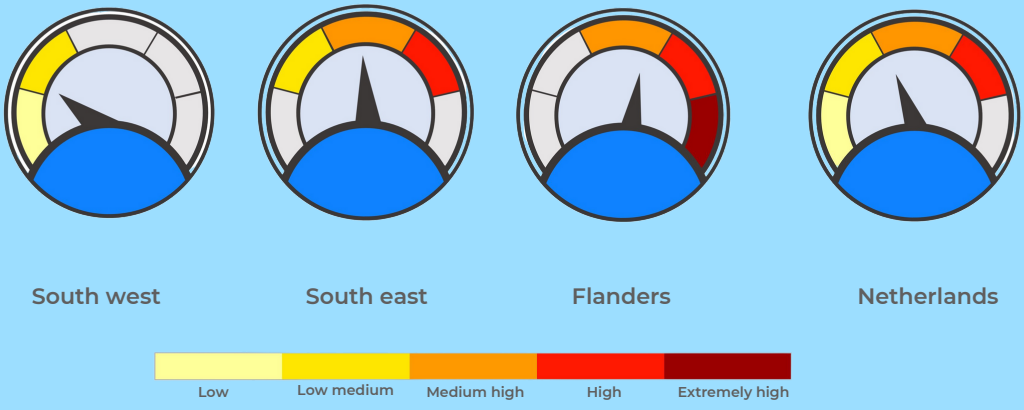
- A high proportion of catchments in the South East would be unable to support additional abstraction. This impacts groundwater levels and river flows and reduces our resilience to extreme events.
- Already high demand for public water supply can increase by 20% in the summer, when flows are lower and pressures on freshwater ecosystems higher.
- Public Water Supply is the biggest user of water, but there is high and growing demand for other users such as agriculture, with implications for seasonal usage.
- A high demand for water already drives need for water efficiency in South East England, but personal demand figures are still higher than the UK average.
- Treated effluent from wastewater treatment can contribute a significant proportion of water available in the river, increasing resources for abstraction downstream as well as supporting low flows.
- Although forecast models predict that the south west of England will have a positive supply demand balance at least until 2080, without improved resilience to the catchment landscape there is a significant risk of long-term future deficits in water supply for humans and the environment.

BELGIUM - FLANDERS

- Flanders is a water scarce region with limited annually renewable water resources. The public water supply is highly dependent on groundwater resources.
- Flanders is highly dependent on the inflow of water from neighbouring regions to operate the canal systems. For both Meuse and Scheldt, the commitments made in the international conventions could not be met during past droughts.
- A range of different sectors are increasingly abstracting groundwater resources. A decrease in precipitation surplus and increase in abstracted volumes may push the overall abstraction pressure to unsustainable levels.
- Groundwater levels are not recovering from past drought episodes. Groundwater levels are becoming critically low, because the abstraction from these deep groundwater aquifers is larger than their recharge. About 40% of the effective rainfall is lost through superficial drainage, overland flow and runoff. If we could transform 25% of these losses into groundwater recharge, future drought episodes can easily be bridged.
- Unconfined groundwater levels are becoming critically low in the summer months. Critical low water flows in many rivers led to the implementation of water saving measures during the summer of 2018.

THE NETHERLANDS – NOORD-BRABANT

- The current average total annual abstracted volume of ground water in Noord-Brabant exceeds the estimated replenishment of ground water resources. This is an unsustainable situation with negative consequences for the economy and the environment.
- Due to climate change and related future water demands (especially in dry periods), the negative consequences might increase.
- Additionally, given the critical water availability – demand balance in the Flemish Region of Belgium, and the connected, shared ground- and surface water bodies in the Campine region, there is an urgent need for a joint Flemish-Dutch strategy for climate-proof land-water management.

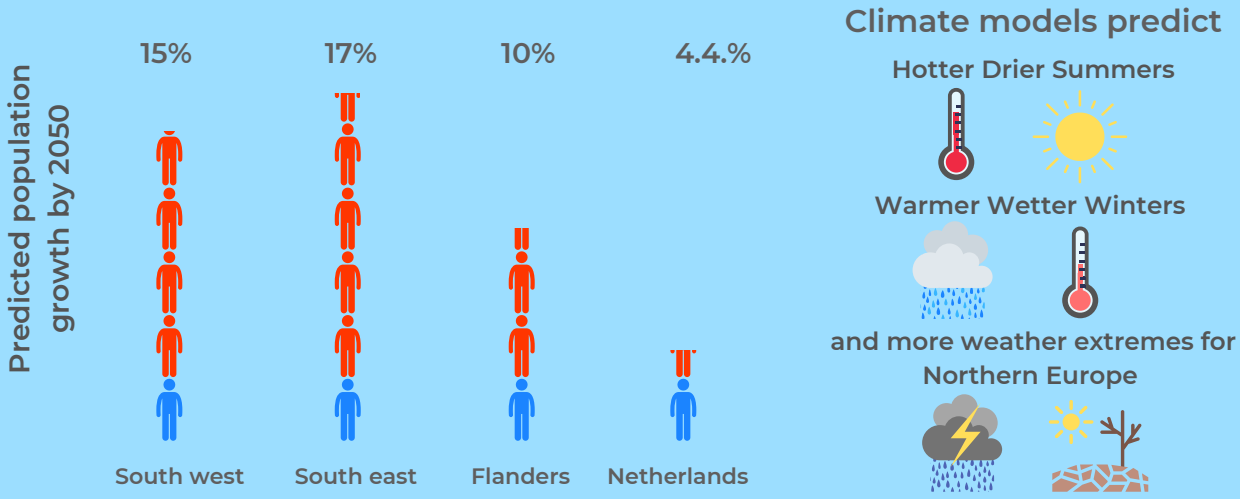


Water stress South West England, South East England, Belgium and the Netherlands.*

* *The Water Exploitation Index plus (WEI+) is a measure of total fresh water use as a percentage of the renewable fresh water resources (groundwater and surface water) at a given time and place. It quantifies how much water is abstracted and how much water is returned after use to the environment.*

FUTURE PRESSURES

- Summer rainfall is reducing on average while winter rainfall increases, and extreme events such as droughts and flooding are becoming more common across the year.
- Episodes with extreme precipitation are less effective for water infiltration and retention in the landscape and increase flood risk.
- Changing climate and population growth will exacerbate water demand pressures resulting in greater water stress.
- Implementation of EbA measures can increase the water infiltration and retention capacity of the landscape to counter climate change impacts and result in sustainable water resources and catchments that are more resilient to both drought and flooding.



Fpredicted population growth by 2050 (left) and climate model predictions (right) across the regions.

SOUTHERN ENGLAND

- Nationally by 2050, restrictions on water use (such as temporary use bans) will be twice as likely as in the period between 1975 and 2004 if no action additional to current water resource plans is taken.
- Daily river flows show a trend for lower summer flow and higher winter flows across the UK, with impacts on water quality and wildlife. Water resources responses are catchment specific.
- Consecutive dry winters present the biggest drought risk, 2012 was a significant drought following 2 dry winters.
- The groundwater recharge period is shortening and becoming more vulnerable to droughts, with the risk of groundwater recharge decreasing locally.
- Soils will become more drought prone and less suitable for today's agriculture, with higher erosion and compaction risks. Freshwater ecosystems as well as terrestrial ecosystems are impacted by these changes.

- In 2004-2006 the response to the drought occurring was focused on maintaining the public water supply and as a result the environment suffered.

- Previous droughts and responses to them show that: good soil management can support agriculture through dry periods, the increasing intensity and frequency of droughts requires efforts to increase the resilience of natural ecosystems and that the variability of weather events with flooding following droughts could be balanced better by increasing the retention capacity of the landscape in a way that would benefit public water supply, agriculture and the environment.

BELGIUM - FLANDERS

- The effects of climate change on Flanders can already be observed in the long-term meteorological data. Temperatures and extreme precipitation have increased in recent decades. Droughts have been increasing more recently. Climate scenarios predict higher temperatures, higher evaporation rates and less rain in the summer for the Flemish region. Consequently, the cumulative precipitation deficit will increase during the growing season.

- The ecological impacts are high, ground and surface water dependent ecosystems suffer from direct and indirect impacts.

- Policies and plans target short term measures for water security and drought risk management, there is too little attention for pro-active measures, such as EbA measures that actively increase water infiltration and retention capacity of the landscape on the long term.

THE NETHERLANDS – NOORD-BRABANT

- Overall average summer rainfall is reducing and average winter rainfall is increasing, and extreme events such as droughts and flooding are becoming more common.

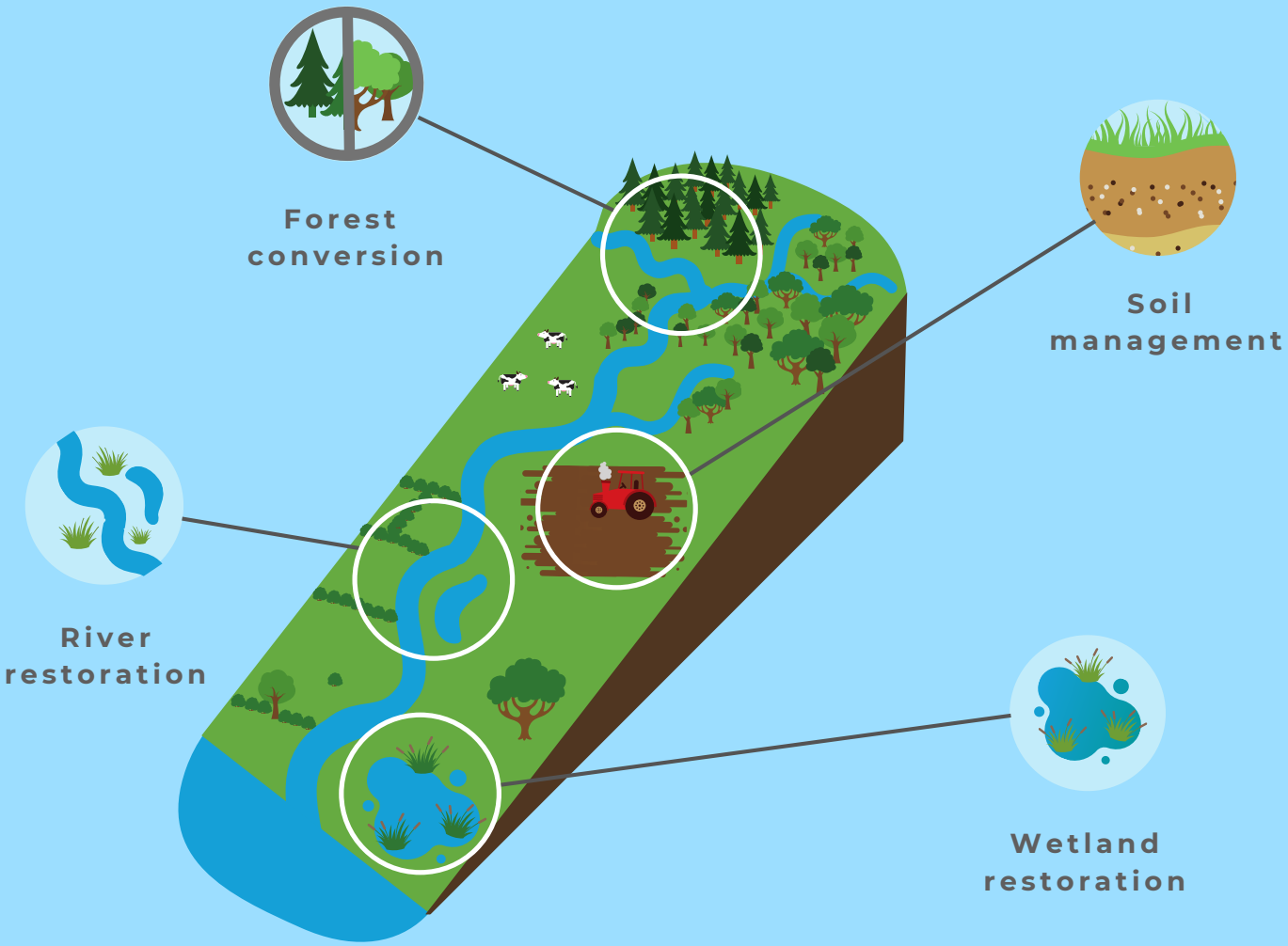
- There is a significant difference between trends in April-September precipitation between coastal and inland region in the Netherlands, but drought scenarios are often studying the whole country of the Netherlands.

- Peak storms events are less effective to store water and most of the water is discharged out of catchment towards the larger rivers.

THE ROLE OF ECOSYSTEM-BASED ADAPTATION MEASURES

- EbA measures are a crucial complimentary building block to their existing resource plans, providing increased resilience to water supply in the form of increased water infiltration and retention, as well as many other benefits to catchments and to their customers

- EbA measures should be considered as a crucial cornerstone of sustainable water management and climate change adaptation, alongside other approaches such as demand management and regional water transfers, whilst also demonstrating the multiple benefits EbA measures provide through additional ecosystems services.



THE ROLE OF ECOSYSTEM-BASED ADAPTATION MEASURES - KEY MESSAGES

Forest conversion

- Coniferous forests intercept more rainfall than deciduous forests, heathland and grassland and can reduce the amount of rainfall that reaches watercourses and aquifers.
- The relationship between trees and water is complex and they can be beneficial or detrimental to infiltration and retention of water depending on the existing natural capital present.
- Woodland creation is also an important measure for reducing flood risk. Tree planting can help reduce peak flood events during extreme rainfall.
- Additional ecosystem services include carbon storage, erosion prevention, biodiversity and often recreational benefits.

Soil management

- Healthy soil drains, stores and filters water, improving food security and our resilience to floods and droughts.
- Additional ecosystem services provided by healthy soil include water purification, carbon storage, nutrient cycling and storage, erosion prevention, climate regulation.

Wetland restoration

- Wetlands play an important role in the hydrological cycle and can support groundwater recharge, augmenting low river flows and reducing flooding.
- Additional ecosystem services provided by wetlands include water purification, nutrient cycling and storage, erosion prevention, carbon storage, climate regulation and recreational benefits.

River restoration

- River restoration is an important measure to mitigate the effects of climate change. Heavily modified rivers are often less resilient and have lost their ability to hold water in both droughts and floods.
- Restoring rivers to their natural form can provide multiple benefits including improvements to water quality, biodiversity, water supply security, reductions in flood risk and pollution and recreational benefits.