Belgian Climate Risk Assessment

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Foreword

Recent and more frequent events at home and abroad show that we need to be better prepared for the impact of climate change and environmental degradation. Moreover, there is growing recognition that this compromises or could compromise national security. The EU published its first Climate Risk Assessment (EUCRA) in 2024 and the subsequent EU Preparedness Strategy, the Union's broader resilience framework, takes climate and environmental impact into account to a significant extent. With this first Belgian Climate Risk Assessment (BCRA), we are taking a crucial step: we are identifying the most important climate risks for Belgium and showing where action is most urgently needed. In addition, first risks resulting from ecosystem degradation have also been included, as it is intrinsically linked with climate change.

In close collaboration with a multidisciplinary group of experts, 28 risks were selected from a wide range based on an initial assessment of urgency, impact and relevance for Belgium.

The risk analysis, based on a clear methodology that combines literature studies with various types of expert consultations, is also aligned with the European framework (EUCRA). We worked with three possible scenarios based on a global warming of 2, 3 or 4°C. These reflect the potential medium- and long-term consequences depending on global emission scenarios.

This report aims to provide policymakers and other actors with a clear compass. It shows which risks will have the greatest impact, who and what are most vulnerable and how we can take action today. The message is clear: acting now is not only sensible, it is hugely cost-effective and prevents a great deal of human suffering. Investing in climate adaptation is not a cost, but an investment in resilience, safety and wellbeing.

The broad collaboration with academics, practitioners and policymakers is a key feature in this assessment. Numerous scientific and policy experts from many diverse institutions have joined forces at federal, inter-federal and regional levels. In a country with a complex institutional structure, easy, but essential. Only by sharing knowledge and responsibility can we achieve a coordinated and effective approach.

The report also highlights the opportunities for action. Some risks are now clearer than ever. There is a wealth of knowledge available and there are concrete measures we can take today. Reforms and adjustments are needed in virtually all institutions and there are many 'no-regret' measures that can be taken quickly. Nature-based solutions play an important role in the latter: they enhance our safety, support public health care and are economically viable.

The goal is clear: we need to build a resilient society for all, one that is prepared for what is to come. This report shows the traffic lights. It is up to us not to ignore them.

We, at Cerac express our great gratitude to all the institutions and individuals who contributed to this work. Their commitment and expertise make this report a milestone.

Luc Bas
Director

Acknowledgements

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- National Crisis Centre (NCCN)
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Executive summary

Belgium faces **accelerating climate and environmental pressures** that are no longer distant or abstract. Rising temperatures, more frequent and intense floods and droughts and drivers of ecosystem degradation are already disrupting communities, ecosystem services and the economy. These risks are deeply interconnected, cascading from one system to another in ways that amplify **costs** and, if left unmanaged, will **erode national resilience, threaten social cohesion and pose growing security challenges.**

The Belgian Climate Risk Assessment (BCRA) provides **the first national integrated risk assessment stemming from climate change and ecosystems degradation.** The BCRA identifies **28 priority risks** across five clusters: ecosystems, food, infrastructure and buildings, human health and population wellbeing, and economy and finance. It aims to identify the most pressing risks related to climate change and ecosystem degradation, assess their **urgency and current policy readines** , and set out strategic priorities to build a **resilient, fair and secure society.**

This report serves as a foundation for further reflection and decision-making. It must be followed by the development of **coherent, concrete, realistic and effective adaptation measures** – both within individual sectors and across domains. These measures must be supported by the necessary political decisions, financial frameworks, and monitoring tools.

METHODOLOGICAL APPROACH

The BCRA aligns with the European Climate Risk Assessment (EUCRA), while filling a gap at national level by identifying 28 key risks for Belgium.

The BCRA is the result of a rigorous, evidence-based process grounded in an extensive review of scientific literature and broad stakeholder consultation of over 250 experts. It provides a structured and transparent framework to identify, analyse, and prioritise risks related to climate change and ecosystem degradation. Each priority risk was evaluated for its severity, the confidence level in the underlying scientific evidence, and policy readiness. A scoring matrix was developed to estimate the urgency of each risk by combining these three dimensions. Each risk is analysed in depth in the accompanying technical papers. These papers and the methodological report are available on our website, www.cerac.be.

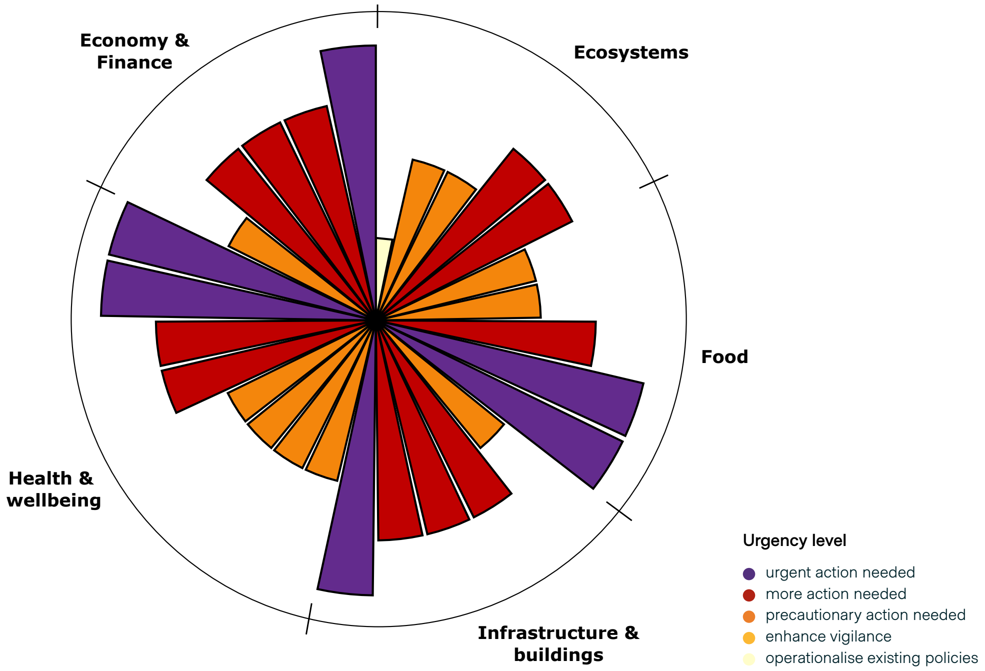
KEY FINDINGS

The assessment identifies several risks that require **urgent action: heat-related health impacts; flooding of buildings and infrastructure**, as well as the cascading risks to **property insurance**; risk to **crops** and **soil ecosystems**; and emerging pandemic **zoonotic diseases**. Other domains, including **key infrastructures**, **freshwater** ecosystems and **food** production demand more action to reduce exposure and prepare for future shocks. As frequency and intensity of climate hazards will increase, strong impacts on social cohesion and public budgets are expected.

P**olicy readiness is uneven** across sectors. In comparison with many other preparedness policies, flood defence planning is at a more advanced stage, albeit insufficiently so in light of future climate risks. Ecosystems protection in the face of climate change, food security, public health preparedness and financial risk integration are marked by critical policy shortfalls that leave them ill-equipped for escalating climate pressures. **Fragmented governance and uneven implementation, temporal misalignments due to short-term political and budgetary cycles, financial constraints and gaps in monitoring hinder effective action**. The inherently cross-sectoral and systemic nature of the risks makes the current, often isolated, risk management frameworks, structures and processes **insufficiently suitable for the future.**

Vulnerability is not evenly distributed: elderly people, children, urban populations, people with disabilities, migrants, healthcare and outdoor workers and those in poor housing (among others) are particularly affected.

Low income populations are disproportionately impacted by almost all risks and lack the resources to adapt and recover. For example, poorer neighbourhoods often have less access to green spaces, are more likely to be located in a flood zone, are more densely populated, and have poorer quality housing, exposing inhabitants to multiple climate and environmental hazards, such as heat, floods, pollution, spread of disease etc. Without fairness, adaptation policies risk worsening inequalities, undermining trust in institutions, threatening social cohesion and leaving parts of society exposed.



MAIN INSIGHTS BY CLUSTER

Ecosystems

Forests, soils, freshwater and terrestrial coastal ecosystems are increasingly threatened mainly by drought, heat, wildfires and rising sea levels. Policy readiness is limited, with fragmented governance and incomplete monitoring.

- **More action** is required to address the degradation of freshwater ecosystems and soil deterioration.
- **Precautionary action** is needed to increase the resilience of forest ecosystems.
- **Operationalisation of existing policies** is required for terrestrial coastal ecosystems and sea-level rise challenges.

Sectoral policies must integrate the risks of ecosystem degradation, ensuring that land use and water management reinforce rather than undermine climate resilience. Key steps include building a coordinated adaptation framework across governance levels, scaling up nature-based solutions, and ensuring the full enforcement of ecosystems protection measures with appropriate funding and monitoring. A representative coordinating body and reliable early detection and warning systems for wildfire risks, a robust, data-driven approach (especially regarding salinisation and soil degradation), and consistent, long-term, climate-adapted forest management are concrete examples of critical measures that must be taken.

Food

Belgium's food systems face declining crop yields, pollinator loss, soil degradation, livestock disease and supply-chain disruptions. For example, the 2018 drought reduced potato yields by nearly 30%, showing how climate extremes can disrupt both farmers' livelihoods and food supply chains. While the Common Agricultural Policy and regional initiatives offer partial coverage, adaptation remains fragmented across policies and regions.

- **Urgent action** is required for declining crop yields and soil degradation affecting agriculture.
- **More action** is needed to reduce livestock disease risks.
- **Precautionary action** is advisable for food safety under global shocks and for pollinator decline.

Belgium must better integrate climate resilience into agricultural policy, protect soils and pollinators, anticipate disease outbreaks and diversify supply chains. Without these measures, food insecurity and price volatility could rise, which would hit low-income households the hardest.

Infrastructure and Buildings

Flooding, drought, heat and invasive species threaten Belgium's infrastructure and buildings. Flood defence planning is relatively advanced, yet broader climate-proofing of housing and critical services lags.

- **Urgent action** is required for flooding of buildings and cascading risks to property insurance.
- **More action** is needed to protect energy and transport networks, civil and domestic water infrastructure.
- **Precautionary action** is advisable to tackle the impacts of changing moisture regimes and invasive species on buildings.

Upgrading flood protection, embedding resilience in construction standards, supporting vulnerable households and ensuring continuity of critical services are immediate priorities. Spatial planning should also be carefully considered to address future climate hazards to ensure that urban development and infrastructure are resilient to climate risks. Infrastructure systems must be designed with long-term climate projections to ensure continuity during extreme events.

Human Health and Population Wellbeing

Climate change directly endangers Belgian lives. Deadly heatwaves, new vector-borne and zoonotic diseases, illness due to increasing UV-radiation, air pollution and pollen, deteriorating mental health, and the interaction of risks will intensify pressure on already stretched health systems. For example, in the heat wave of the summer of 2025, nearly two-thirds of heat-related deaths in Europe were directly linked to climate change. Even under the most optimistic scenario Belgium could face over a thousand additional deaths each year due to intensified heat stress. Beyond health, climate shocks risk undermining social cohesion, through internal displacement, unequal burdens and stress on social systems. Preparedness is partial, with patchy surveillance and limited capacity.

- **Urgent action** is required to reduce the risks of heat stress and zoonotic pandemics.
- **More action** is needed for non-communicable diseases and pressures on social cohesion.
- **Precautionary action** is advisable for vector-borne diseases, mental health impacts, health system strain and flood-induced internal displacement.

Belgium must integrate climate resilience into health planning, invest in climate-proofed health infrastructure, expand surveillance of emerging risks and improve early warning, invest in mental health services, and address data gaps. This must be underpinned by an integrated approach enhancing coherence and coordination, alongside long-term adaptation measures such as structural investments in urban greening and targeted support for vulnerable populations. Strategies must also anticipate displacement and strengthen social safety nets. Risks are compounded due to overlapping inequalities such as poverty, poor housing, ill-health, etc. Not addressing the resulting erosion of social cohesion can become a national security risk. Protecting the most vulnerable strengthens resilience for all.

Economy and Finance

An increase in the intensity and frequency of climate-driven disasters, particularly flooding, puts pressure on the Belgian insurance framework. Simultaneously, public finances are expected to be impacted significantly, through multiple complex transmission channels. Even under conservative assumptions, the budgetary impacts are expected to be very significant, already by mid-century.

Belgium is also vulnerable to international climate events affecting its supply chains for strategic essential imports. While worsening climatic conditions worldwide, amplified by financial speculation, are anticipated to drive up the prices of agricultural commodities on international markets. Finally, mismanagement of water supply combined with the rise of temperatures and the increase in the frequency of droughts could affect Belgian industries vulnerable to water stress.

- **Urgent action** is required to reinforce and/or reform the "cat nat" (natural catastrophe) insurance regime.
- **More action** is needed to strengthen the resilience of supply chains for strategic imports, and to address international food price shocks as well as to safeguard public finances.
- **Precautionary action** is advisable for industrial sectors (pharma, chemicals, agri-food and, to a lesser extent, tourism) vulnerable to water stress – both qualitative and quantitative.

Belgium should urgently reinforce the insurance regime for natural disasters and restore trust in the legal insurance framework. It should fund regional solidarity mechanisms appropriately and create a fund to help finance adaptation investments.

To mitigate risks related to its supply chains, Belgium should promote diversification, redundancy and substitution, as well as encourage industry adaptation and circular options for critical materials. To alleviate water-related pressure on vulnerable industries, it should incentivise circular water systems, (reclaimed water use, greywater systems, rainwater harvesting, industrial process optimisation,...).

CASCADING IMPACTS FOR BELGIUM

These risks do not occur in isolation. A drought can weaken freshwater ecosystems, reduce agricultural output, raise food prices, damage soils and increase fiscal stress. A heatwave can cause direct loss of life, strain hospitals, raise energy demand and intensify inequality. Cascading risks mean **resilience in one sector depends on resilience in others.**

Failure to act will **multiply reconstruction and healthcare costs, erode natural resources and deepen social divides.** Proactive adaptation offers multiple dividends: healthier ecosystems, food security, safer infrastructure, more equitable societies and stronger fiscal stability. Above all, it **strengthens national security** by reducing the likelihood of cascading failures that threaten financial stability and undermine social cohesion and public trust.

PRIORITY RECOMMENDATIONS:

- **Consider climate and environmental resilience a matter of national security.**
- **Ensure resilience is just**, leaving no one behind and strengthening social cohesion.
- **Adapt the national security architecture** to integrate and prepare for climate and ecosystem degradation risks.
- **Fully fund and enforce adaptation strategies** across federal and regional levels.
- **Mainstream strengthening resilience** into all economic, social, spatial and infrastructure policies.
- Make **ex-ante climate impact assessments mandatory** for all major public decisions, by establishing a framework that ensures **qualitative and meaningful evaluations**.
- **Strengthen** vertical and horizontal **coordination** across governance levels and sectoral authorities.
- **Scale up nature-based solutions and ecosystem restoration**, embedding them systematically in planning, investment and regulation.
- **Restore trust in the natural catastrophe insurance framework** by funding appropriately regional solidarity mechanisms, creating a fund dedicated to adaptation investments and reaffirming commitment to the legal framework.
- **Close monitoring and knowledge gaps**, with predictive models and early warning systems guiding prevention, preparedness and long-term planning.

Belgium is entering a **decisive decade for climate resilience**. The risks are **urgent, interconnected and already visible.** Addressing them demands **integrated governance, sustained investment and a commitment to just adaptation**. Recognising that climate resilience strengthens national security will help ensure it is prioritised at the highest level.

Acting now will protect lives, safeguard ecosystems, strengthen the economy and preserve social cohesion. Waiting will amplify costs, vulnerabilities and threats to stability. A resilient Belgium is achievable but it requires **decisive, coordinated and fair action without delay**.

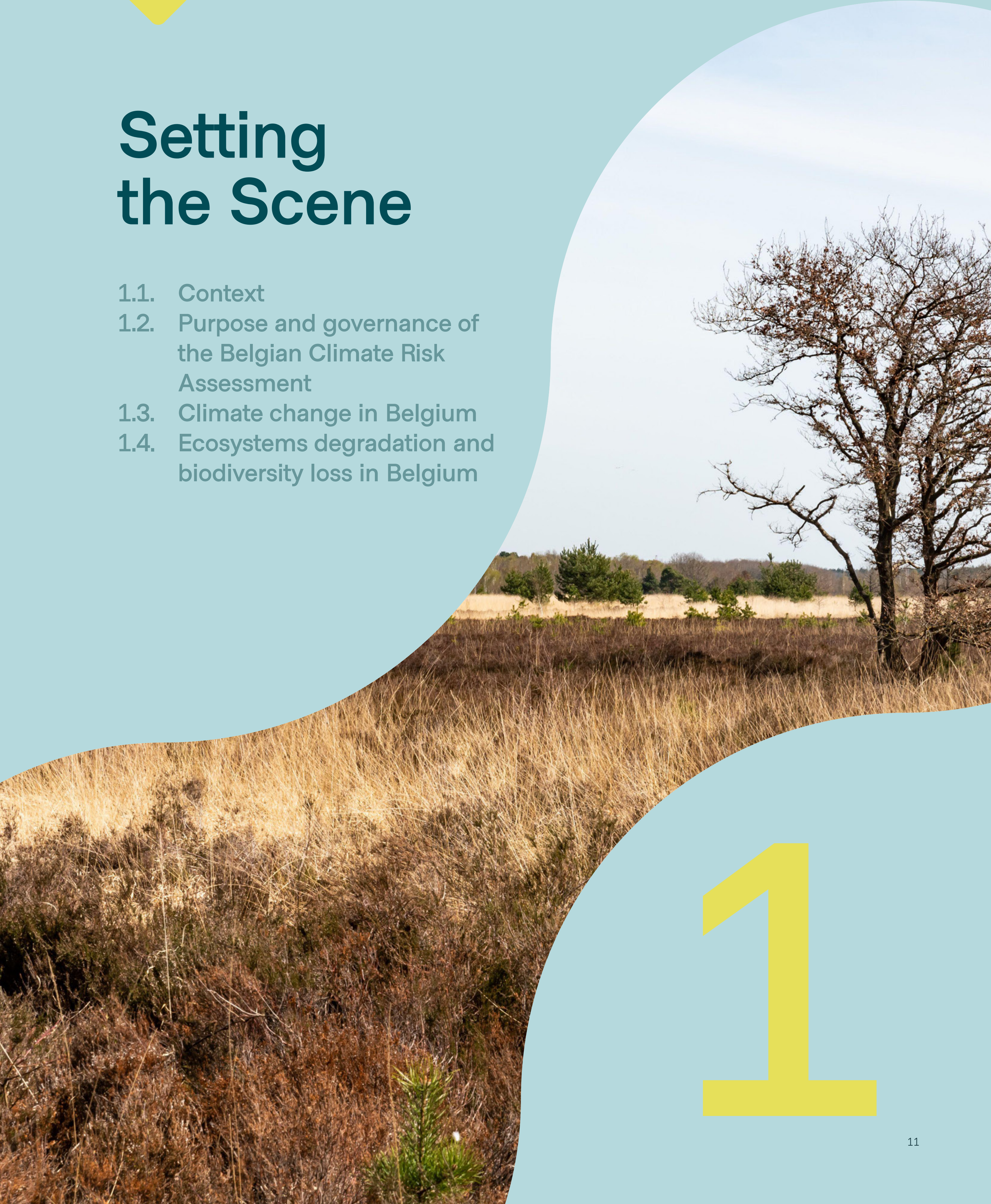
FUTURE STEPS

This **BCRA** represents a critical first step in a broader, iterative process aimed at strengthening Belgium's adaptation and security policies. One of its overarching objectives will be to inform future strategies, including the upcoming revision of the **National Adaptation Strategy** and the **National Security Strategy,** ensuring that Belgium is prepared to withstand future shocks while safeguarding vulnerable populations.

In line with its mandate, Cerac will continue to actively support the next steps by providing expertise, analysis and strategic recommendations to sectoral actors. As a living document, the BCRA will evolve over time, incorporating new data, insights and stakeholder feedback. It will continue to guide Cerac's future work, helping to refine risk assessments, identify emerging threats and support the design of targeted, evidence-based policy responses.

Following this BCRA, Cerac will maintain its engagement with the main security actors. Through this collaboration, Cerac will **identify further knowledge gaps, take initiatives to deepen our understanding of what is needed, and support policy proposals to reinforce our resilience**. Risk assessment can only have an impact if it is part of a **full risk cycle**. Through this continued work with the security stakeholders, the next phases of this cycle will now have to be completed.

Setting the Scene



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1 Setting the scene

1.1. Context

Climate change and environmental degradation are no longer distant threats, they are unfolding right now, with increasing intensity and local consequences.

In 2024, the world recorded its **hottest year to date**, with record-breaking heatwaves across Europe, including temperatures above 45°C in parts of southern Europe (C3S & WMO, 2025). Belgium was no exception – **2025 has already seen the driest spring in over 130 years** (RMI, 2025a). Belgium has just experienced the second hottest June on record, after 2023 (RMI, 2025a). These extreme warm and dry conditions increase the risk of **water scarcity, crop failure** and **wildfires**, putting additional stress on ecosystems. Public health is also already under threat; 2300 inhabitants of twelve major European cities died due to the late-June heatwave, of which two-thirds are attributable to climate change (Clarke et al., 2025).

At the same time, Belgium is also increasingly exposed to **severe flooding events**, as illustrated by the **devastating floods of July 2021**, which caused extensive damage, claimed 39 lives and underscored the **urgent need for adaptation and preparedness**. These contrasting extremes – from droughts to floods – highlight the **multi-hazard nature** of the climate crisis.

Increasingly, climate change is acknowledged as a fundamental and existential risk to our resilience and societies. The Belgian National security strategy of 2021 states that climate change "*threatens our societal model and, moreover, has a multiplier effect on other phenomena such as poverty, conflict and migration, with increasing pressure on states (not least the EU's southern neighbours) and the multilateral system.*" At EU level, in its EU Preparedness Union Strategy, the Commission emphasises the interlinkage between climate, environment and security and will propose a Climate Adaptation Plan to strengthen and safeguard the resilience of the Union. At Nato level a Climate Change and Security Action Plan has been adopted, establishing a framework for increasing awareness and developing adaptation and mitigation measures to address security impacts like extreme weather, military operational disruptions and geopolitical risks from resource competition.

Climate change is not an isolated challenge but is intertwined with **ecosystems degradation**, which mutually reinforce each other. Ecosystems degradation is driven not just by climate change but also by changes in land and sea use, direct exploitation of organisms, pollution and invasion of alien species (INBO, 2020; IPBES, 2019) – ultimately leading to **biodiversity loss**. Globally, one million species are at risk of extinction and Europe is experiencing severe declines in pollinators, farmland birds and amphibians (EEA, 2023; IPBES, 2019). In Belgium, 30% of species are currently threatened (Goudeseune et al., 2025) and 38 out of 44 Flemish habitats of the European habitats directive were in a very poor condition in 2020 (INBO, 2020).

The erosion of natural capital undermines ecosystem services that determine our resilience against global changes. For instance, **ecosystems ameliorate climate change impacts** by storing water, buffering heat extremes and reducing the magnitude of floods. Addressing risks linked to ecosystems degradation thereby acknowledges these interlinkages and responds in part to the need for a systemic approach to climate risk assessment.

For Belgium to be able to take, in the most efficient way possible, the necessary policy steps to ensure the continued resilience of our country and society in a climate-changed future, we first need to have a good understanding of that likely future. It is with this objective that Cerac carried out the first Belgian climate risk assessment.

1.2. Purpose and governance of the Belgian Climate Risk Assessment

Cerac's mission is to help build a more resilient Belgium by preparing the country to adapt to climate change and ecosystems degradation while addressing the associated risks. This approach ensures the protection of Belgian citizens, territory and society from potentially severe and irreversible consequences. Through this report, Cerac aims to provide assessments of the most significant risks for Belgium due to climate change and ecosystems degradation and to make recommendations on how to prepare for and adapt to them.

Cerac's role is to serve as a trusted and impartial advisor to the National Security Council, policymakers and Belgian citizens. By contributing to effective risk prevention strategies and adaptation policies, Cerac helps to enhance the safety, security and wellbeing of Belgian society.

The **Belgian Climate Risk Assessment (BCRA)** aims to assess the risks that Belgium faces due to climate change and ecosystems degradation. It also evaluates the potential impacts of these risks on key sectors and systems, such as food systems, energy and transport infrastructure, public health and natural ecosystems, while considering broader socio-economic implications.

The assessment builds upon existing initiatives, particularly the European Climate Risk Assessment (EUCRA). The BCRA identifies and prioritises risks that Belgium faces under different scenarios, thereby representing a major milestone in Cerac's work programme and defining future project avenues. The specific objectives were:

- Analysing and prioritising risks associated with climate change and ecosystems degradation in Belgium.
- Identifying knowledge gaps related to these risks and their components.
- Providing recommendations to the National Security Council and other policy makers.
- Offering guidelines for future Cerac risk assessments.

Cerac and the consortium selected the most relevant risks related to climate change and ecosystems degradation. Considering the specific Belgian context, this yielded a total of 28 risks across five key clusters – ecosystems, food, infrastructure, health and economy. Out of these, 23 risks relate to climate change and five relate to ecosystems degradation resulting in reduced ecosystem services. The BCRA acknowledges the interlinkages and urgency of both the climate and biodiversity crises. Yet, a lower number of ecosystems degradation-related risks were analysed due to the relatively limited literature available in a Belgian context and the prioritised need for a complete climate risk assessment.

It should be noted that this BCRA represents only a first step in the process of guiding and strengthening Belgium's adaptation and resilience policies and measures in response to climate change and biodiversity loss. The assessment is designed to raise awareness and deepen understanding of emerging and intensifying risks, support policy decisions on adaptation priorities and to provide recommendations for the strategic direction of adaptation efforts. This report serves as a foundation for further reflection and decision-making. It must be followed by the development of coherent, concrete, realistic and effective measures – both within individual sectors and across transversal domains. These measures must be supported by the necessary political decisions, financial frameworks and monitoring tools.

In line with its mandate, Cerac will ensure the follow-up of this initial risk assessment by providing expertise and analysis and will continue working with various stakeholders to refine and translate them into actionable steps.

1.3. Climate change in Belgium

GLOBAL CLIMATE CHANGE

Today, atmospheric CO2 concentrations stand at nearly 422 ppm (C3S, 2025), a 50% increase compared to the pre-industrial value of 280 ppm. As a result, the observed global 30-year average temperature exceeds that of the pre-industrial period (1850-1900) by 1.4°C (C3S, n.d.-a). At the current rate of warming, it is expected that the 1.5°C limit established under the Paris agreement will be reached before the end of the decade (Figure 1). The Intergovernmental Panel on Climate Change (IPCC) projects global temperature trends for a range of climate scenarios (Figure 1), the so-called *Shared Socio-economic Pathway* (SSP) scenarios (IPCC, 2021; Riahi et al., 2017). Even under the most optimistic scenario (SSP1-2.6), global temperatures are set to rise during the next decades.

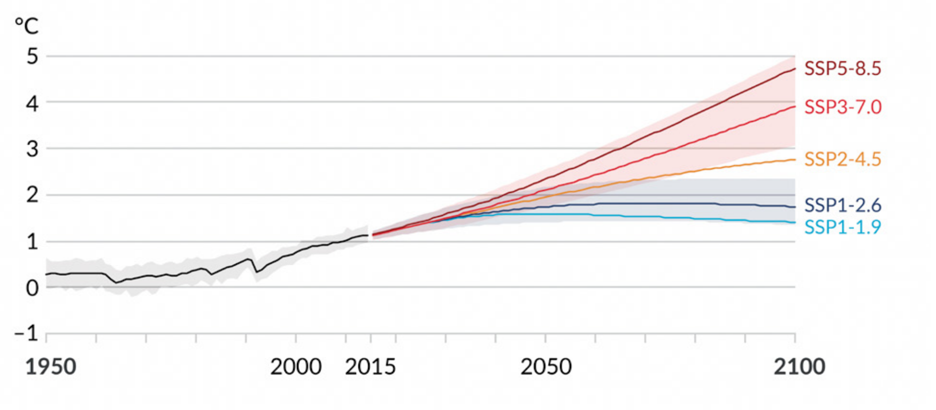


Figure 1. Global surface air temperature change relative to 1850-1900. Source: IPCC (2021).

According to UNEP (2023), "*Fully implementing and continuing mitigation efforts of unconditional nationally determined contributions (NDCs) made under the Paris Agreement for 2030 would put the world on course for limiting temperature rise to 2.9°C this century*". This could be considered the most likely scenario at the moment and corresponds to a global warming level that would be reached under the SSP2-4.5 scenario by 2100 ("Middle of the Road" scenario; orange line in Figure 1). Limiting global warming to 2°C with a high (80%) probability will only be possible by reaching conditional objectives of Nationally Determined Contributions (NDCs) and net-zero engagements.

PRESENT-DAY CLIMATE TRENDS FOR BELGIUM

The *Climate Atlas* developed by the Royal Meteorological Institute of Belgium (RMI, n.d.) maps the geographical distribution of climate norms for the baseline period 1991-2020. Even though Belgium is a small country, the spatial variations in temperature and precipitation are substantial (Figure 2). The number of tropical days (i.e., maximum air temperature exceeding 30°C) shows a distinct pattern with lower values near the coast and on the Ardennes plateau and the highest values over the sandy soil areas of the northeast Campine region. Concerning precipitation, the wettest areas received about twice the rainfall of the driest regions.

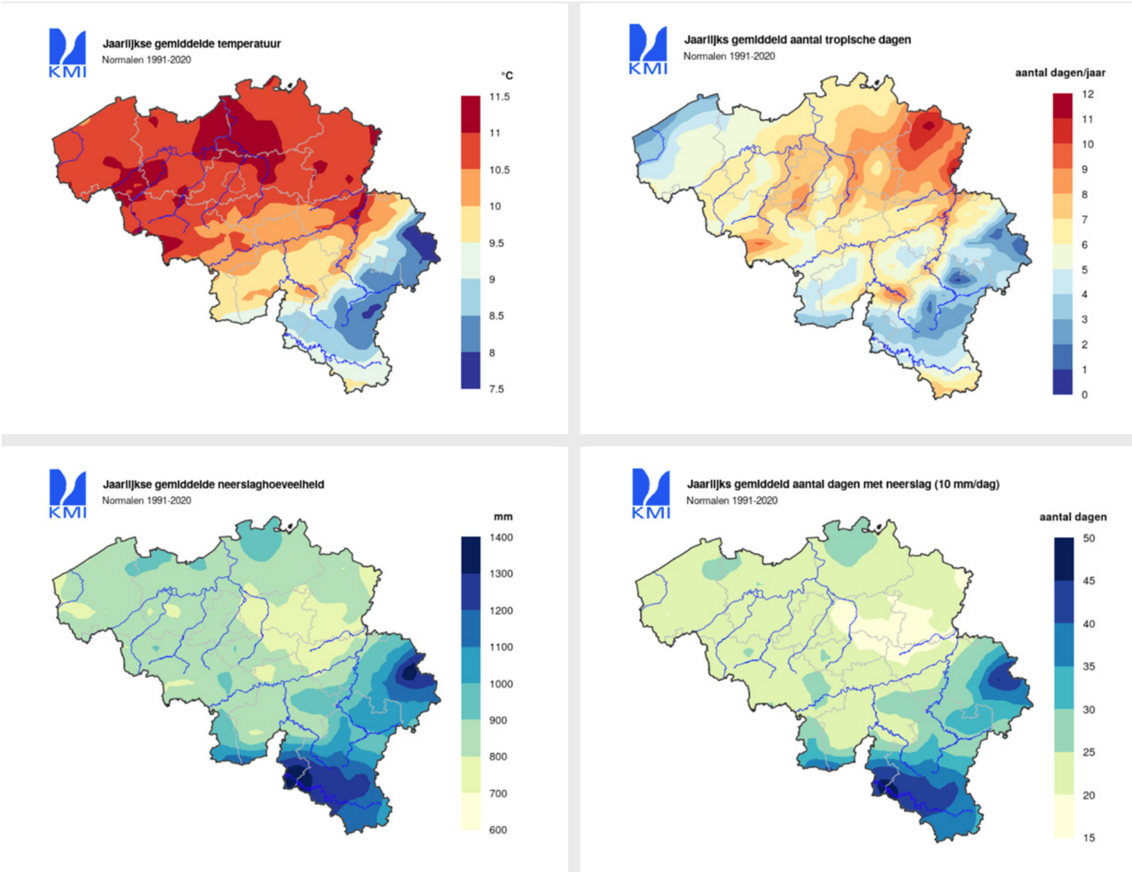


Figure 2. Climate norms for Belgium, for 1991-2020. The upper panels show the annual average temperature (left) and number of tropical days (max. temperature exceeding 30°C, right). The lower panels show annual mean precipitation (left) and number of days with precipitation in excess of 10 mm (right). Source: RMI (n.d.)

Observations conducted since the 19th century show that surface air temperature in Belgium (as a whole) has increased by nearly 1.5°C within the period 1991-2020 relative to 1850-1900. In 2020, the temperature anomaly almost reached 2.2°C, illustrating the increasingly rapid pace at which climate change has been progressing in recent decades (Berkeley Earth, n.d.). The observed warming at the Belgian scale reflects patterns at the European scale, which also reached 2.2°C based on the five-year period 2019-2023, relative to 1850-1900 (C3S/ECMWF, n.d.). This emphasises the difference between global and local warming; although we are yet to reach 1.5°C of global warming, this threshold can be crossed substantially locally – with Europe warming twice as fast as other continents over the past 30 years (WMO, 2022).

In Belgium, global warming has already affected multiple climate parameters according to observations by the RMI (RMI, 2020):

- **Temperature**-related parameters have changed most prominently. Based on data from Uccle, the annual number of summer days (daily maximum temperature T_{max} exceeding 25°C) has been increasing steadily since the 1980s, from around 20 to more than 30 per year. Data available within the Copernicus C3S Atlas (C3S, n.d.-b) yields a similar picture for the number of very hot days (temperature exceeding 35°C). In recent decades, the annual maximum temperature has significantly increased, by 0.85°C per decade, culminating in a record value of nearly 40°C on July 25th of 2019 in Uccle. Nighttime temperatures also significantly increased, with the number of warm nights (minimum temperature T_{min} above 15°C) having doubled since the 1970s. The frequency and duration of **heatwaves**, defined as a period of at least five days with $T_{max} > 25$°C, of which at least three days with $T_{max} > 30$°C, has risen significantly since the early 1980s. Except for 2021, each year within the period 2015-2024 has experienced at least one heatwave. Heatwave intensity, which is a combination of heatwave duration and temperature levels, has increased four-fold since the 1970s.

- **Precipitation** trends observed over Belgium do not allow us to confirm a clear increase or decrease. This is partly due to the fact that annual mean precipitation values show strong inter-annual fluctuations. Still, precipitation time series show a possible long-term trend with a 10% increase between the pre-industrial period (1850-1900) and the present. **Precipitation extremes** exhibit a more pronounced trend. In the past 30 years, the number of days with precipitation exceeding 20 mm has more than doubled. In the same vein, the IPCC (2021) states that "in Europe, there is robust evidence that the magnitude and intensity of extreme precipitation has very likely increased since the 1950s".

- With regard to **drought**, the number of days per year with less than 1 mm of precipitation does not show a clear trend, except in spring, where an increase in dry days has been observed in recent decades. However, when accounting for evaporation, a clearer picture emerges. In E-OBS data contained in the C3S Atlas, the SPEI-6 indicator, which reflects the balance between accumulated precipitation and potential evapotranspiration, shows a clear downward trend in recent decades compared to the long-term historical distribution. The risk of drought has been increasing and this will continue in the future with longer and more intense droughts like those we have experienced in 2022 and 2025.

PROJECTED FUTURE CLIMATE CHANGE

Based on data from the European Copernicus C3S Atlas (C3S, n.d.-b) and the Royal Meteorological Institute (RMI, 2025b), a good picture of the Belgian climate future can be drawn. Compared to the pre-industrial baseline (1850-1900), scenario SSP2-4.5 projects a (median) **temperature** increase in Belgium of 2.2°C in winter and 2.7°C in summer by mid-century (2041-2060) and 2.9°C (winter) and 3.7°C (summer) by the end of the century (2081-2100). Under scenario SSP3-7.0 (SSP5-8.5) and for the period 2081-2100, summer temperatures are predicted to increase by 5.3°C (6.9°C) relative to pre-industrial values.

These temperature changes have a strong impact on temperature extremes. In SSP2-4.5, the annual number of tropical days (i.e., days with $T_{max} > 30°C$) is projected to increase by five days by the middle of the century, on top of the current 1-12 days per year depending on the location within Belgium (Figure 2). Conversely, the number of **ice days** ($T_{max} < 0°C$) will drop by a factor of two, to around 2.5 days per year, compared to the 1991-2020 baseline.

Precipitation predictions suggest a slight increase in winter and a somewhat larger decrease during summer. In SSP2-4.5, the changes are of the order of 10% by 2050. Changes in **precipitation extremes** are more significant. Return periods for extreme 5-day accumulated precipitation levels are projected to decrease considerably (meaning more frequent events). For example, a 5-year event, which corresponds to 76 mm of precipitation during the baseline period (1985-2014), is projected to occur every 3.5 years by mid-century across climate scenarios. Likewise, an event accumulating 105 mm of precipitation over a 5-day period, currently occurring every 50 years, will likely occur once every 30 years. IPCC (2021) states that *"extreme precipitation and pluvial flooding are projected to increase at global warming levels exceeding 1.5°C in all* [European] *regions except the Mediterranean (high confidence)"*.

Drought, expressed here as the moisture content of the upper soil layers, is projected to intensify during summer, especially in July and August, whereas the winter will remain relatively unchanged. As a result of projected wetter winters and drier summers, seasonal fluctuations in soil moisture are expected to intensify.

Put concisely, the climate in Belgium is expected to be characterised by:
- a strong winter warming trend;
- a very strong summer warming trend;
- greater temperature extremes;
- wetter winters and dryer summers;
- increased precipitation extremes;
- overall increase in summer droughts, both in frequency and intensity;
- larger seasonal variation in soil moisture.

1.4. Ecosystems degradation and biodiversity loss in Belgium

Biodiversity, or biological diversity, is defined by the **Convention on Biological Diversity** (CBD) as "the variability among living organisms from all sources, including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems" (CBD, 1992).

As such, **biodiversity levels can be seen as an indicator for the state of our ecosystems.** The drivers of species diversity declines are, in decreasing order of importance: changes in land and sea use, direct exploitation of organisms, climate change, pollution and invasion of alien species (IPBES, 2019). It is important that **both these drivers and the resulting biodiversity loss itself represent risks.** For instance, the emergence of zoonotic diseases is primarily attributable to habitat fragmentation, urban encroachment and overall ecosystems degradation, since these increase the probability of contact between humans and animals able to transmit zoonoses. Biodiversity loss itself plays a smaller role (see technical paper "Risk to human health due to the increase of pandemic zoonotic diseases"). Sometimes, however, biodiversity plays a more direct role; the loss of pollinator biodiversity is a threat for food security (technical paper "Risk to food production due to pollinator decline"). In this assessment, we therefore use ecosystems degradation as the fundamental phenomenon, acknowledging cascading links to biodiversity loss.

Key Belgian ecosystems include:

- Marine and coastal ecosystems. The Belgian marine ecosystems are part of the North Sea. They encompass nearly 3,500 km^2, which amounts to 0.5% of the entire North Sea. The term "coastal" can refer to the land that is strongly influenced by sea-based processes (e.g., as in "coastal communities") or to the part of the marine environment that is strongly influenced by land-based processes. Thus, coastal seas are generally shallow and near-shore (Glossary IPCC AR6).
- Freshwater habitats. Lakes, rivers and wetland ecosystems. Saline Belgian wetlands, such as the Zwin tidal marsh, are covered under the coastal system and therefore not included under this ecosystem.
- Forests, including ancient beech in the Sonian Forest and upland bogs in the High Fens Forests.
- Open natural habitats – heaths, moors, meadows and grasslands.
- Agroecosystems – cultivated ecosystems where agriculture is the central focus.
- Urban ecosystems, which encompass cities' green and blue infrastructures, including how their living organisms interact with the built environment.

Natura 2000 protected areas cover ~12-13% of Belgian terrestrial and marine areas.

The "biodiversity information system for Europe" (BISE) Belgian country fiche (BISE, n.d.) shows that both in terms of coverage of (i) terrestrial territory (Figure 3, left) and (ii) protected areas network (Figure 3, right), forests, agroecosystems and urban ecosystems are Belgium's most common terrestrial ecosystems. Freshwater comes fourth with ~1% of territorial coverage and ~4% of protected areas.

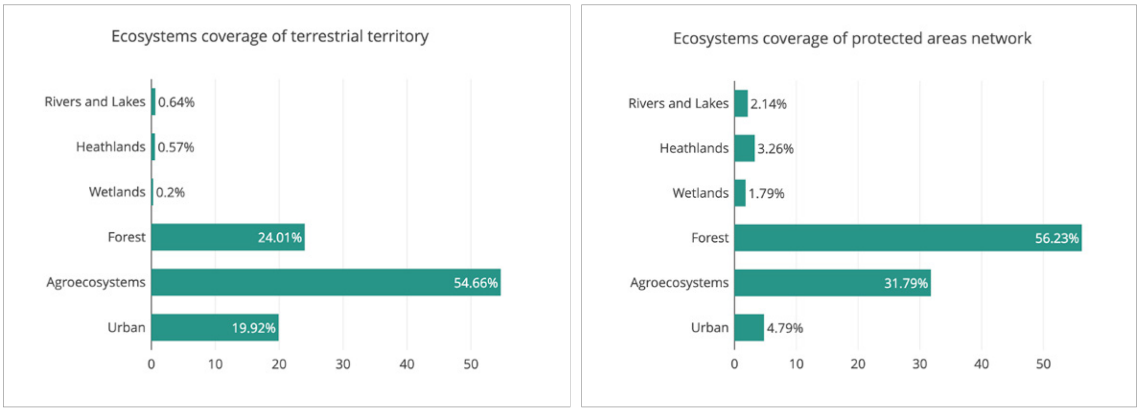


Figure 3. Belgian ecosystems coverage. Source: BISE (n.d.).

The current national biodiversity loss trend was last analysed in detail in the Living Planet – Belgium Report (WWF, 2020). This report pointed out that the main critical declines are observed:

- in forests, where populations of all species declined by an average of around 27% between 1990 and 2018, driven by interacting disturbances like pests, diseases, droughts and nutrient imbalances.
- in agroecosystems, where bird populations fell by 61% in the same period. Key drivers are landscape simplification, eutrophication and the excessive use of pesticides.

The European Biodiversity Information System also reports on habitats' conservation status (Figure 4). Overall, the conservation status of Belgium's continental habitats is rather poor with 79.6% of habitat assessments indicating bad conservation status (see Figure 5).

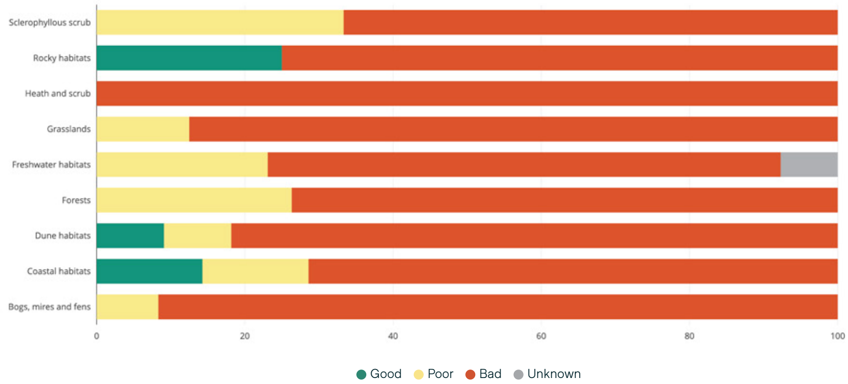


Figure 4. Percentage of conservation status of habitats groups in Belgium.
Habitats are part of, or overlap with, ecosystems identified earlier in the text.

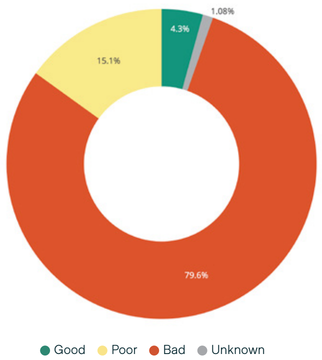


Figure 5. Conservation status of Belgium's habitats under the EU Habitats Directive.
Source: European Biodiversity Information System with datasets from Article 17,
Habitats Directive 92/43/EEC reporting, EEA

Concerning future trends, the regional IPBES report for Europe and Central Asia (IPBES, 2018) raised strong concerns about the overall loss of biodiversity in western Europe (Figure 6). Forest products (lumber and constructions, wood pulp and paper, fuelwood) are specifically identified as one of the main declining ecosystem services in our Atlantic region.

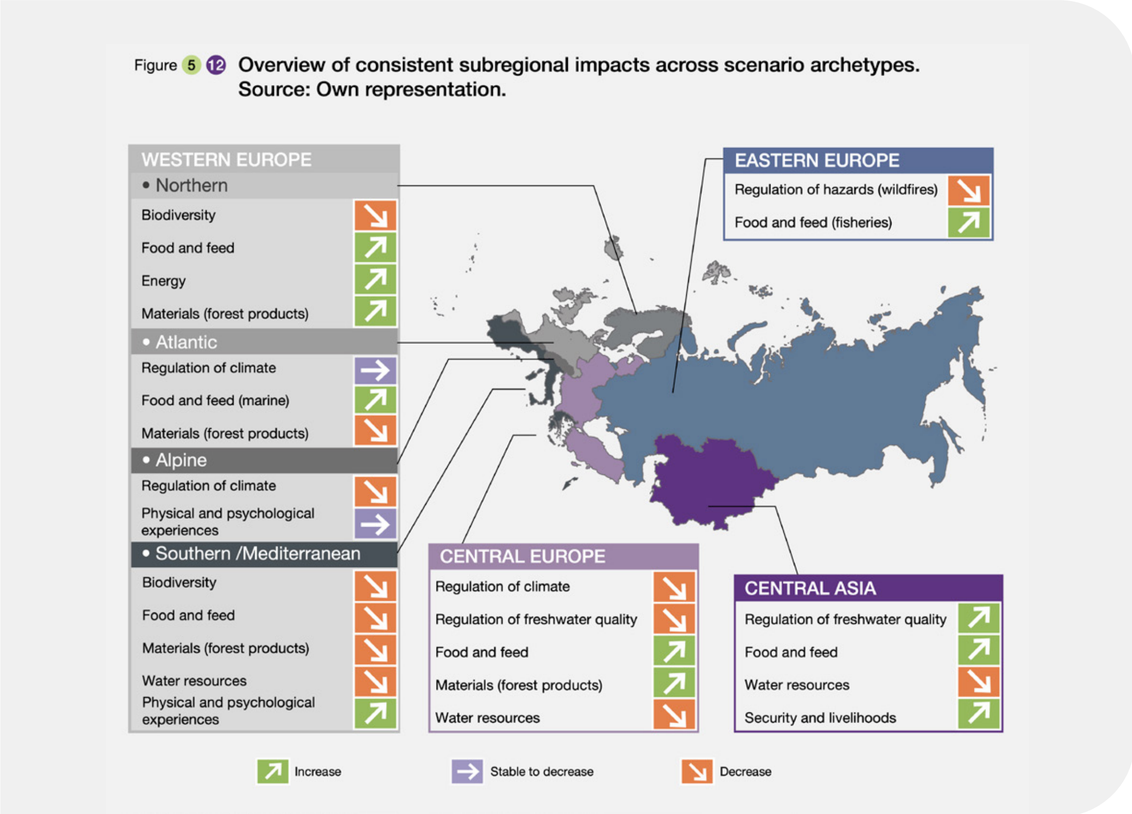
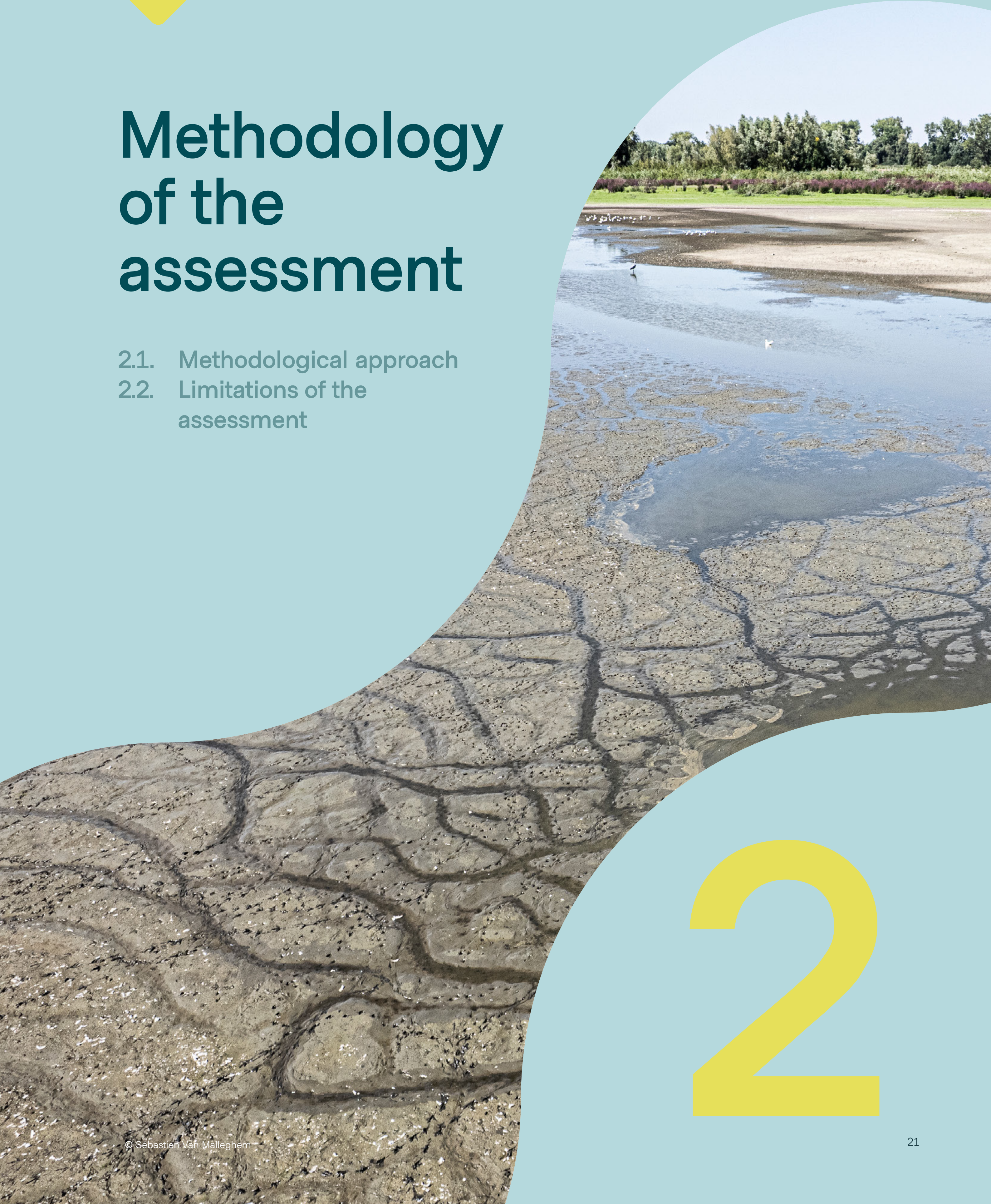


Figure 6. Trends in impact on ecosystem services (source: IPBES)

All economic activities both impact and rely on biodiversity to various extents. In recognition of this fact, central banks and economic institutions (e.g. the OECD, the Dutch Central Bank, the US National Bureau of Economic Research) are investigating the relationships between biodiversity decline and risks to corporate and financial institutions, how this will impact financial performance and, ultimately, financial and price stability (Giglio et al., 2021, p. 202; OECD, 2023; Salin et al., 2021; van Toor et al., 2020).

Given Cerac's society-centric focus concerning risk assessments, we adhere to the concept of **ecosystem services** (see the following chapter Methodology of the assessment), which is also adopted by IPBES and the financial sector.

Methodology of the assessment



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2 Methodology of the assessment

2.1. Methodological approach

Unique to the **Belgian Climate Risk Assessment (BCRA)** is the consideration of risks derived, directly and indirectly, from exposure to hazards related to both climate and ecosystems degradation. This dual focus acknowledges the interrelatedness of the crises in climate and biodiversity, reflecting a growing global effort to bridge these two scientific domains (Pörtner et al., 2021). This was done by applying a unified methodological framework that nonetheless considers approaches and concepts that are specific to the respective scientific domains – paying particular attention to the specific disciplinary definitions of "hazards" and "scenarios".

The BCRA methodology followed three sequential steps of analysis (risk identification, risk analysis and risk prioritisation) and a fourth step of consultation, respecting standard risk assessment practices (ISO, 2021).

28 risks were thoroughly analysed for severity based on scientific literature, while the policy readiness was assessed through desk research. These findings were then reviewed, supplemented and validated through stakeholder consultations that included interviews, workshops and a Delphi survey conducted for each cluster.

This multi-step process resulted in a risk-by-risk estimation of the risk severity, the confidence evaluation and the policy readiness – together ultimately defining the risk urgency score. Particular attention was paid to highlighting sectoral and social vulnerabilities. Quantitative and qualitative data from reputable sources is provided whenever possible. The prioritisation of risks was further discussed with various stakeholders, including security actors. The present report highlights the most severe threats to Belgian society and provides tailored recommendations to offer actionable insights to policymakers.

Methodological elements that are essential for the correct interpretation of this report are summarised here. For more details and the rationale underlying methodological choices, please refer to the complete methodological report (Cerac, 2025).

2.1.1. Step 1: risk identification

2.1.1.1. Concept of risk

The BCRA uses the IPCC definition of the risk as "qualitative and/or quantitative scientific estimation of potential for adverse consequences for human or ecological systems", together with the conceptual framework representing the risk as resulting from interactions between hazards, exposure and vulnerability for specific systems, grouped into clusters:

CLUSTER

Following the approach of EUCRA (EEA, 2024b), **clusters** group **systems and sectors with similar characteristics**. This pragmatic approach acknowledges that these groups are not necessarily comprehensive; a selection of systems was made based on the relevance for Belgium and data availability.

SYSTEM

In risk assessment, a **system** is described as "**a set of interrelated or interacting elements**" (ISO, 2021). Systems are not static entities that exist independently; rather, they represent dynamic networks of **relationships** (Dison, 2016).

HAZARDS

A hazard refers to a potential source of harm.
Hazards induced by **climate change** include slow-onset and chronic changes (e.g. long-term temperature increases), rapid or acute climatic extremes (e.g. heatwaves) and increased variability (e.g. change in rain patterns). Twenty-four climate hazards have been identified as relevant in Belgium in this report.

Hazards induced by **ecosystems degradation** have been defined as the erosion or shortage of **ecosystem services**. Thirty-six ecosystem services have been considered relevant for Belgium.
The complete list of climate hazards and ecosystem services can be found in the annexes of the methodological report (Cerac, 2025).

EXPOSURE

Exposure refers to what is at risk: people, species, ecosystems or assets in areas susceptible to hazards. In the BCRA the possible elements exposed to hazards have been grouped into 5 clusters and their constituting systems:

- Ecosystems
- Food
- Infrastructure and buildings
- Human health and population wellbeing
- Economy

VULNERABILITY

Vulnerability is a system's susceptibility to harm, influenced by **sensitivity** (the degree to which a system is affected positively or negatively by a hazard) and **adaptive capacity** (ability to adjust to the new situation when a hazard occurs, depending on technical, policy, financial, social and ecological factors).

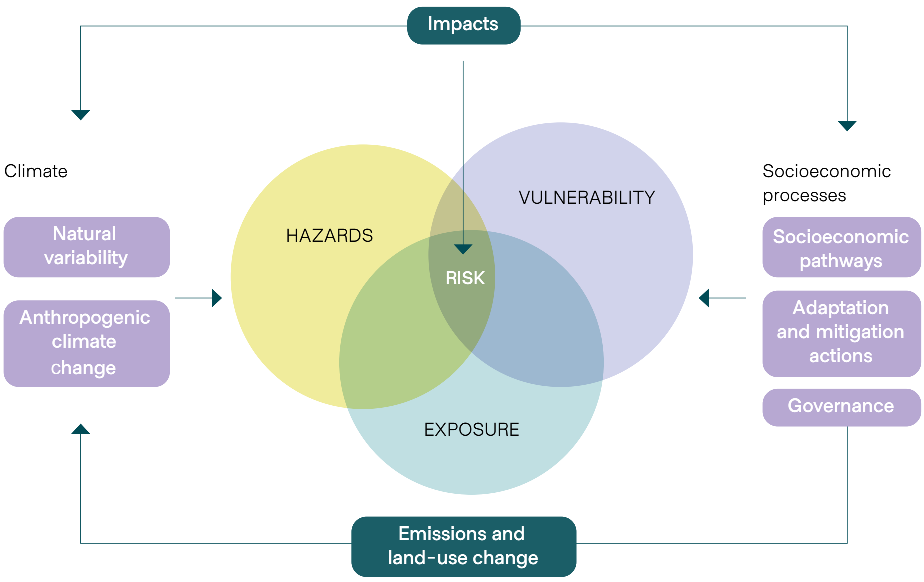


Figure 7. Illustration of the core concept of risk (after IPCC, 2014)

2.1.1.2. Evolution scenarios

Projections of **climate hazards** and impacts are usually based on scenarios (e.g. SSP scenarios of the IPCC) and time horizons (commonly 2050 and 2100). To leverage information from sources using different scenarios and time horizons, the BCRA adopted the IPCC's alternative methodology of **"global warming levels" (GWL)**.

Thinking in terms of GWL circumvents a main limitation associated with scenarios – different scenarios can lead to the same result, i.e. the same level of warming (Lepousez et al., 2022). This approach acknowledges that the impacts of climate change are more directly related to the specific level of global warming that is reached than they are to emission pathways as such. The BCRA adopts three GWL benchmarks: +2°C, +3°C and +4°C above the pre-industrial reference period of 1850-1900 (IPCC, 2021). Climate risk severity and urgency are each assessed as functions of all three GWLs.

Analogous to the IPBES's scenarios (IPBES, 2019), **ecosystems degradation** impacts were estimated according to future projections. Note that BCRA scenarios are not exhaustive in their consideration of possible drivers of biodiversity decline (land use, pollution, overexploitation, invasive species, climate change) meaning that impacts are likely to be underestimated. Additionally, analogous to the IPBES approach and because of data gaps, risks were not subdivided in different scenarios following the degree of ecosystems degradation and biodiversity loss. The BCRA provides three scenarios for climate risks and one scenario for ecosystems degradation risks.

2.1.1.3. Risk selection

A pre-identification and final selection of the potential most important risks was done as follows (Figure 8):

- The 24 identified climate hazards and 36 ecosystem services were crossed with the 5 clusters and their constituting systems. This resulted in, respectively, 456 and 504 potential climate and ecosystems degradation risks.
- For each risk, a keyword-based scientific literature search was conducted. The first 30 results were then screened and evaluated for relevance.
- A final selection was made based on scientific and expert advice, literature availability and other criteria to ensure representativeness and balance within the cluster. It was validated by cluster lead experts (Cerac and the Consortium) and the steering committee.

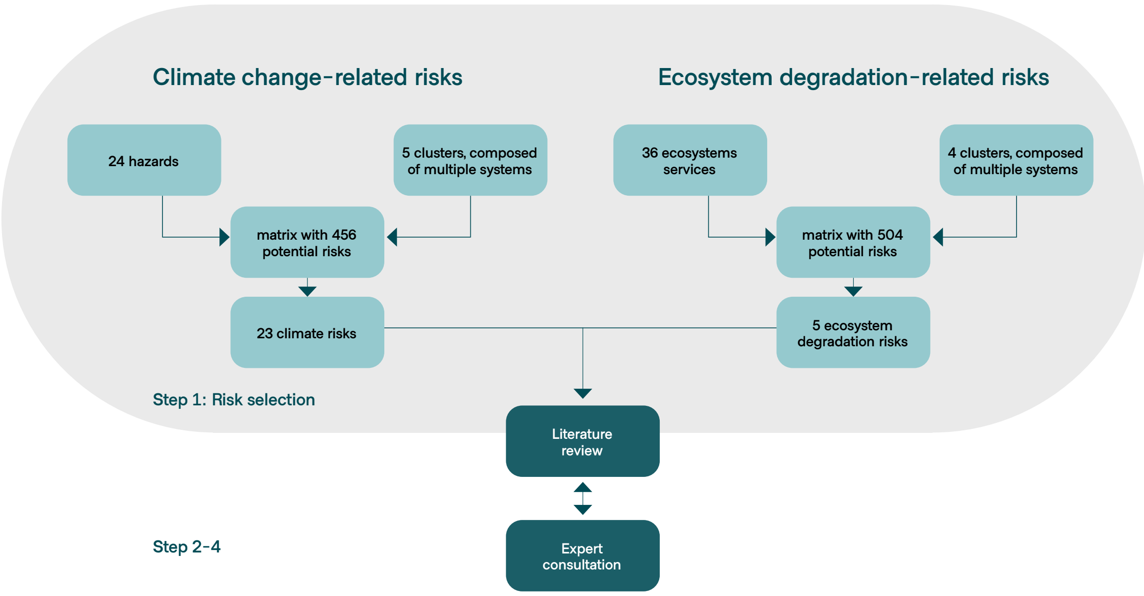


Figure 8. Risk pre-selection process

2.1.2. Step 2: risk analysis

The risk analysis integrates multiple elements needed to fully appreciate the mechanisms, severity, certainty and policy readiness underpinning the risk. Based on these elements, an urgency scoring was attributed to the risk (see 3.1.3 Step 3: Risk Urgency Score). This risk analysis is based on literature screened in the previous step, including scientific publications and reports from recognised institutions such as the IPCC, WHO and StatBel and supplemented by additional literature review where needed, as well as by feedback from experts collected during the expert consultation process.

The risk analysis generated 28 technical papers of about 15 to 35 pages each that can be individually consulted on www.cerac.be. Technical papers always follow the same structure:

1. The **risk description** elaborates on the processes that define the risk and generally provides a snapshot of the current situation based on qualitative and/or quantitative information.
2. **Risk severity**, one of the crucial dimensions determining risk urgency, is based on qualitative and quantitative thresholds summarised in Table 1. Thresholds and definitions are based on the EUCRA (EEA, 2024) and the UK's Climate Change Risk Assessment (CCRA3, 2021) and scaled for Belgium. Quantitative data was not always available or reliable for each risk or for each scenario considered in this report. Since a risk is not less severe because exact figures are unavailable, no priority was given to either qualitative or quantitative data. The absence or availability of reliable data is reflected in the confidence level. Climate-related risk severity was assessed for the three GWLs, whereas risks related to ecosystems degradation only include one scenario and therefore one severity grading.

Table 1. Risk severity scale

Risk severity	Description	Impact on people	Economic damage	Other impact categories
Catastrophic	Very large and frequent damage, very large extent or very high pervasiveness, irreversible loss of system functionality, systemic risk.	Hundreds of deaths, >500 injured, >5,000 health impacts or >150,000 people affected	>€500 million damage (economic) or foregone opportunities	Land lost or severely damaged; Major or irreversible impact on valued habitat or landscape types; Major or irreversible impacts on or loss of species groups; Major or irreversible impact on an individual natural resource asset and associated goods and services; Destruction or irreversible damage to iconic heritage assets.
Critical	Large and frequent damage, large extent and high pervasiveness, long-term disturbance of system functionality, cascading effects beyond system boundaries.	50-100 deaths or 250-500 injured, 2500-5000 health impacts or 100,000-150,000 people affected	€100-500 million damage (economic) or foregone opportunities	Major impact on valued habitat or landscape types; Major impacts on or loss of species groups; Major impact on an individual natural resource asset and associated goods and services; Major loss or irreversible damage to iconic heritage assets.
Substantial	Substantial losses, moderate extent or pervasiveness, temporary or moderate disturbance of system functionality.	Tens of deaths or 100-250 injured, 1000-2500 health impacts or 50,000-100,000 people affected.	€10-100 million damage (economic) or foregone opportunities.	Intermediate impact on valued habitat or landscape types; Intermediate impacts on or loss of species groups; Intermediate impact on an individual natural resource asset and associated goods and services; Medium loss or irreversible damage of iconic heritage assets.
Limited	Limited or rare losses, no significant disturbance of system functionality.	A few deaths or none, <100 injured, <1000 health impacts or <50,000 people affected.	<€10 million damage (economic) or foregone opportunities.	Minor impact on valued habitat or landscape types; Minor impacts on loss of species groups; Minor impact on an individual natural resource asset and associated goods and services; Low loss or irreversible damage to iconic heritage assets.

3. Complementing the risk severity, the **confidence** dimension reflects how certain we are about the severity level estimation. The focus is on the magnitude of the risk, not the direction it will take (i.e. worsening, stable or ameliorating). While we might be certain that a risk will worsen, for instance the risk of deteriorating social cohesion, little data might be available to justify just how much it will worsen. The confidence rating itself is based on multiple elements with the last two being given extra weight:
   - The amount of available evidence
   - The credibility of the sources
   - The utility of the data – is information available for Belgium and according to the GWLs?
   - The existence of consensus across sources

4. The **spatial distribution** of the risk within Belgium – which regions, cities, ecosystems or land-use classes are most affected? Where are potential 'risk hotspots'?

5. **Societal vulnerabilities** – which groups of people (e.g. pregnant people, the elderly, farmers, urbanites with low socio-economic status, etc.) are more sensitive to hazard exposure and have less adaptability?

6. **Policy readiness** refers to the extent to which public policies are equipped to address an identified climate or environmental risk. It assesses the presence, quality and maturity of existing policy, regulatory and strategic frameworks, as well as their capacity to anticipate, manage or mitigate the impacts of the risk. The policy readiness is based on multiple criteria that are detailed in the technical papers, including: the level of political awareness and surveillance of the risk, notably through monitoring and early warning mechanisms; the risk ownership; the existence of an appropriate legal and policy framework; and the degree of implementation of existing measures. Within the BCRA framework, this assessment is indicative and based on a qualitative analysis, complemented by expert elicitation. This review results in a readiness score going from low, medium, advanced to very advanced (see Table 2). Note that a fully comprehensive governance mapping was out of scope for this first BCRA. However, the essential information should be complete and correct, given that the assessment has undergone numerous expert feedback rounds.

Table 2. Policy readiness scale

Policy readiness	Description (at system level)
Low	Few, if any, policies, plans or strategies are in place to reduce the risk.
Medium	Policies, plans, strategies or legislation are in place but their targets and objectives are vague or only short-term actions are considered.
Advanced	Policies, plans or strategies that manage the risk effectively are partly in place.
Very advanced	Policies, plans or strategies are in place with clear objectives and actions to manage the risk. Policies and actions consider short-term risk management and long-term risk reduction where relevant.

7. **Risk ownership** refers to the attribution of primary responsibility for managing a climate risk to one or more levels of governance. It reflects the legal, institutional and operational capacity of an actor to design, implement and finance adaptation or risk-reduction measures.
   - A risk is considered **co-owned** when responsibility is distributed across several levels of governance, reflecting joint competence or interdependence between sectoral policies and requiring coordinated and integrated responses.
   - Conversely, a risk is attributed to a specific level of governance when the relevant areas of competence fall largely under the responsibility of that level of governance (**regional, federal**).

The BCRA does not aim to provide an exhaustive analysis of risk ownership. While different levels of governance may be involved, including local authorities, supranational institutions such as the European Union or private actors, the assessment of risk ownership within the BCRA primarily focuses on public authorities at the federal and federated-entity levels. Responsibilities exercised by other levels or sectors may be mentioned but are not factored into the final assessment of risk ownership. Risk ownership has not been integrated as an independent variable in the evaluation of risk urgency but it has helped to inform the analysis of policy preparedness with respect to the identified risks.

8. Finally, based on the policy readiness, stakeholder consultations and the literature review, the technical paper provides a set of non-exhaustive **recommendations** to policy makers. The most important and transversal recommendations are provided in the current report, but please refer to the individual technical papers for more recommendations tailored to specific risks (cerac.be).

The BCRA contributes to knowledge about the specific impact of climate change on various key sectors and social services. Mobilising the IPPC-AR6 methodological framework, it is a source of information both for crisis management and for risk analysis, considering from the start a generic risk and crisis management system that takes into account the entire risk cycle.

2.1.3. Step 3: risk urgency score

Based on estimations of risk severity, confidence level and policy readiness, risk urgency was defined based on a matrix inspired by the EUCRA (EEA, 2024b) (Table 3).

Table 3. Risk urgency matrix

Risk severity	Confidence	Policy readiness		
		Very advanced	Advanced	Medium / Low
Catastrophic	High	More action needed	Urgent action needed	Urgent action needed
	Medium	Precautionary action needed	More action needed	Urgent action needed
	Low	Precautionary action needed	Precautionary action needed	More action needed
Critical	High	Operationalize existing policies	More action needed	Urgent action needed
	Medium	Operationalize existing policies	Precautionary action needed	More action needed
	Low	Operationalize existing policies	Precautionary action needed	Precautionary action needed
Substantial	High	Operationalize existing policies	Operationalize existing policies	More action needed
	Medium	Operationalize existing policies	Operationalize existing policies	Precautionary action needed
	Low	Operationalize existing policies	Operationalize existing policies	Precautionary action needed
Limited	High	Operationalize existing policies	Operationalize existing policies	Enhance vigilance
	Medium	Operationalize existing policies	Operationalize existing policies	Enhance vigilance
	Low	Operationalize existing policies	Operationalize existing policies	Enhance vigilance

Urgency levels are defined as follows:

- Urgent action needed
  The combination of critical to catastrophic risks and insufficient policy readiness calls for urgent, new, stronger or different action in the coming years to reduce climate and ecosystems degradation risks. Such actions include policymaking, implementation, capacity building or enabling the environment for adaptation, over and above those already planned.
- More action needed
  The severity of risk and the limited level of policy readiness calls for more action to be implemented. It is crucial to initiate processes that strengthen adaptation action to avoid critical impacts of climate change.
- Precautionary action needed
  Precautionary actions and no-regret measures are needed due to the potential severity of the risk, even when knowledge is scarce. Additional evidence must be gathered regarding the severity of the risk as well as policy readiness, e.g. through dedicated research, monitoring or policy evaluation.

- **Enhance vigilance**
  The evidence in these areas should be kept under review, with continuous monitoring of risk levels, so that further action can be taken if necessary.
- **Operationalise existing policies**
  Current or planned actions are appropriate, but effective implementation of related policies and plans is needed to ensure that the risk is also managed in the future. A monitoring process should be in place to evaluate policy effectiveness, with a view to continuous improvement.

This exercise was repeated for all three global warming levels. In some cases, however, this EUCRA-inspired approach leads to decreasing urgency scores with increasing global warming – for instance due to confidence levels dropping as projections are made for increasingly further time horizons. Since such decreases in urgency are not realistic, the urgency level was chosen to be able to stagnate or increase with increasing GWLs, but not to decrease.

Urgency levels reported throughout this document represent the situation at a GWL of 3°C. This represents a middle way, being a warming level that is likely to happen at the middle-to-long term.

The BCRA presents this risk analysis as part of a comprehensive approach to risk management that incorporates preventive and preparatory measures. The BCRA contributes to raising awareness of risks and threats and strengthens the framework for strategic foresight, and political action.

2.1.4. Step 4: expert and stakeholder consutations

The assessment resulting from steps 1 to 3 was supplemented and challenged through several types of expert consultations (Figure 9):

- One-on-one **interviews** (2 to 4 interviews per cluster) with recognised field experts and academic researchers.
- One full-day **workshop** per cluster, organised to foster real-time collaboration and exchange with a diversity of participants – scientists, federal and regional public servants and expert practitioners. Approximately 20-40 participants attended each workshop.
- Five online **Delphi-inspired questionnaires** with two rounds per cluster gathered diverse input from a broader audience, selected from a database of 500 stakeholders including scientists, public servants and end-users. For each cluster, around 100-200 persons were invited, with response rates ranging from 55% (Health) to 15% (Economy and Infrastructure).
- End-users of the risk assessment study were actively involved through their participation in the study's steering committees and by contributing to two dedicated workshops with key security stakeholders. The objective of these workshops was to better understand their expectations regarding the study, capture their specific vocabulary and explore their climate-related concerns.

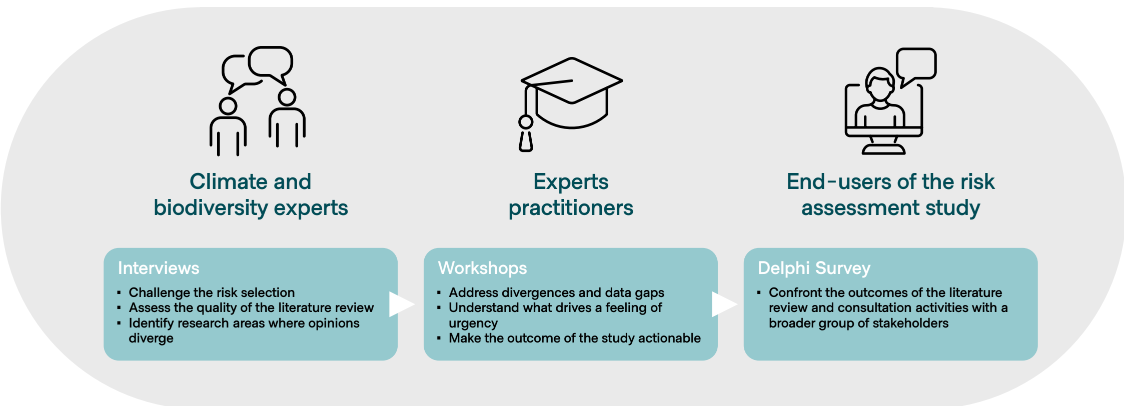


Figure 9. Stakeholders' consultation process and the intended outcomes of each phase

The consultation process was particularly useful in enabling validation of to what extent a risk is being recognised or managed. Even though legislation, strategies and plans might exist, experts and stakeholders could confirm whether or not these were actually implemented and impactful. This also informed on issues of governance dynamics between policy domains and/or authority levels.

2.2. Limitations of the assessment

Hundreds of possible hazard-system combinations represented risks that could potentially have been considered in this first BCRA. Of these, **28 priority risks were selected** for thorough analysis. Careful consideration was given to including the most urgent and relevant threats for Belgium. This selection was also validated by the scientific and steering committee. Yet, it is possible that the BCRA omits unidentified or unassessed risks of relatively high urgency because of a lack of available knowledge or data.

Given that the assessment relied on **available literature**, the scarcer data on ecosystems degradation-related risks – especially for the Belgian territory – resulted in a lower number of those risks being analysed. This reflects data limitations, not a judgment that they are of lesser importance, and underscores the pioneering nature of applying risk assessment to ecosystems degradation and biodiversity loss.

Complementing climate risks with those originating from **ecosystems degradation** represented multiple challenges. Firstly, the impact chain linking ecosystems degradation to actual risks is highly complex. As is the case for the risks of zoonotic diseases, for example, it is possible that both the drivers of ecosystems degradation and the resulting biodiversity loss itself embody a risk. The BCRA therefore opted to start from ecosystems degradation first, explaining the link to biodiversity loss and the consequences for ecosystem services.

Furthermore, climate change is a known driver of ecosystems degradation and biodiversity loss, underscoring the **need for a systemic approach**. Yet, there are other non-climatic drivers that also aggravate many of the risks that are included in the BCRA. For example, the climate and biodiversity crises are part of even larger interrelated global change issues, which, for instance, also include modifications of the carbon, nitrogen and phosphorus cycles. This first BCRA added some pressing ecosystems degradation risks in a pragmatic fashion. Yet, the BCRA does not provide a comprehensive assessment of important risks related to ecosystems degradation and biodiversity loss. Although this could not be achieved in this first iteration of the Belgian Climate Risk Assessment, there is a strong aspiration to integrate, at a later stage, an approach that enables the measurement of crosscutting, compound and cascading risks.

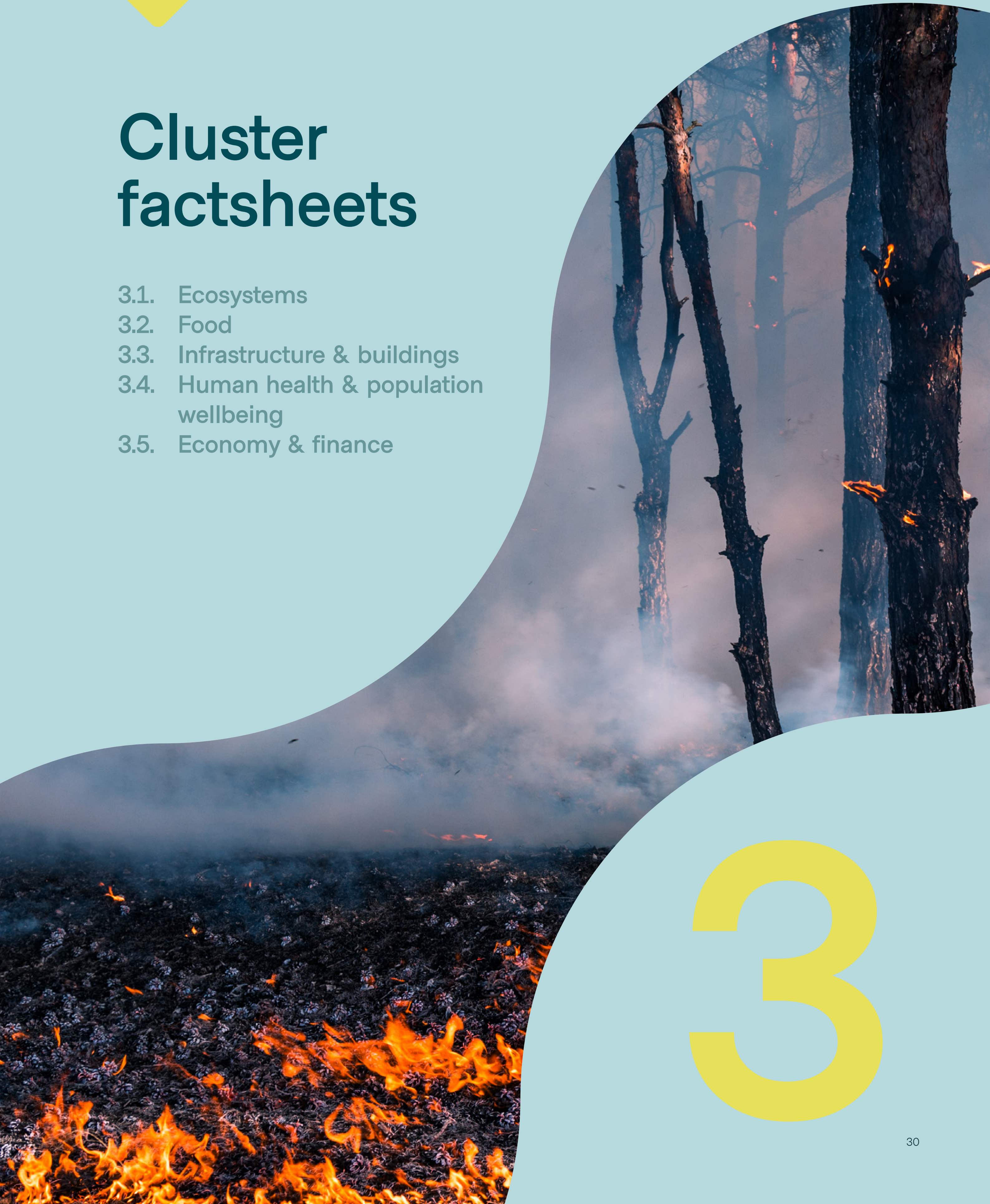
A shared methodology for all risks enabled some prioritisation but **making direct comparisons between risks requires caution**. Information was sourced in different ways: scientific papers, institutional reports and expert consultation. In multiple cases – and because of the highly heterogenous nature of data availability – these created contrasts between risks in terms of confidence. For example, in some cases, multiple robust quantitative estimations allow for a clear risk severity assessment, whereas other risk assessments are based on data of a qualitative nature (note that qualitative data does not imply low-quality information). This makes direct ranking or comparison between risks difficult.

While extensive **consultation informed the assessment**, it did not equate to validation. Stakeholders contributed valuable feedback, but no single expert could validate all aspects due to the interdisciplinary nature of the work. For instance, finding an expert at the climate change-mental health nexus working on future projections using Belgian data is very challenging. Final scores rely on collective knowledge.

A cross-cluster workshop with security experts explored interconnections between clusters and identified "primary concerns for national security" among the 28 risks. This was a **critical discussion**, not a validation step.

While challenges and knowledge gaps remain, this first BCRA succeeded in identifying and assessing the most pressing risks related to climate and ecosystems degradation for Belgium. The broad alignment in feedback from consulted experts highlights the strong consensus around the urgency and relevance of these risks.

Cluster factsheets



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Cluster factsheets

This chapter presents the main results of the risk analysis and is structured into subchapters per cluster. For each cluster (ecosystems, food, infrastructures, health and economy), a description and a visual diagram summarise key risk elements (hazard or systems) that have or have not been analysed, including relationships between risks and other clusters. Figure 10 shows the five analysed clusters, the main climatic and non-climatic drivers, as well as the links between the systems. More detailed links can be found in the specific figures per cluster.

Risks are concisely summarised, focusing on the key elements that define the risk urgency score: risk severity, confidence level and policy readiness. The complete risk analyses can be found in the respective technical papers (see cerac.be). These papers include in-depth risk descriptions, additional information such as the spatial distribution of the risk and resulting social vulnerabilities, as well as the full list of sources.

Finally, each sub-chapter concludes with a more qualitative and systemic cross-risk analysis within a cluster.

Broader transversal aspects arising from interactions between risks and clusters are discussed in chapter 5.

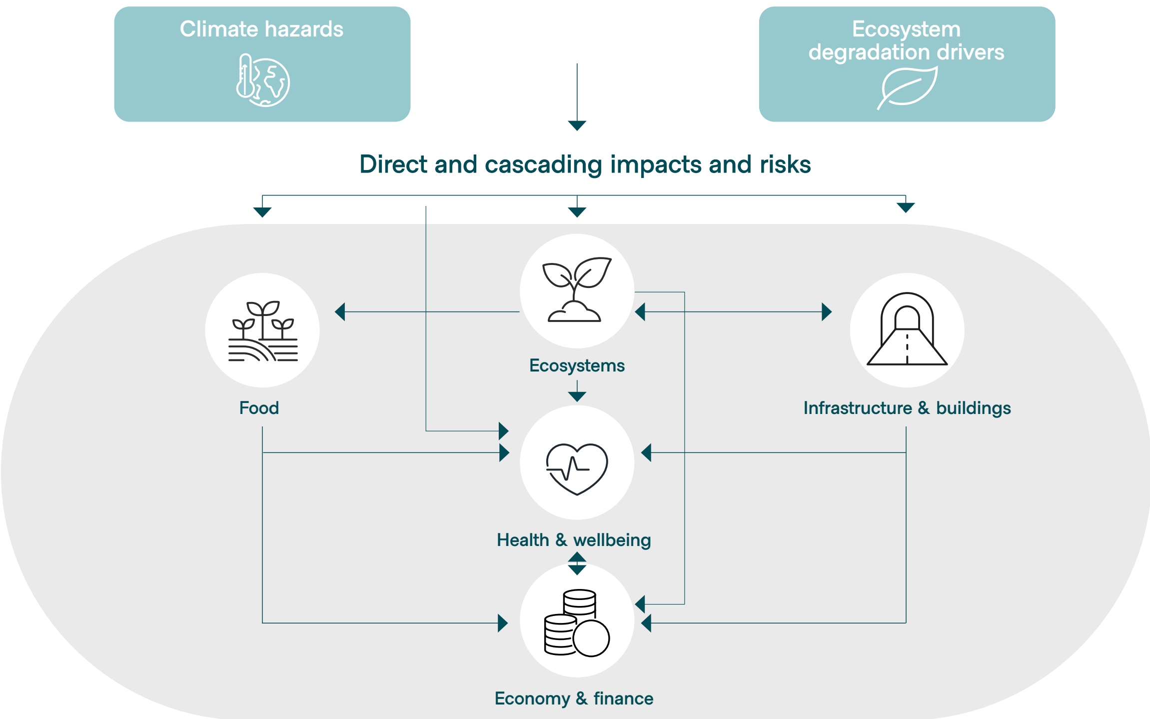

Figure 10. Links between risk drivers and clusters

3.1. Ecosystems

3.1.1. Description

This chapter explores the risks to ecosystems. Ecosystem means a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit (Convention on Biological Diversity). Five Belgian ecosystems were considered during the analysis (Cerac, 2025):

- coastal & marine ecosystems;
- freshwater ecosystems;
- forest ecosystems;
- soil ecosystems;
- other terrestrial ecosystems (peatlands, heathlands, grasslands).

Agroecosystems and urban ecosystems have not been investigated under this Ecosystems cluster but rather under the Food cluster and Infrastructures and buildings cluster respectively.

The present analysis focuses on the risk to biodiversity arising from climate hazard. Risks arising from hazards due to ecosystems degradation and biodiversity loss itself were not investigated, although it is possible that such risks exist, creating a feedback loop accelerating biodiversity decline[1].

Climate change is one of the major drivers of biodiversity loss and ecosystems degradation. Other major drivers of biodiversity loss and ecosystems degradation are: (i) land use change and fragmentation of habitats; (ii) over exploitation of natural resources; (iii) pollution and (iv) invasive alien species. Climate change also interacts with and exacerbates these non-climate drivers (IPBES, 2018, 2019).

Finally, it is important to note that biodiversity is not only affected by climate change but also provides solutions contributing both to climate change mitigation and adaptation (nature-based solutions). In adaptation, ecosystems can act as a buffer for human systems against climate-driven risks (flooding, droughts, heatwaves and wildfires).

[1] An example of a negative feedback loop of biodiversity decline upon biodiversity itself is the decline of biodiversity in soil ecosystems, which may lead to degradation of soil quality and fertility regulation services, leading to a degradation of forest and/or grassland ecosystems in the area.

Key messages

1. Key climate risks for ecosystems are: disruption of food web dynamics and related ecosystem services; increased frequency and intensity of wildfires; population declines and local extinctions, particularly in freshwater ecosystems; and soil biodiversity decline, soil erosion due to climate – and land use – driven by hydrological changes.
2. Current climate induced degradations for ecosystems are well established, however severity of impacts in the long-term depend on emission scenarios.
3. Risks to ecosystems may cascade to other sectors such as food and water security and human health.
4. The climate and biodiversity crises are highly interconnected, requiring policy coherence.
5. Key policy priorities include: (1) addressing drivers of biodiversity loss, (2) protection and restoration of nature, which accommodates climate induced species range shifts, (3) sustainable management to improve climate-resilience of ecosystems and (4) improving habitat connectivity and diversity.

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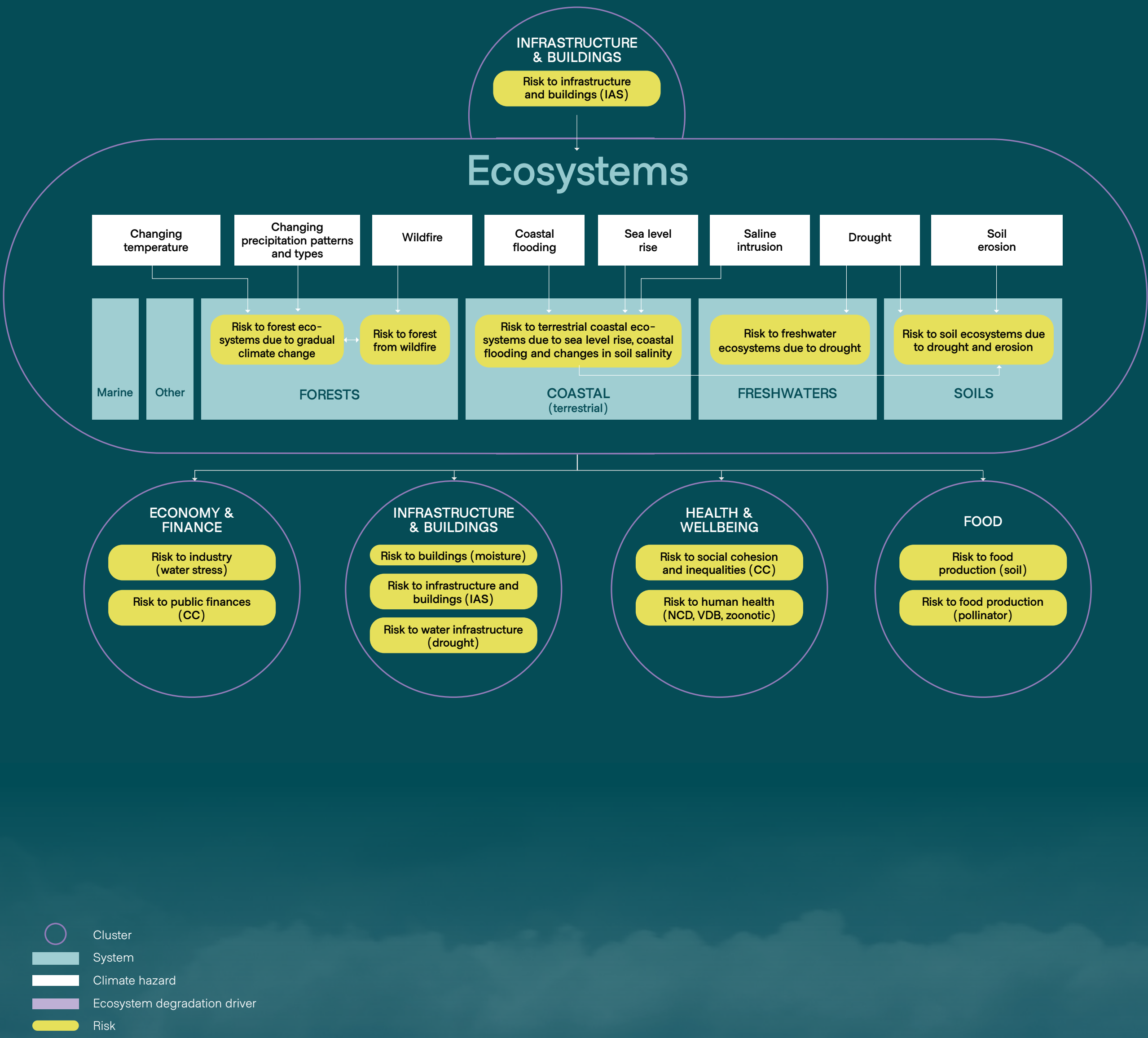

Figure 11. Ecosystems impact chain and interlinkage with other clusters

3.1.2. Risk assessment factsheets

A brief review of available literature explored existing documentation on risk arising from the combination of 21 climate hazards and the five above-mentioned ecosystems (coastal, marine, freshwater, soils, forests and other terrestrial ecosystems). A potential risk for Belgian ecosystems was identified for 46 out of these 105 combinations, according to the relevant literature. 11 combinations were considered leading to no relevant risk in Belgium and, for 48 other combinations, the preliminary analysis did not allow assessment of whether there is such a potential risk for Belgian ecosystems. Following experts' suggestions for representativeness (covered area, administrative distribution and severity of impacts), the final 5 risks to analyse are:

- Risk to **forest ecosystems** due to **gradual climate change**;
- Risk to **forest ecosystems** from **wildfires**;
- Risk to **terrestrial coastal ecosystems** due to **sea level rise**, **coastal flooding** and changes in **soil salinity**;
- Risk to **freshwater ecosystems** due to **droughts**;
- Risk to **soil ecosystems** due to **droughts** and **erosion**.

Due to the analytical approach taken for this risk assessment, cascading impacts on people and the economy due to the degradation of ecosystem services are not considered in the risk severity scores under this cluster. Some of the cascading impacts are included in other clusters, through the following biodiversity driven risks:

- Risk to food production due to soil ecosystems degradation;
- Risk to food production due to pollinator decline;
- Risk to human health due to the increase of pandemic zoonotic diseases;
- Risk to industry from water stress.

Table 4. Summary of risk assessments for "Ecosystems"

Climate risk	Urgency to act	Risk severity 2°C	Risk severity 3°C	Risk severity 4°C	Policy readiness	Risk ownership
Risk to **forest** ecosystems due to **gradual climate change**	Precautionary action needed	+ + (Substantial)	+ + (Critical)	+ + (Critical)	Advanced	Regional
Risk to **forest** ecosystems from **wildfire**	Precautionary action needed	+ (Critical)	+ (Critical)	+ (Critical)	Medium	Regional
Risk to **terrestrial coastal** ecosystems due to **sea level rise**, **coastal flooding** and changes in **soil salinity**	Operationalise existing policies	+ + (Substantial)	+ + (Substantial)	+ + (Substantial)	Advanced	Regional
Risk to **freshwater** ecosystems due to **droughts**	More action needed	+ + (Substantial)	+ + (Critical)	+ + (Catastrophic)	Medium	Regional
Risk to **soil** ecosystems due to **droughts** and **erosion**	More action needed	+ + (Substantial)	+ + (Critical)	+ + (Critical)	Low/Medium	Regional

Urgency to act

- Urgent action needed
- More action needed
- Precautionary action needed
- Enhance vigilance
- Operationalise existing policies

Risk severity

- Catastrophic
- Critical
- Substantial
- Limited

Confidence

Low: +
Medium: + +

RISK TO FOREST ECOSYSTEMS DUE TO GRADUAL CLIMATE CHANGE

Description

Climatic shifts influence tree physiology (photosynthesis, cell division and metabolism), tree phenology, growth rates, species distribution, forest structure, forest health and susceptibility to disturbances (e.g. pests and diseases). Altered climatic conditions contribute to the loss of vitality and restoration capacity of forests, exacerbating the vulnerability of ecosystems and modifying their overall functionality. In natural conditions, species have two options – adapt or move – otherwise they go extinct. Extinction is a particular risk for species with small populations with limited genetic diversity, a restricted distribution area and/or a narrow ecological niche.

However, the vulnerability of Belgian forests to climate change is also largely defined by historical management practices, which themselves depend on the history of the socio-economic context of Belgian agricultural and industrial sectors. Belgium's massive historical deforestation has profoundly altered the restorative capacity of forest ecosystems, requiring massive reforestation in the early 19th century with species such as Scots pine and Norway spruce. Most planted forest stands are monospecific, even-aged (single-layered) and genetically homogenous. In addition, many stands were planted in unsuitable sites without respecting the tree species autecology. Coupled with biotic and abiotic stress (e.g. game pressure, acidification due to nitrogen deposition, etc.), this heritage has strongly contributed to the sensitivity of the ecosystem and underpins the major actual Belgian forest disasters (beech disease [beetles of the genus *Trypodendron*], oak dieback, ash dieback [*Hymenoscyphus fraxineus, fungus*], ...).

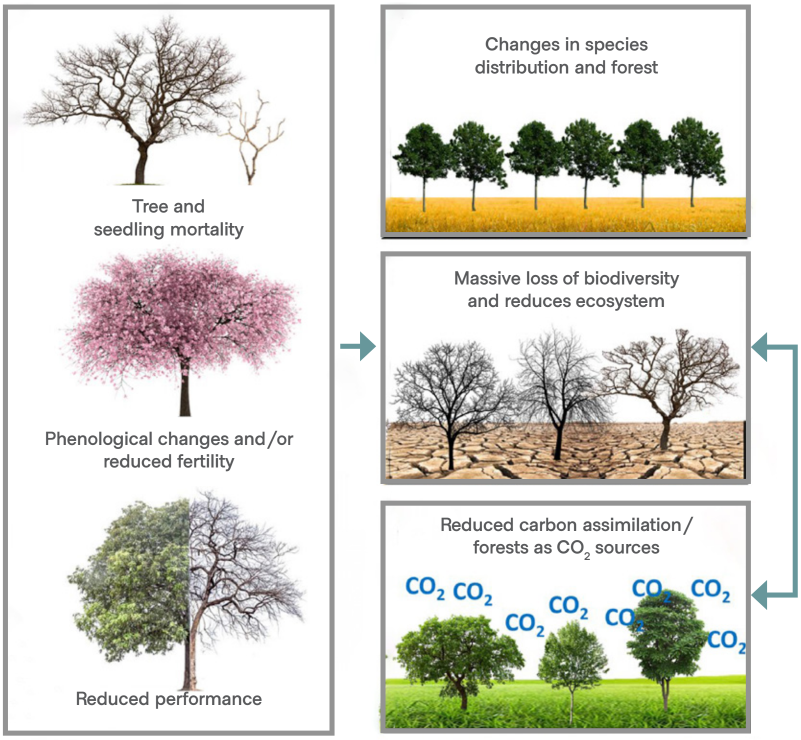

Figure 12. Some possible impacts of climate change on forest ecosystems. Source: Menezes-Silva et al. (2019)

The risk severity score is considered ***substantial*** at a global warming level of +2°C and ***critical*** at +3°C and +4°C, with medium confidence. Policy readiness is considered ***advanced***. This leads to an urgency score of "**operationalise current policies**" to face a +2°C global warming level and "**precautionary action needed**" for the +3°C and +4°C levels.

Risk Severity

The ***substantial*** severity level at a global warming level (GWL) of +2°C, is justified by the already numerous forest diebacks observed over the past decades, the associated economic consequences and the large areas of stands assessed as being unsuited to the site. The actual Belgian forest composition is largely dominated by a limited pool of vulnerable emblematic tree species (beech, Norway spruce, temperate oaks and Scots pine). The forest structure is largely dominated by monocultures, which are less resilient to climate shocks. For the other two GWLs (+3°C and +4°C), it may be that the severity level is higher, with these levels leading to cascading impacts and irreversible damage to actual forest ecosystem. However, the literature review does not provide sufficient quantitative evidence of this projection. The severity level depends directly on the forest stakeholders' ability to anticipate and apply adaptive forest management. Although Belgian forests will probably not disappear, their composition, structure and functioning, as well as the level of ecosystem services they provide, will likely change significantly.

Confidence level

The confidence level is medium. Most of the information used in this review is recent (> 2020) and comes from peer-reviewed research published in internationally recognised scientific journals. Available studies converge towards the same conclusion – a clear impact, both observed and projected. There is therefore strong evidence of the impacts and a broad scientific consensus. However, according to the confidence scale used in the methodology, a higher confidence score would require more quantified information on the costs of the impacts at large scale.

Policy readiness

The policy readiness regarding this risk mainly depends on the forestry sector's ability to ensure long-term resilience of forests in the face of climatic hazard by adopting appropriate silvicultural practices as quickly as possible. Belgium has made tangible progress in preparing its forest sector for the impacts of gradual climate change. A range of policies and strategies, at international, European and regional levels, are already in place and these are increasingly backed by concrete actions such as reforestation programmes, forest management plans and targeted subsidies. The involvement of professionals, researchers and regional administrations is strong and various platforms now exist to share knowledge and support implementation.

Nonetheless, the effectiveness of governance in addressing the degradation and vulnerability of Belgian forests also faces several challenges. The long timeframes inherent to forest ecosystems make it difficult to adapt management practices quickly. Moreover, coordination and communication between numerous forest management actors across regions remain uneven. Legal frameworks are also not always flexible enough to respond to gradual ecological shifts, while budgetary constraints and/or diverging priorities between stakeholders

also hinder progress. There are also important issues that still need to be decided, such as whether or not to give space to exotic species that would be better adapted, for instance, to drier weather conditions.

The ecosystems cluster shows clear signs of advancement. A shift from isolated efforts to a more structured and responsive approach to forest adaptation is evident across both public and private sectors. This justifies an advanced rating – while not yet fully comprehensive, the policy framework is maturing and increasingly capable of addressing the discussed risk. Going forward, improved policy coherence, through aligned objectives, uniform standards and coordinated enforcement, will be essential.

RISK TO FOREST ECOSYSTEMS FROM WILDFIRES

Description

The simultaneous impact of heat and dryness predisposes forests to wildfires, which, although historically limited in scale in Belgium, could become more frequent and more severe. The term "wildfire" broadly encompasses uncontrolled vegetation fires, including forest, bush and grassland fires. In this analysis, it primarily refers to forest fires, though its scope may vary depending on the context of the referenced literature. Combination of heat and dryness also triggers "dryland mechanisms" – self-reinforcing positive feedback mechanisms that exacerbate impacts as declining soil moisture intensifies heatwaves and further suppresses precipitation, creating vicious cycles that are difficult to reverse.

Progressive weakening of forests due to repeated drought and heat stress also accelerates tree dieback and mortality, resulting in the accumulation of dry biomass such as deadwood, leaf litter and dried vegetation. This accumulation increases overall fuel loads, enhancing the probability of ignition, intensity and spread of wildfires. Additionally, canopy gaps formed by declining tree cover expose the forest floor to direct solar radiation, elevating surface temperatures and lowering relative humidity in the understory, which further dries the vegetation and soil top layers. Wildfires subsequently exacerbate land degradation by accelerating soil erosion, depleting nutrients, reducing soil organic matter and causing potentially irreversible losses in biodiversity and water pollution.

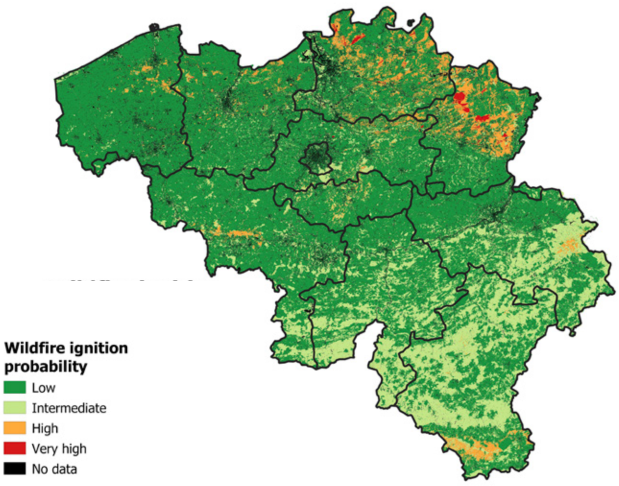

Figure 13. Wildfire ignition probability map of Belgium (Depicker et al., 2020)

The risk severity score is considered ***substantial*** at a global warming level of +2°C and ***critical*** at +3 and +4°C with low confidence. Policy readiness is considered medium. This leads to an urgency score of "**precautionary action needed**".

Risk Severity

The occurrence of extreme climatic events will undeniably rise and affect forest ecosystems. Droughts and heatwaves impact both forests structure and distribution. Their combined effect increases tree vulnerability – exacerbated by environmental pressures such as excessive nitrogen deposition – making them more prone to pest outbreaks, wildfires and other disturbances, potentially leading to forest die-off. This is especially the case for trees and forests that have undergone repeated episodes of compound extreme heat and drought events. Consequences of extreme climatic events have already been observed in Belgium.

In a +2°C warmer world, droughts that previously occurred once per century in the pre-industrial era could become more than a once-per-decade event and extreme heat events are expected to occur annually. The risk is considered ***substantial*** in a +2°C global warming scenario as Belgian forests already face growing vulnerability, which will further intensify. Large forest ecosystems will be impacted as main species, such as Norway spruce (Wallonia), Scots pine and beech trees (Flanders) are found to be susceptible to climatic changes. Growth rate declines due to pest outbreaks and wildfires largely affect the entire territory of Belgium, with some higher probability in Flanders on sandy soils.

In a +3°C hotter world, the frequency of compound events combining extreme heat and drought is projected to increase tenfold, occurring approximately once every decade instead of once per century. Under a +4°C warming scenario, the frequency of multi-year droughts is expected to be seven times higher than under the current climate. This highlights a significant rise in both the intensity and recurrence of hydrometeorological extreme events, which will further exacerbate delayed impacts on forest ecosystems. Multi-year disturbances will threaten biodiversity and deteriorate ecosystem services such as carbon sequestration and forest productivity, with long-term implications for ecosystem stability and wildfire risk. The risk is therefore considered ***critical*** under these global warming scenarios.

The **spatial distribution** of forest vulnerability to climate extremes in Belgium is highly heterogeneous and closely linked to soil characteristics, forest composition and landscape structure. Possible hotspots include sandy soils in Eastern Flanders (Limburg) and the Ardennes region in Wallonia.

Confidence level

The confidence level is low. The sources used in this review primarily consist of peer-reviewed studies from prestigious scientific journals and reports from internationally recognised institutions like the European Environment Agency. Most references are recent (2020 onwards) and cover (pan-)European or biome-level studies, with relevant insights from Germany, and there is apparent scientific consensus on the direction of the impacts. Yet, although internationally validated, few directly address Belgium. While research on monospecific stands of most frequently observed species (e.g., Norwegian spruce, beech) is more frequent, studies on mixed forests, understory vegetation, fauna and regeneration remain scarce, indicating a knowledge gap. The magnitude of impacts also remains highly uncertain, with little quantitative data, particularly regarding localised impacts. According to the confidence scale used in the methodology, more quantified information on the costs would be required to give a high confidence score.

Policy readiness

The score awarded to the policy readiness regarding the risk to forest ecosystems from wildfire is medium. Belgium is at a critical juncture in dealing with the growing risk of wildfires, which are expected to become a critical security issue in the next 15-20 years, leading to ecosystems degradation but also public health and potentially devastating financial impacts.

In Belgium, there is an excellent awareness of the impact of climate change on the vulnerability of forests and a willingness to find pragmatic solutions to ensure their long-term survival, both in the public sector and among private owners of forest land. However, there are still many uncertainties about the silvicultural directions to be taken, such as a decision on the role of deadwood in wildfire risk versus its value for biodiversity. One of the challenges will be to align policies and measures between stakeholders to ensure consistent implementation across regions and forest types.

Moreover, wildfire policy landscape reflects a growing awareness of the risks posed by climate change and increasingly frequent fire events. The country has taken several of steps, including the development of standard operating procedures, regional fire danger indices and participation in European coordination mechanisms. These efforts are supported by multidisciplinary networks and emerging data tools, indicating a clear shift toward more structured preparedness. The inclusion of wildfire risks in recent coalition agreements and national risk assessments further confirms that the issue is gaining political traction.

Despite the increasing recognition of wildfire risks, especially in light of climate change, Belgium's response remains constrained by limited resources and inconsistent regional implementation. The absence of a coherent national strategy and harmonised data-driven approach hinders preparedness. Stronger national and cross-border coordination will be essential to address these gaps in forecasting, prevention and response. With targeted investments in predictive modelling, early warning systems and firefighting capacities, Belgium could transition from reactive suppression to proactive risk reduction. Strengthening public awareness and embedding wildfire considerations into spatial planning and climate adaptation policies will also be key to enhancing long-term resilience.

RISK TO TERRESTRIAL COASTAL ECOSYSTEMS DUE TO SEA LEVEL RISE, COASTAL FLOODING AND CHANGES IN SOIL SALINITY

Description

According to the IPCC (IPCC-AR6, 2022), it is extremely likely that future sea level rise (SLR) will continue to increase due to global warming, with high confidence in this projection. Sea level rise and sea flooding can lead to ecosystems degradation due to the excess of water, salt and pollution. This assessment focuses on the subsequent impact of changes in soil salinity and the consequences for terrestrial coastal ecosystems.
Salinisation poses a significant risk for soil degradation directly or indirectly affecting natural habitats and agricultural productivity. The impact of salinisation on agriculture is especially relevant in the Belgian low-lying coastal areas where agricultural production is a major land use. Coasts and estuaries are dynamic environments where habitats develop based on salinity, flooding, sediment composition and deposition rate, and hydrodynamic forces. Changes in salinity gradients alter community structures of fauna and flora. Adding seawater to a system results in higher salt stress, especially during extreme weather events, causing a decline in biodiversity as only salt-tolerant organisms survive (Van der Aa et al., 2015).

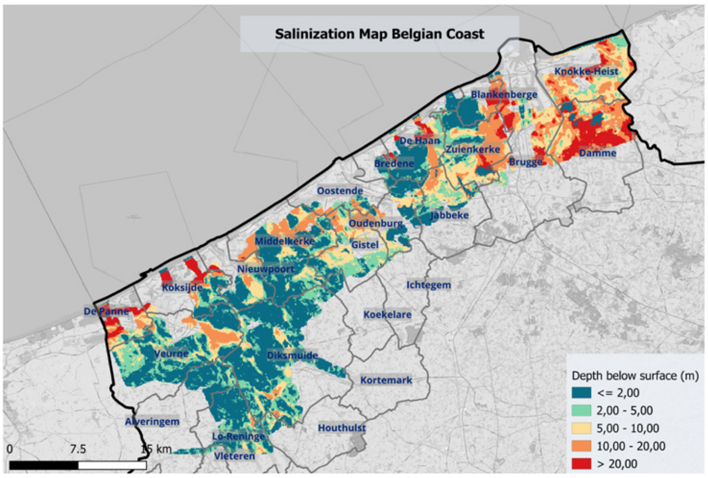

Figure 14. Salinisation map of the Belgian coast, expressed through the approximate depth of the interface between fresh and salt groundwater (source: https://www.dov.vlaanderen.be/)

The risk severity score is considered ***substantial*** at all global warming levels with medium confidence. Policy readiness is considered advanced. This leads to an urgency score of '**operationalise current policies**'.

Risk Severity

No local impact scenarios are available for changes in the soil salinity gradient resulting from sea level rise or sea flooding in Belgium. Lee et al. (2025) analysed the impact of SLR on salinisation globally, including six European estuaries, among which were the Rhine-Meuse estuaries. Significant impacts on salinisation were found in those findings published recently. There is high confidence that the sea level will rise globally in the future and at the Belgian coast.

From literature review and consultations, it can be concluded that there is still much uncertainty about the occurrence and effects of salinisation, future precipitation patterns and effects of coastal protection measures on salinity and the tolerance of nature to acute or chronic salinisation, as well as on the types of provided ecosystem services. Furthermore, coastal environments are dynamic. Salinisation can potentially lead to both risks and new opportunities for habitats.

Based on these elements the risk assessment to terrestrial coastal ecosystems is set to ***substantial*** for the different scenarios.

Confidence level

There is strong international evidence and consensus on the impacts of climate change on SLR and salinisation, including in the Belgian share of the North Sea. However, no quantitative impacts have been calculated from specific climate scenarios in Belgium. Therefore, the confidence level of the severity score is set to medium.

Policy readiness

Flanders developed a Masterplan with measures against a SLR of 30cm and extreme floods, which should provide sufficient protection until 2050. Additionally, the Flemish government created the 'Kustvisie', setting out strategies (i) to further protect the coast in the event of sea level rises of up to 3 m and (ii) to displace the coastline by an average of 100 m. The accompanying policy plans were approved in February 2024.

This assessment shows that while Flanders has robust coastal protection strategies in place, these are not yet adequately aligned with the emerging ecological risks from SLR-induced flooding and salinisation. We can therefore only suppose that existing policies will have indirect positive effects on the protection of ecosystems. To improve policy readiness, Flanders should invest in targeted research on salinisation and its subsequent impacts on terrestrial ecosystems. This research would help to determine whether biodiversity considerations should be made a mainstream part of coastal adaptation and water governance frameworks. The focus would shift from protecting infrastructure alone to achieving the holistic resilience of socio-ecological systems. For these reasons, the score awarded is advanced.

RISK TO FRESHWATER ECOSYSTEMS DUE TO DROUGHTS

Description

Belgium, despite its small size, has a rich hydrography composed of different surface water bodies, including stagnant waters (lakes, ponds, reservoirs), flowing waters (springs to large rivers) and wetlands (vegetation along stagnant or flowing waters, marshes, peat bogs, reed beds and wet shrublands).

The water that flows and contributes to surface waters correspond to direct runoff and water that infiltrates and moves through the surface layer of the soil, though above the water table (hypodermic flows).

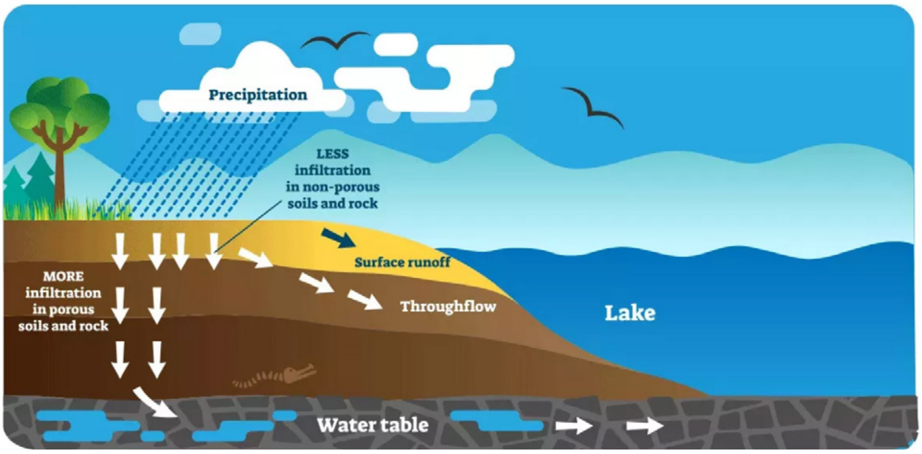

Figure 15. Water flows contributing to surface waters. Source: www.nesdis.noaa.gov
https://www.nesdis.noaa.gov/about/k-12-education/jpss-education/exploring-groundwater

Droughts, becoming more frequent due to alterations in precipitation patterns, lead to a reduction in catchment runoff and infiltration, as well as decreased river flows and lower lake levels impacting freshwater ecosystems. They can affect the physical properties of freshwater ecosystems by affecting the water quality. They also disrupt biological processes at all levels (species composition, ecosystem functions), leading to reduced habitat suitability, loss of sensitive aquatic species and shifts in community structure (Machuca-Sepúlveda et al., 2024).

The risk severity score is considered ***substantial*** at a global warming level of +2°C, ***critical*** at +3°C and ***catastrophic*** at +4°C, with medium confidence. Policy readiness is considered ***medium***. This leads to an urgency score ranging from "precautionary action needed" at +2°C, "more action needed" at +3°C and "urgent action needed" at +4°C global warming.

Risk Severity

The severity rating is:

- ***Substantial*** at +2°C warming
- ***Critical*** at +3°C
- ***Catastrophic*** at +4°C

Overall, water inputs are projected to rise in autumn, winter and spring but decline in summer, especially under higher warming scenarios. In some watersheds, such as in the Vesdre river, summer precipitation could be reduced by 70% at +4°C, while certain areas may see slight increases, underscoring significant spatial variability. These changes will lead to drier summers and more severe seasonal droughts, posing major challenges for water resource management and ecosystem stability (Pirlot et al., 2025).

At the international level, freshwater ecosystems are among the most severely affected, with only 13% (area covered) of wetlands remaining by 2000 compared to 1700. Between 1970 and 2008, the average rate of wetland loss accelerated to 0.8% per year. The Living Planet Index shows an 84% decline in freshwater vertebrate populations since 1970 (IPBES, 2019).

Droughts pose a growing threat to freshwater ecosystem services of provisioning (for example, water and food supply), regulating (water quality and flood mitigation, etc.) and cultural services (physical interactions with nature, education and aesthetic experiences) (Sousa et al., 2024). In addition to pollution caused by the local population, there is also pollution generated by the tourism sector during the summer months. This pollution is even worse when water levels are low. Campsites, few of which are equipped with purification systems, contribute to the deterioration of water quality, particularly in terms of bacteriological quality, during periods of low water levels – which are becoming increasingly frequent. During drought, reduced river flow decreases dilution capacity, leading to higher pollutant concentrations and greater risks to water quality (van Vliet et al., 2023).

Confidence level

There is broad scientific consensus that drought has an adverse effect on freshwater ecosystems but quantitative estimations of the impacts (e.g. decline in biodiversity) for Belgium are insufficient. This suggests only a medium confidence level on the risk severity score.

Policy readiness

The policy readiness for addressing the risk to freshwater ecosystems due to droughts is assessed as ***medium***. Belgium's policy readiness to address drought risks to freshwater ecosystems is supported by a comprehensive European framework that combines both water-specific and broader environmental policies. The Water Framework Directive (WFD) provides the legal backbone for integrated water resource management, complemented by a series of water policies. In parallel, environmental instruments under the Green Deal such as the Nature Restoration Law emphasise ecosystem restoration and resilience. Together, these frameworks are mutually reinforcing. Water policies ensure the sustainable use and protection of water resources, while environmental policies promote the ecological integrity of freshwater systems, including their capacity to withstand climate-related pressures like drought.

Implementation of this framework occurs primarily at the regional level, where authorities are responsible for developing drought-specific strategies and measures. Wallonia has adopted a comprehensive Integrated Drought Strategy supported by the SRRE (*Schéma Régional des Ressources en Eau*) 3.0 roadmap, while Flanders has launched the Blue Deal and developed tools such as the Priority Water Use Assessment Framework (*reactief afwegingskader voor prioritair watergebruik*). Brussels has begun integrating drought concerns into planning, though a formal drought strategy is still lacking. These regional efforts are supported by monitoring platforms and drought coordination bodies.

Despite these achievements, several challenges persist. The risk to freshwater ecosystems from drought is not addressed systematically. Instead, ecological concerns are often treated as secondary to socio-economic priorities such as water supply and infrastructure resilience. The underlying assumption is that by ensuring overall water availability, ecosystems will also benefit. However, this approach overlooks the specific ecological requirements and vulnerabilities that may not be met through general water management alone.

Moreover, existing initiatives remain scattered across sectors and regions, with limited coherence and insufficient implementation. Funding constraints, administrative barriers and the absence of legally binding measures further hinder progress. Finally, the lack of a unified monitoring index and ecosystem-specific data limits the ability to assess and respond to drought impacts on freshwater biodiversity. As a result, while the policy framework looks advanced in structure, its operational effectiveness remains partial, especially regarding ecosystems risks.

RISK TO SOIL ECOSYSTEMS DUE TO DROUGHTS AND EROSION

Description

Climate projections for Belgium show reducing summer precipitation (with high interannual variability), increasing drought frequency and intensity and increasing heavy rains (Fettweis et al., 2024; IPCC-AR6, 2022). These drivers lead to soil erosion, threatening soil ecosystem health and quality.

Soil organic matter (SOM) comprises organic residues at various stages of decomposition. Although it represents a relatively small fraction of the soil matrix, SOM plays a critical role in maintaining soil health, as it enhances water and nutrient retention capacities and aggregate stability and as it helps in supporting soil biodiversity and plant growth, thereby mitigating erosion and leaching in soils (FAO, 2020). The principal component of SOM is soil organic carbon (SOC), recognised as a key indicator of soil health and soil biodiversity.

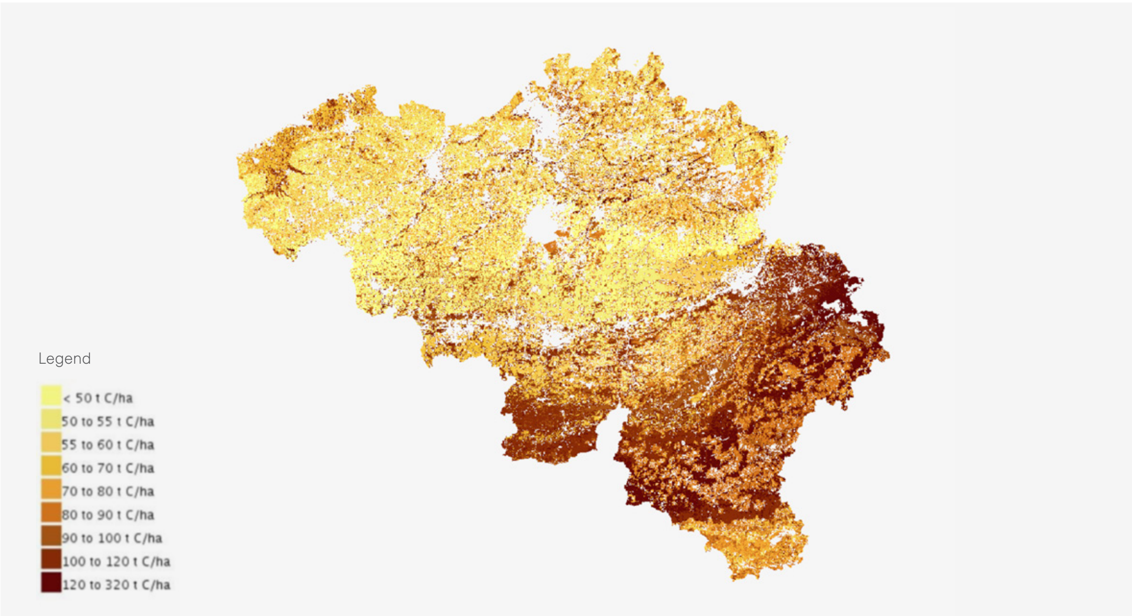

Figure 16. Soil organic carbon stock map for Belgium (average value in t C/ha; resolution of 40x40 m).
Source: https://www.dov.vlaanderen.be/

The risk severity score is considered substantial at a global warming level of +2°C and critical at +3°C and +4°C, with medium confidence. Policy readiness is considered low to medium. This leads to an urgency score of "**precautionary**" to "**more action needed**".

Risk Severity

The risk of soil ecosystems degradation in Belgium due to soil droughts and cascading erosion impacts is likely to be ***substantial*** to ***critical*** (medium confidence). Belgium is expected to experience increased drought frequency and intensity, with extreme precipitation events and high interannual variability in rainfalls and associated erosion cascading effects becoming more likely. Under those projected climatic conditions, the changes in soil biodiversity, functional diversity and richness should be important. It would reduce soil ecosystem resilience and could lead to a long-term disturbance in soil functions and health, inducing alterations in soil ecosystem services. Those effects could have significant repercussions on other systems:

- Agricultural production and yields, as plant growth is highly dependent on plant-microbe interactions, therefore relying on the composition and diversity of soil microbial communities,

- Freshwater areas and wetlands, as run-off water carries a higher load of sediments and nutrients due to erosion, leading to a risk of eutrophication in rivers, for instance,
- Flood-prone infrastructures as soils, with reduced structure and porosity due to soil degradation, tend to have lower rainfall infiltration capacity, leading to increased runoff and substantially decreasing their resilience to severe floods.

The risk of soil degradation may therefore turn into a systemic risk.

Sensitive regions to these conditions include shallow soils and soils with low available water reserves, such as sandy soils (e.g. Campine) and those with low organic matter content. Steep slopes and conventionally cultivated cropland are more prone to erosion risk.

Confidence level

The level of confidence in the information on droughts and erosion projections for Belgium is medium. Credibility of the sources is high (peer-reviewed research). However, the quantification of impacts is lacking, in particular for Flanders and Brussels-Capital.

Policy readiness

The policy readiness for addressing the risk to soil ecosystems from drought and erosion is currently assessed as ***low***, with some elements suggesting a transition toward ***medium*** readiness. While the foundations for improved soil ecosystem management are emerging, the current policy landscape lacks coherence, long-term vision and adequate resource allocation. To move toward a more advanced level of readiness, Belgium will need to strengthen cross-sectoral coordination, harmonise soil health data and embed soil ecosystem risks more explicitly within climate and adaptation policies.

At the European level, significant progress has been made through initiatives such as the EU Soil Strategy for 2030. The proposed Soil Monitoring Law and the Nature Restoration Regulation collectively provide a strategic framework for soil protection and restoration. These are complemented by the Common Agricultural Policy (CAP), which includes measures to promote sustainable soil management.

At the regional level, Wallonia, Flanders and Brussels have launched promising initiatives, including soil quality indices, erosion control plans and nature-based solutions that contribute to improved soil resilience. However, these efforts remain fragmented and the integration of climate-specific risks, particularly those linked to slow-onset events like drought, is still limited. Monitoring tools are siloed and do not systematically capture the cascading impacts of climate change on soil ecosystems. Governance structures are dispersed across sectors and regions, with soil protection often treated as a secondary issue within broader environmental or agricultural agendas.

3.1.3. Qualitative assessment of the cluster

As shown in the previous chapters, climate change in Belgium is becoming a major threat to biodiversity and ecosystems. These climate-related risks do not occur in isolation and are intertwined with non-climatic drivers. The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) has identified the main non-climatic drivers of biodiversity loss to be land use change, overexploitation, pollution and invasive alien species (IPBES, 2019).

The analytical approach that was taken for this Belgian climate risk assessment (breaking down risks into a combination of specific climate hazard upon specific ecosystem) appeared particularly challenging in this cluster. While it allows a risk to be isolated and for some quantifications and projections, it also oversimplifies the complex interactions within and between ecosystems (Westra & Zscheischler, 2023).

The analytical approach also meant that the analysis within this cluster was limited to the impacts and effects of climate change on ecosystems (which are considered the victims of risk here). Cascading effects on human and economic clusters are considered in other chapters, respectively 3.4 and 3.5. This led to an assessment that may seem understated, particularly when applying the risk severity scale from the methodology since it combines health, economic and land indicators. It is therefore crucial to remember that this chapter should be considered additional to an assessment of the severity and urgency to act to prevent the biodiversity decline. This is regularly pointed out in reports on the status of nature conservation such as reports from the European Environment Agency and WWF's Living Planet reports.

To shift from climate-vulnerable to climate-resilient biodiversity, we must move from an interventionist nature-protection approach (with management actions targeting species goals within limited areas) to a holistic, regenerative approach that alters human activities so they embed within and enrich their local ecosystem (Andres et al., 2023; Schlaepfer & Lawler, 2023).

Ultimately, ecosystems resilience demands integrated policy responses – linking climate, energy, biodiversity, nutrition and social equity. For example, there are many inter-connections between response to climate-driven risks upon ecosystems and policies supporting the Net Zero agenda (Betts et al., 2021). In many cases, because of the multifunctionality of the natural environment and dependency on where and how the Net Zero options are implemented, there are often mixed effects on adaptation and the risks. This is the case for example in woodland planting and bioenergy, where monoculture plantations are effective for increasing the carbon sink effect and promoting the Net Zero agenda but are much more vulnerable to pests and climate extremes, such as drought and windblow (Cubelier et al., 2025). Climate adapted species can also increase forest resilience but increase invasive alien species threats.

For all the options, more knowledge is needed on their context dependency and the magnitude of their impacts and interactions. Like nature-based solutions, there can be other co-benefits or trade-offs not captured by this analysis, particularly those relating to human health and wellbeing resulting from improved or increased habitat area or possible opportunities for enjoyment of the natural environment. There is an opportunity to maximise the mitigation-adaptation synergies and minimise the trade-offs, thus turning the mitigation options into nature-based solutions. The co-benefits from nature-based solutions link to ecosystem services and to risks in other chapters, such as those relating to food security (chapter 3.2) and water scarcity (chapters 3.3 and 3.5).

3.2. Food

3.2.1. Description

The food system in Belgium encompasses a network of interconnected processes and actors involved in

- **crop production,**
- **livestock production,**
- **food processing, storage, distribution, trade,**
- **and consumption,** including considerations of **food security.**

It is shaped by a complex interplay of socio-economic, environmental and political factors, which makes it both a significant contributor to, and highly vulnerable to, climate change and ecosystems degradation. This analysis specifically examines the risks that climate change and ecosystems degradation pose to the Belgian food system. While it is widely acknowledged that the food system itself also drives environmental degradation – contributing to greenhouse gas emissions, air pollution and contamination of water sources among other sources of ecosystem disruption and ecosystems degradation – those feedback effects are beyond the scope of this assessment and are therefore not addressed in the present document.

Domestic production and trade are key pillars of food security, as they both determine the availability and affordability of food. In this context, the focus is placed on the biophysical aspects of domestic production and food safety, while the risk of food inflation resulting from disruptions in production or trade is addressed within the economic cluster of this BCRA.

Food production sub-systems are interdependent – for example, livestock feed depends on both crop production, grasslands and trade – and are closely embedded in local ecosystems, relying on soil health, water availability and biodiversity including pollinators and the soil microbiome.

Key messages

1. Climate change affects global food systems both directly – through shifts in temperature and precipitation patterns – and indirectly, by altering the occurrence and distribution of pests, weeds and diseases, as well as through its impact on energy provision and prices, which are a major determinant of food production.
2. Actions to address risks to the food system should avoid narrowly focused technical or performance-based solutions that risk exacerbating climate change and biodiversity loss. Instead, they should support a transition toward a more sustainable and resilient food system, grounded in agroecological principles.
3. Belgian crop production is increasingly at risk due to extreme weather events – such as heatwaves, droughts, excess rainfall and frosts – exacerbated by climate change. Projected climate impacts on crops could lead to major economic losses and would affect vulnerable farmers and consumers in particular.
4. Declining soil health and biodiversity, driven by intensive land use and climate extremes, are critically undermining Belgium's agricultural productivity. Soil organic carbon and matter levels are already at dangerously low levels across most agricultural lands, especially in Wallonia. Without long-term restoration, soil degradation is functionally irreversible, threatening the long-term sustainability of food production, as all soil-based ecosystem services are affected. This risk is assessed as the most severe threat to the food system.
5. Belgium's fruit sector – including apples, pears and strawberries – relies heavily on wild pollinators, whose populations are declining due to climate change, habitat loss and pesticide use. This trend threatens crop yields, quality and economic viability, especially for small and organic farmers. While honeybees are managed, they cannot fully replace the stability and efficiency of diverse wild pollinators. The risk is systemic, with potential effects on nutrition and food supply chains.
6. Climate change is expanding the range and activity of disease vectors (e.g. ticks, mosquitoes), increasing the spread of livestock diseases such as bluetongue and avian flu in Belgium. The impacts are already visible, with outbreaks costing millions in economic losses and trade disruptions. The risk is rated as ***critical*** across all warming scenarios, with heat stress further weakening animal health and increasing vulnerability to emerging pathogens.
7. Food safety in Belgium is at growing risk due to climate-driven disruptions in global agricultural production. Warmer conditions favour the growth of pathogens and toxins in food chains – such as Salmonella, Listeria and mycotoxins – while extreme heat can compromise refrigeration during transport and storage. The combined effects could lead to more frequent outbreaks, product recalls and public health threats, particularly impacting vulnerable groups and food import systems.

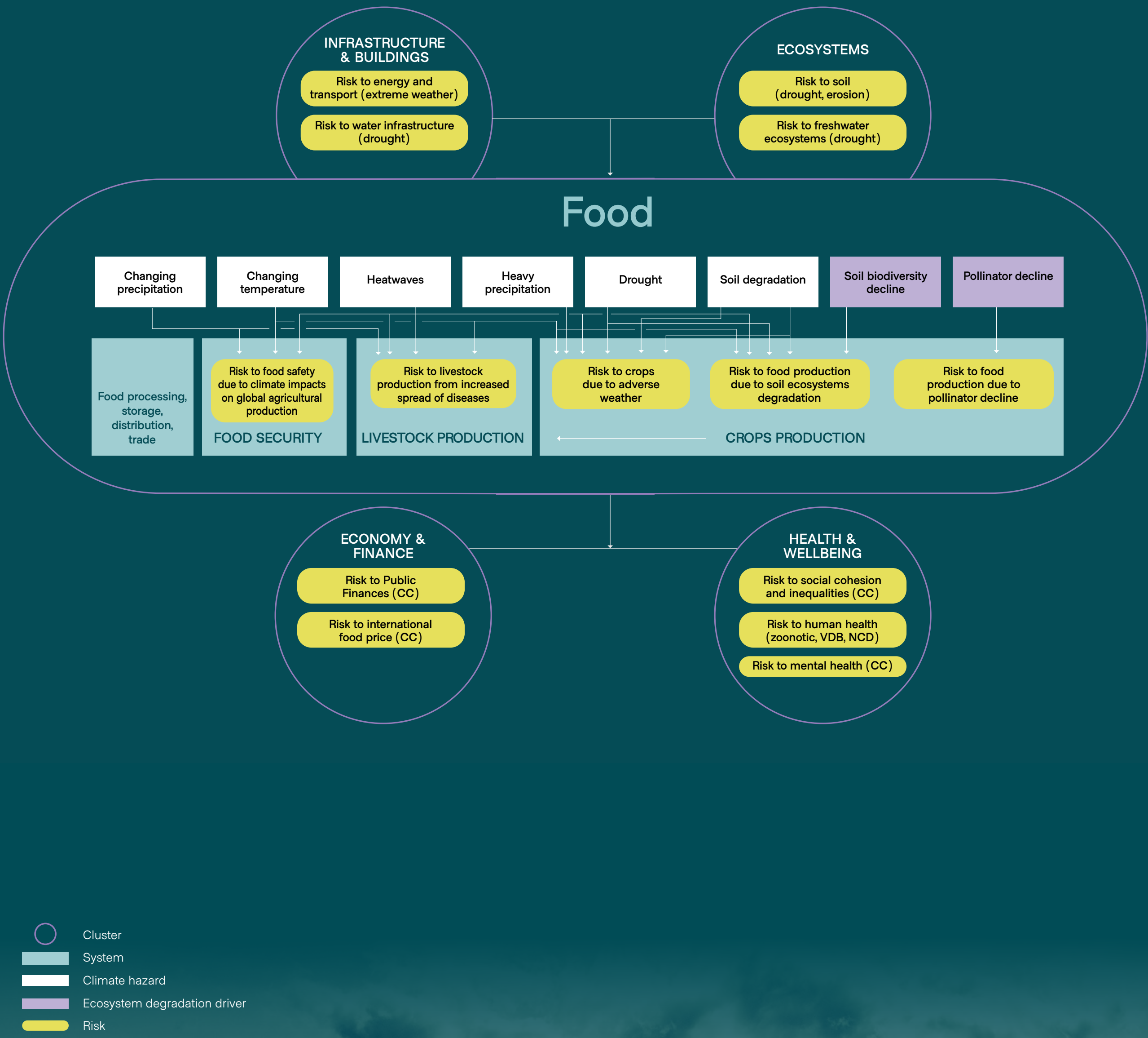

Figure 17. Food impact chain and interlinkage with other clusters

3.2.2. Risk assessment factsheets

Table 5. Summary of risk assessments for "Food" cluster

Climate risk	Urgency to act	Risk severity			Policy characteristics	
		2°C	3°C	4°C	Policy readiness	Risk ownership
Risk to **crops** due to **adverse weather conditions**	Urgent action needed	+ + +	+ +	+ +	Low	Regional
Risk to **food production** due to **soil ecosystems degradation** (ecosystems degradation)	Urgent action needed	+ + +			Medium	Regional
Risk to **food production** due to **pollinator** decline (ecosystems degradation)	Precautionary action needed	+ +			Advanced	Regional
Risk to **livestock** production from increased spread of **diseases**	More action needed	+ +	+	+	Medium	Regional
Risk to **food safety** due to climate impacts on **global** agricultural production	Precautionary action needed	+	+	+	Medium	Federal

Urgency to act

- Urgent action needed
- More action needed
- Precautionary action needed
- Enhance vigilance
- Operationalise existing policies

Risk severity

- Catastrophic
- Critical
- Substantial
- Limited

Confidence

Low: +
Medium: + +
High: + + +

RISK TO CROPS DUE TO ADVERSE WEATHER CONDITIONS

Description

The risk concerns reduced yield and quality of Belgian crops due to adverse weather conditions intensified by climate change. This includes heatwaves, drought, excess rainfall, flooding and frost events, all of which affect crop productivity depending on timing and crop type.

Belgium's agricultural land is mainly used for pasture and fodder crops (over 55%), with the rest for cereals (23.7%), industrial crops like potatoes and sugar beets (13.6%) and horticulture (5.1%). While only a fraction of production is consumed domestically, the Belgian food industry processes ~60% of local production, linking crop risks to broader economic sectors including exports and employment.

Climate change affects agricultural productivity through multiple, sometimes opposing, mechanisms (heat and drought stress or excess rainfall and flooding) that can reduce yields or delay harvests, while elevated CO_2 concentrations and longer growing seasons may temporarily enhance productivity for some crops in quantity but may have a negative impact on crop quality.

Crops such as maize, potatoes, wheat and sugar beet have been used to illustrate these dynamics in Belgium, as they occupy large areas and are well documented. For instance, maize shows declining suitability under warming scenarios due to water stress, while potatoes may benefit from increased CO_2 in some models, yet remain highly vulnerable to extreme precipitation and disease pressure. Sugar beet tends to respond positively across all warming scenarios in terms of average yield potential but remains at risk of total yield failure in certain years due to extreme weather events, particularly drought or waterlogging. These examples highlight the uncertainty and non-linearity of climate impacts, with yield losses not only depending on average climate trends but also on year-to-year extremes, regional variability and local agronomic conditions.

Urgent action is needed on this risk as the severity is considered ***critical*** with ***high*** confidence and policy readiness is assessed as ***low***.

Risk Severity

The severity rating is:

- ***Critical*** at +2°C warming, due to widespread negative yield trends and economic exposure.
- ***Substantial*** at +3°C and +4°C, where CO_2 fertilisation may improve average yields but increase volatility and risk of crop failure.

Several key elements underline the severity of climate-related risks to crop production in Belgium. Empirical evidence from past events – such as the 2016 wheat failure in France – and Belgium-specific modelling (Lacroix et al., 2025) confirm that significant yield losses are already occurring. Certain crops, notably maize, consistently exhibit negative yield trends across all warming scenarios, highlighting their particular vulnerability. Economic projections about potato production estimate annual losses ranging from €43 million to over €140 million at +2°C, with even greater impacts anticipated at higher temperature increases. Beyond primary production, the broader agri-food sector is highly exposed with Wallonia's food industry generating ten times more added value than agriculture itself and employing approximately 25,000 people directly. These compounding factors place considerable pressure on farmers' livelihoods, to the point where public compensation mechanisms have become a routine necessity in managing losses from adverse weather events.

Climate-related impacts on crop production have important social consequences, disproportionately affecting small-scale farmers and migrant labourers, who often have limited adaptive capacity and fewer financial resources to cope with yield variability and economic shocks. In parallel, reduced agricultural output contributes to food price inflation, which can undermine access to healthy and affordable diets – a concern that already affects 15 to 20% of the Belgian population (Sciensano, 2024). As these pressures intensify, the demand for food assistance is likely to grow, with 209,000 people already relying on food banks in 2024, a figure expected to rise if climatic impacts on food systems are not adequately addressed.

The spatial distribution of the risk can be described as follows:

- Flanders (especially in central and southeastern regions) shows significant declines in land suitability for maize and potatoes due to rainfall extremes and soil moisture trends.
- The Jurassic zone in Wallonia appears particularly vulnerable to yield reductions across all major crops.
- In contrast, elevated areas like the Ardennes may experience marginal improvements due to increased thermal availability.

Confidence Level

The confidence level depends on the envisaged global warming level:

- ***High*** confidence at +2°C due to convergence in crop-specific models and multiple lines of evidence.
- ***Medium*** confidence at +3°C and +4°C because of divergence in model predictions and unaccounted biotic factors like pests and diseases.
- Additional uncertainty arises from limitations in model coverage and exclusion of soil degradation or pest evolution in simulations.

Policy readiness

The policy readiness for addressing the risk to crop production from adverse weather conditions in Belgium is assessed as ***low***. The current policy landscape remains fragmented, under-resourced and lacks targeted or coherent policies specifically addressing crop resilience. Existing policies are insufficiently aligned with the scale and urgency of the climate risks facing crop production.

While data collection and monitoring systems provide valuable data, these tools are primarily used for tracking production trends and market dynamics rather than informing proactive adaptation strategies. The absence of meta-analyses, scenario planning and coordinated risk assessments undermines the capacity to anticipate and respond to climate-induced threats to crops.

At the EU level, the Common Agricultural Policy (CAP) offers a strong financial and regulatory framework. However, this instrument is still largely geared toward supporting short-term productivity and income stability, rather than building resilience to climate shocks and crop resilience is often treated indirectly and is insufficiently operationalised in existing policies. Environmental requirements under the CAP, including good agri-environmental conditions (GAECs) and statutory management requirements (SMRs) (rules on public, animal and plant health, animal welfare and the environment), do not explicitly address climate-induced risks to crops. Moreover, existing measures, such as eco-schemes, agri-environmental climate measures remain fragmented and are often voluntary, with limited binding obligations or long-term vision. Recent revisions to the CAP have further diluted environmental ambitions in favour of economic flexibility. The EU is currently debating a new regulation on new genomic techniques (NGTs) which could enhance crop resilience to drought and pests, though their adoption remains controversial both because of the uncertainties concerning the long-term environmental and health impacts and because of the further concentration of power it may lead to.

In Belgium, agricultural policy is regionalised, with both Wallonia and Flanders implementing CAP Strategic Plans and additional initiatives. Yet these policies lack crop-specific adaptation measures and the shift toward risk mitigation remains marginal. Alternative regional initiatives in the field of water management and spatial planning show promise but they remain constrained by administrative complexity and limited integration with agricultural policy. Direct targeting of crop losses due to adverse weather is in place through various risk management mechanisms, such as the Walloon Calamity Fund and the Flemish subsidised insurance model, which offer valuable protection but vary significantly between regions.

More broadly, existing agricultural policies continue to favour a productivist model, reinforcing short-term output rather than promoting long-term adaptive capacity. A systemic transformation of farming practices and cropping systems is required to ensure resilience, shifting from incremental sustainability tweaks to deep adaptation capable of withstanding increasingly frequent and severe climate disruptions.

RISK TO FOOD PRODUCTION DUE TO SOIL ECOSYSTEMS DEGRADATION

Description

The risk is defined as the potential reduction in crop yields and quality due to soil erosion and degradation (quality and fertility) following soil biodiversity decline, which supports healthy and high-quality soils.

A large share of Belgium's agricultural land being devoted to forage crops and horticulture, food production in Belgium is highly dependent on soil ecosystem services (ESS), including nutrient cycling, water regulation and pollutant filtration. Many of these ESS rely on essential soil processes maintained by soil biodiversity, such as organic matter decomposition, increasing nutrient availability, pathogen control and soil structure – all being critical for sustaining crop yields and mitigating environmental risks.

The functions and ESS provided by soil biodiversity for agricultural production and food supply rely on soil health and quality. Soil health is determined by its physical, chemical and biological properties, all of which are interlinked with soil biota.

However, soil degradation, soil biodiversity decline and their drivers threaten soil health and fertility. The decline in soil microbial, mesofaunal and macrofaunal biomass and biodiversity limits biological processes such as organic matter decomposition, nutrient cycling, soil aeration and improvement of aggregate stability. At the same time, soil degradation and erosion processes not only disturb soil functions and ecosystem services but also further impact soil biological processes, soil biota and resilience.

This ultimately impairs soil health and fertility, although this negative effect is often masked by external inputs such as fertilisers, which sustain yields temporarily but do not restore soil functions. Furthermore, soil degradation and biodiversity loss reinforce each other in a feedback loop, thereby intensifying vulnerabilities in agroecosystems. Drivers of soil degradation and biodiversity loss include anthropogenic factors, such as intensive farming and reliance on monocropping schemes, heavy machinery, land-use change, urbanisation and their harmful effects, such as soil erosion, SOM and SOC decline, nutrient imbalance, acidification, soil compaction and sealing, and soil pollution.

The severity of the risk is assessed as ***critical***, with a ***high*** level of confidence. However, in the context of climate change and increasingly frequent extreme weather events – both of which exacerbate threats to soil – the risk tends toward a ***catastrophic*** classification. Policy readiness, by contrast, is rated as ***medium***. Consequently, the overall urgency of this risk is determined as "urgent action needed", especially as the dependency level of crop production on soil health, fertility and biodiversity is critical and as soils play a central role in the context of resilience and mitigation to climate change.

Risk Severity

The level of dependency of crop production in Belgium to soil ESS is ***critical***, as a major part of these ESS are essential for agricultural production. Soil degradation and the loss of soil biodiversity could severely impact food production, since substitutes such as fertilisers and irrigation cannot fully replicate the functions fulfilled by soil biodiversity. The risk severity tends toward a ***catastrophic*** classification in the context of climate change.

Projections from Wallonia indicate a significant decline in soil-related ecosystem services due to climate change, especially through increased drought and temperature stress. This decline threatens key provisioning services including food production, forage supply and livestock farming. While some crops such as potatoes might temporarily benefit from CO_2 fertilisation effects, major crops such as maize and orchard fruits are expected to suffer considerable yield losses due to drought sensitivity. However, the impacts of soil biodiversity loss and other degradation factors on ecosystem service provision remain insufficiently studied.

In line with EU trends, Belgian soils show alarming declines and generalised low levels in soil organic carbon (SOC) and soil organic matter (SOM), which serve as proxies for soil biodiversity and overall soil health, as it directly influences microbial activity, diversity and biomass, nutrient retention, soil structure and resilience to soil degradation. In Wallonia, nearly 90% of arable soils have critically low SOM levels, with an average SOC content far below healthy thresholds. SOC levels have declined by 20% since the mid-20th century, with recent decreases particularly marked in key agricultural regions. Permanent grasslands are also experiencing SOC decline. In Flanders, arable lands, which cover a large portion of the territory, show lower SOC stocks per hectare than forest and grasslands and therefore remain vulnerable. This decline alters soil structure, fertility, carbon storage and water regulation, increasing vulnerability to further degradation.

Soil erosion and degradation, exacerbated by climate change-induced extreme weather events, represent additional critical threats to soil biodiversity and related ESS. Increased erosion risk in different global warming scenarios results in loss of nutrient-rich topsoil layer, disruption of nutrient cycles and exposure of less fertile subsoils. In Wallonia, 57% of agricultural soils face unsustainable erosion, while in Flanders tens of thousands of hectares of farmland are at high erosion risk, especially on slopes and with erosion-prone crops like maize. Soil texture, topography, land use and management practices strongly influence erosion rates. Soil degradation is functionally irreversible on human timescales without long-term restoration measures, as processes such as erosion, organic carbon loss and biodiversity decline progressively undermine soil resilience, with recovery potentially taking centuries or even longer – rendering it effectively irreversible for practical purposes. The combined effects of soil degradation and biodiversity loss threaten the long-term sustainability of Belgian agriculture, as all soil-based ecosystem services are affected, with profound environmental, economic and food security implications at local and national scales.

Confidence level

The level of confidence in the information used to assess this risk severity for Belgium is ***high***. Credibility of the sources is high (peer-reviewed research) and their utility is medium (mostly recent papers but not all specific to Belgium). However, latest updates show low SOC levels across Belgium and the scientific community and literature strongly agrees on the critical role of soil biodiversity for soil-based ESS, soil health and therefore crop production.

Policy readiness

Belgium's policy readiness to address soil degradation risks to food production is best described as ***medium***. The country operates within a strong EU policy framework, including the Common Agricultural Policy (CAP), the Sustainable Use of Pesticides Directive and the forthcoming Soil Monitoring Law. Belgium has adopted many of these policies into regional policies, with Wallonia and Flanders notably implementing their own CAP Strategic

Plans. While these include eco-schemes, agri-environment climate measures and support for organic production, they also link farmers to a system of agricultural subsidies that rewards economies of scale and monocropping schemes and generally are considered unsupportive of a genuine transition to agroecology. At the regional level, Flanders and Wallonia have also developed a range of soil monitoring tools, such as erosion maps or the soil passport.

Despite these efforts, monitoring remains fragmented with significant variations between regions and comprehensive, standardised soil health data is lacking. Moreover, inconsistent compliance with existing regulations remains an issue as the enforcement of existing agro-ecological policies depends largely on non-binding and voluntary measures or is subject to exemptions. Recent regulatory easing at the EU level has further reduced the ambition of existing soil protection policies. Furthermore, soil-related risks, especially those arising from erosion and pollution, are compounded by short-term land leases and agro-industrial practices, which limit incentives for long-term soil stewardship. Political pressures and weak enforcement continue to undermine progress, preventing Belgium from fully addressing the risk that soil degradation poses to food production.

RISK TO FOOD PRODUCTION DUE TO POLLINATOR DECLINE

Description

Belgium's crop production system is a vital part of its food system, contributing significantly to domestic food availability, economic activity and regional rural livelihoods. The country produces a variety of crops, including cereals, vegetables and notably fruits such as apples, pears and strawberries. These fruit crops are particularly dependent on animal pollination for yield and quality. While Belgium is not self-sufficient in all categories, it is a net exporter of some key pollinator-dependent fruits – especially apples and pears – making pollination services critical for both domestic consumption and trade. The system also supports associated sectors such as food processing and agrotourism.

The decline of pollinators – especially wild bees – is driven by multiple interacting stressors: climate change, habitat fragmentation, intensive agriculture, pesticide use, invasive species and pathogens. In Belgium, data shows a significant reduction in the distribution and abundance of wild bee species. Although honeybees remain present due to beekeeping, wild pollinators are more effective for certain crops and their decline leads to less stable and lower-quality pollination services. Climate change is expected to exacerbate this hazard, notably through increased heatwaves and phenological mismatches between plants and pollinators. Southern Europe is seen as a hotspot, but Belgium is not exempt, especially in agricultural regions with low floral diversity and limited semi-natural habitat.

The reduction in pollination services poses a critical risk to crop production in Belgium, especially for fruit sectors that are highly dependent on wild pollinators. Yield losses, reduced quality and increased variability in production are likely outcomes, with potential revenue losses for farmers and the agri-food sector. The effects could also ripple into food prices, dietary diversity and nutrition security, especially concerning access to fresh fruit. Small-scale and organic producers, who are more reliant on ecosystem services and less able to substitute with managed pollinators or technical inputs, are especially vulnerable. The risk is considered systemic and long-term, as current declines are expected to continue or worsen without intervention.

Precautionary action is needed as the severity level is assessed as ***critical*** with ***medium*** confidence and advanced policy readiness.

Risk Severity

The Belgian food system has limited direct economic dependency on pollination services overall, as most domestic crop production – such as cereals, fodder and industrial crops – is not dependent on pollinators. However, certain high-value fruit sectors, notably apples, pears and strawberries, are strongly reliant on pollination, particularly by wild pollinators. These crops contribute to both domestic consumption and exports. In addition, Belgium relies heavily on imports of other pollinator-dependent products – such as tropical fruits, nuts and some vegetables

– which creates indirect vulnerabilities to pollinator decline in other regions, potentially affecting food diversity and availability. Beyond these immediate risks, pollinator decline also undermines the potential for a sustainable transition of the food system, since many agroecological approaches and diversification strategies depend on healthy pollinator populations. In this sense, a reduction in pollinators not only threatens current production models and consumer choice but also creates additional obstacles to shifting toward more resilient and pollinator-dependent forms of agriculture, thereby amplifying the long-term vulnerability of the system.

The severity of the risk posed by pollinator decline to Belgium's food system is therefore assessed as ***critical.*** This evaluation is based on:

- High ecological dependency of key Belgian fruit crops – such as apples, pears and strawberries – on animal pollination, primarily by wild pollinators.
- Documented declines in wild pollinator diversity and abundance in Belgium, with national red lists confirming negative trends in many bee species.
- Evidence that wild pollinators provide more stable and efficient pollination services than managed honeybees for many crops, especially in complex landscapes and under variable climatic conditions.
- The limited substitutability of pollination services – managed bees cannot fully replace the contribution of diverse wild pollinator communities, particularly for certain fruit varieties and flowering periods.
- The systemic nature of the risk, as pollinator loss affects not only crop yield and quality but also associated agri-food chains, rural incomes and long-term ecosystem stability.

Current observations already show reduced pollination reliability and increased yield variability in some regions. Under climate change scenarios (e.g. +1.5°C to +3°C), risks are projected to intensify, due to stronger pressures on pollinators from heatwaves, droughts and mismatches between flowering and pollinator activity. These changes could lead to declines in productivity and quality of pollinator-dependent crops and greater income volatility for farmers.

Fruit-growing regions, where habitat fragmentation, intensive agriculture and pesticide use coincide, are particularly vulnerable. Areas with low floral diversity and few semi-natural habitats are especially exposed to pollinator losses and insufficient pollination services.

The impacts are not evenly distributed. Small-scale and organic farmers are more exposed, as they rely more directly on ecosystem services and typically have fewer technical and financial means to compensate for declining pollination. Consumers may also face reduced access to fresh, nutrient-rich fruits, with possible implications for nutrition and food equity over the longer term. Rural communities dependent on fruit production for employment and local economies are at elevated risk.

Confidence Level

There is a strong consensus on the direction of risk – pollinator decline will worsen outcomes for agriculture and biodiversity. However, the magnitude of the economic and health impacts in Belgium remains uncertain, due to limited quantitative studies linking pollinator decline directly to crop losses, income reductions or health effects. Most available data is qualitative or extrapolated from broader European assessments. The overall confidence is ***medium***, reflecting high credibility of sources but limited data specificity for national-scale severity assessment.

Policy readiness

The policy readiness for addressing the risk of pollinator decline in Belgium is assessed as ***advanced***. This reflects the existence of a comprehensive and multi-level policy framework, supported by both European and national initiatives, but also acknowledges gaps between policy commitments and effective implementation. Continued efforts are needed to ensure comprehensive monitoring, coordination and effective implementation. Bridging data gaps and ensuring that planned actions translate into measurable outcomes will be key to strengthening long-term pollinators resilience and food security.

At the European level, instruments such as the EU Biodiversity Strategy for 2030 (2020), outlining the revision of the EU Pollinators Initiative (2023) and the adoption of the Nature Restoration Law (2024) provide a robust policy backbone, setting binding targets to reverse pollinator decline by 2030. These are complemented by the development of the EU Pollinator Monitoring Scheme (EU PoMS), which aims to standardise and improve data collection across member states, including Belgium. The Common Agricultural Policy (CAP) also integrates biodiversity and pollinator-related objectives, although its effectiveness continues to be debated, particularly regarding support for agroecological practices.

At the national level, Belgium has adopted the National Pollinator Strategy 2021-2030, which outlines ambitious targets and a holistic approach across federal and regional levels. Regional strategies and action plans further reinforce this commitment. However, implementation remains unclear, with notable gaps in evaluation and enforcement. The presence of dedicated governance structures (e.g. the Federal Task Force on Pollinators), targeted funding (e.g. CAP support for beekeeping) and ongoing methodological development (e.g. EU PoMS under STING and STING+ projects) all contribute to a relatively high degree of readiness.

Nevertheless, systemic contradictions within agricultural and food policy frameworks continue to hinder progress toward ecological sustainability and resilience. Current policies often prioritise maintaining or increasing agricultural productivity, which paradoxically exacerbates the drivers of pollinator decline. This tension between productivity-driven incentives and ecological sustainability undermines the effectiveness of existing policies. The challenge for pollinators decline is to adapt production practices from producing more to producing better, ensuring ecological sustainability, fair farmer incomes and affordable access to healthy diets for all.

RISK TO LIVESTOCK PRODUCTION FROM INCREASED SPREAD OF DISEASES

Description

Climate change is increasing the risk of livestock diseases in Belgium and across Europe through several mechanisms. Rising temperatures and changing precipitation patterns are altering the distribution, abundance and activity of vectors such as ticks, mosquitoes and midges, facilitating the spread of diseases like bluetongue. These changes also impact on animal physiology, leading to weakened immune systems and higher susceptibility to infection. Additionally, shifts in wildlife migration and plant pathogen dynamics (e.g., increased mycotoxins in feed) further complicate disease transmission.

At the European level, the CLEFSA project (CLimate change and Emerging risks for Food SAfety) and EFSA (2020) have highlighted 30 climate-sensitive health issues, most notably vector-borne diseases, as likely to become more prevalent with climate change. In Belgium, the livestock sector is characterised by high animal density and increased specialisation, which elevate vulnerability to disease spread.

Several diseases are already present (e.g., bluetongue, avian influenza, Q fever) and others – such as Rift Valley fever and *peste des petits ruminants* (PPR) – pose a potential threat. High-intensity rainfall, warmer winters and extreme heat events are expected to exacerbate disease conditions and increase reliance on veterinary drugs, raising concerns over antimicrobial resistance and food safety. The complexity of the issue does not allow for predicting all new diseases that could emerge in Belgium.

More action is needed on this risk as the severity is considered ***critical*** and policy readiness ***medium***, with a confidence level ranging from ***medium*** to ***low***.

Risk Severity

The risk to livestock production from the increased spread of diseases has been assessed as ***critical*** under all global warming levels (2°C, 3°C and 4°C). This rating is based on both current evidence of economic disruption and expected future vulnerability due to climate change.

The main elements leading to the severity score are:

- **Historical and ongoing outbreaks**: Belgium has already faced significant economic consequences from disease outbreaks. The 2018 African swine fever (ASF) episode – despite not affecting domestic pigs – led to export restrictions, a 50% drop in total pork export value and losses of €3.2 million per week for the sector. Avian influenza outbreaks have been persistent since 2020, affecting commercial and wild populations and raising concerns due to its zoonotic nature. Bluetongue is now endemic, with thousands of hotspots and over €17 million in public support provided in Wallonia in 2024 alone. These figures underestimate the true economic impact of disease outbreaks, as they don't include indirect costs, downstream effects on processing and trade or shifts in market dynamics.
- **Heat stress**, a quantifiable indicator of future vulnerability, is expected to grow. Under a +4°C scenario, pigs could face over 30 days at risk of death per year (compared to 0 to 5 today), while ruminants and poultry would experience widespread moderate to severe stress, compounding disease susceptibility and reducing productivity.

Spatial data shows that Flanders, particularly the provinces of East Flanders and Antwerp, are most at risk due to high livestock density and concentration of farms. For avian flu, high-risk zones include areas near major rivers, coastal zones, Ghent and Antwerp, which attract large populations of wild waterfowl and migratory birds.

In terms of social vulnerabilities, farm workers face increased risk of exposure to zoonotic pathogens through contact with infected animals, particularly in outbreaks of avian flu, Q fever, brucellosis and others. The general population is also at risk from food-borne pathogens (e.g., *Salmonella, E. coli*, antimicrobial-resistant bacteria) via contaminated animal products. Vulnerable groups such as children, the elderly and immunocompromised individuals are especially at risk. Additionally, the broader agri-food sector – which supports tens of thousands of jobs – is exposed to cascading economic impacts, particularly in high-export sub-sectors.

Confidence Level

The overall confidence in the severity assessment is ***medium*** at 2°C warming and ***low*** for higher warming levels. This reflects:

- Strong consensus on qualitative trends (e.g., increased disease emergence)
- Moderate availability of data for current impacts
- Limited quantitative projections for specific future disease dynamics

Only a few studies, such as (Hempel et al., 2019), offer numerical estimations related to heat stress, which serves as a proxy for increased vulnerability to infections.

Policy readiness

While a coherent policy framework is currently in place, it is not yet adapted to the evolving nature of climate-related disease risks. Greater integration of climate foresight, structural financing and cross-sectoral coordination is needed to address future challenges effectively and enhance resilience in the livestock sector. For these reasons current policy readiness is best characterised as ***medium***.

Belgium has a well-established legal and institutional framework for monitoring and responding to livestock diseases, supported by robust digital tools (ADIS, TRACES, SANITEL) and centralised agencies such as the FASFC and Sciensano. The EU Animal Health Law and national legislation provide a solid basis for disease surveillance and control, while the federal sanitary fund offers structural financial support for regulated outbreaks. However, the system remains largely reactive and is not sufficiently equipped to anticipate or manage emerging threats linked to climate change.

Vaccination campaigns are launched on an ad hoc basis and lack structural financing, while budgetary constraints and human resource shortages, particularly among veterinarians, undermine long-term resilience. The integration of livestock health into agricultural policies, notably the CAP, is limited and lacks targeted measures for climate-related disease risks. Awareness-raising efforts and technical support for farmers are also insufficient.

RISK TO FOOD SAFETY DUE TO CLIMATE IMPACTS ON GLOBAL AGRICULTURAL PRODUCTION

Description

This risk focuses on food safety – protecting consumers from hazards like pathogens, contaminants and toxins in food – as opposed to food security (which deals with food availability and access). Climate change is undermining food safety worldwide by creating conditions that favour contamination. Rising ambient temperatures and shifting moisture patterns provide more conducive environments for foodborne pathogens and toxin-producing organisms. For example, warmer and more humid climates boost bacteria such as *Salmonella* and *Listeria* and are expanding the range of mould species that produce mycotoxins (e.g. aflatoxins) into regions like Belgium that were previously too cool. More frequent and intense heatwaves put strain on food refrigeration ("cold chains"), sometimes breaking temperature controls and allowing bacteria to proliferate during storage and transport. Additionally, water scarcity and drought can degrade water quality – farmers may resort to lower-quality water sources for irrigation and processing – and increased pest pressures can lead to heavier pesticide use, raising the risk of chemical contaminants (such as heavy metals, PFAS or pesticide residues) entering the food chain. All of these climate-driven factors compound to threaten the sanitary integrity of the food supply.

The consequences of these compounded food safety hazards are far-reaching. In extreme cases, climate-induced contamination and spoilage can lead to widespread foodborne illness, product recalls and losses of edible food. Supply chain disruptions and safety scares tend to erode consumer confidence and can drive up food prices, exacerbating food insecurity for low-income households. Global trade is also sensitive to food safety issues – if exporting regions suffer climate-related outbreaks of plant or animal diseases, or fail to meet strict standards, importing countries like Belgium could impose border rejections or bans. In this way, climate change impacts on agriculture abroad can translate into domestic food safety risks for Belgium, intertwining with food security concerns (e.g. greater reliance on imports or prolonged storage may further increase contamination risk). Overall, climate change adds a new layer of risk to maintaining safe food, by intensifying biological and chemical hazards throughout the global supply chain.

The risk severity score is considered ***critical*** at all global warming levels with ***low*** confidence. Policy readiness is considered ***medium***. This leads to an urgency score of "precautionary action needed".

Risk Severity

The severity of climate-related food safety risks is assessed as ***critical*** under current and future warming scenarios. This classification reflects the potential for system-wide disruptions to public health and the food sector, even though precise quantitative data is lacking. Multiple climate-driven factors – from heatwave-induced cold chain failures to accelerated pathogen growth and expanding mycotoxin contamination – could act together to cause widespread food safety failures. The baseline burden from unsafe food is already substantial (around *600 million illnesses and 420,000 deaths globally per year* from foodborne diseases) and warming is expected to further increase the frequency and intensity of outbreaks (e.g. more frequent *Salmonella* and *Listeria* incidents under warmer conditions). In economic terms, climate-induced spoilage and contamination events can trigger expensive recalls, trade interruptions and productivity losses. The ***cascading effects*** – direct public health impacts, high costs (e.g. energy strains on refrigeration) and knock-on disruptions in trade and consumer trust – all underpin the evaluation that this risk is critical. However, it should be noted that without country-specific metrics or damage estimates, this critical rating entails some uncertainty and is based on qualitative evidence.

Certain groups in society are especially vulnerable to food safety problems exacerbated by climate change. People with weaker immune systems or health conditions – including children and the elderly – face higher risks from foodborne pathogens and would suffer more severe consequences from contaminated food. Low-income households are also at risk, as they have less capacity to cope with rising food prices or to invest in adaptive measures (e.g. extra cooling equipment at home to limit risk of contamination)

Confidence Level

There is broad scientific agreement that climate change heightens food safety risks (multiple rigorous studies and reports document the mechanisms involved). The evidence base includes large-scale qualitative assessments (e.g. an EFSA study on emerging risks) that consistently describe how warming, humidity and other climate shifts disrupt food safety controls. However, the absence of quantitative data – such as measured increases in contamination rates, the health burden in Belgium or economic loss estimates – severely limits our ability to gauge the exact magnitude of the risk. Little information is specific to Belgium's context and no standardised metrics exist yet to compare this risk against others. As a result, despite generally strong evidence that the hazard exists, the uncertainty is high in terms of the size of the impact. Therefore, the overall confidence level assigned to this climate-related food safety risk assessment is ***low***, reflecting the gaps in data and the speculative nature of estimating its severity for Belgium.

Policy readiness

The policy readiness for food safety risks linked to climate impacts on global agricultural production is assessed as ***medium***. While the existing policy framework is solid for current risks, there remain limitations in flexibility, international coordination and anticipatory capacity. Strengthening forward-looking surveillance, harmonising standards across the chain and reinforcing international cooperation will be essential to improve preparedness for climate-driven food safety threats.

Belgium and the EU benefit from a robust and well-established legal framework that effectively addresses known food safety risks. Instruments such as the General Food Law Regulation (Regulation 178/2002) and related legislation provide clear structures for surveillance, control and response. Tools like EFSA's scientific assessments, the Food Safety Barometer and the Rapid Alert System for Food and Feed (RASFF) contribute to a strong monitoring culture and have proven effective in managing regulated pathogens and preventing crises.

However, the current system remains largely reactive and insufficiently equipped to address emerging risks driven by climate change. Monitoring frameworks are slow to adapt, with limited coverage of emerging pathogens. International cooperation is fragmented and the absence of a global equivalent to the EU surveillance systems weakens early detection capacities for threats originating outside the EU. Additionally, uneven levels of awareness and control across the food chain creates blind spots in traceability and risk mitigation. External pressures, including trade liberalisation and geopolitical tensions, further challenge the EU's ability to maintain high standards, potentially undermining long-term resilience.

3.2.3. Qualitative assessment of the cluster

As shown in previous chapters, climate change and ecosystems degradation increasingly threaten the foundations of our food systems. In Belgium, as elsewhere, agriculture – particularly conventional, intensive models – faces growing challenges from rising temperatures, prolonged droughts, water scarcity and soil degradation and biodiversity loss. While some crops may temporarily benefit from warmer conditions, others are already at greater risk (EEA, 2023). Moreover, the decline in essential ecosystem services – including pollination and soil fertility – further jeopardises food production. Seeking to increase production at all costs or to maintain existing yields-per-hectare regardless of the long-term consequences, will not provide solutions. Quite to the contrary – ecosystem services are increasingly degraded by intensive farming practices and land-use pressures (IPBES, 2019).

These climate-related risks do not occur in isolation. Food systems are deeply intertwined with non-climatic drivers such as fossil energy dependence and trade vulnerabilities, both threatened by geopolitical instability. The war in Ukraine, for example, led to speculation on food and energy markets that exacerbated the increase of food and energy prices, revealing the fragility of global food supply chains and the consequences of overdependence on imported grains and fertilisers (FAO et al., 2022). Intensive agriculture's reliance on oil and gas – for machinery, synthetic fertilisers, food processing, storage, transport and packaging – increases food systems' vulnerability to energy price spikes (IEA, 2021). Reducing this fossil fuel dependence is key to resilience.

Climate impacts abroad also threaten Belgium's food imports and contribute to rising food prices at home. This can exacerbate food insecurity and social inequalities, especially for low-income households (IPCC-AR6, 2022).

The root causes of both current and future food insecurity include diets dominated by animal-based and processed products, environmental degradation driven by industrial agriculture, widespread food waste and the decline of small-scale farming systems in an increasingly competitive environment (Gerten et al., 2020; HLPE, 2020). Against this background, it is evident that the prevailing food system is undermining its own long-term viability and requires structural transformation. Nonetheless, for the purpose of this analysis, assuming no major systemic changes, Belgium's ability to produce sufficient food – both in terms of quantity and quality – is expected to decline, as demonstrated by multiple studies projecting reduced yields for the country's key crops.

To shift from vulnerability to resilience, food systems must move away from narrow efficiency models toward diversified, agroecological farming. Agroecological systems – integrating trees, crops and animals – can stabilise yields, reduce input dependency and promote soil health (Altieri et al., 2015). They also offer health and social benefits – lowering pesticide exposure, cutting emissions and supporting local economies through shorter supply chains, while providing high quality food products. Scenarios exist showing that the European Union can transition to agroecology, provided a shift is made to more plant-based diets (See IDDRI, *Ten Years for Agroecology in Europe*).

Long-term strategies are needed. Short-term solutions that boost productivity (e.g. monocultures or heavy irrigation) can undermine sustainability over time by accelerating soil erosion and biodiversity loss. Instead, resilience must be built gradually over a 10-15 year timeline, with support for mixed farming, better rainfall capture and ecological restoration (IPCC-AR6, 2022).

On the demand side, transitioning to healthy, sustainable diets and reducing food waste can relieve pressure on food production while improving public health outcomes (Willett et al., 2019).

Ultimately, food systems resilience demands integrated policy responses – linking climate, soil, water, energy, biodiversity, nutrition and social equity. Farmers themselves are among the first victims of climate inaction. Building more resilient, just and sustainable food systems is thus a shared societal imperative.

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3.3. Infrastructure & buildings

3.3.1. Description

The Infrastructures and Buildings system encompasses a complex set of interrelated sub-systems vital to Belgium's societal functioning. These include:

- **Buildings** (residential, commercial, industrial, public and heritage)
- **Urbanisation and green-blue infrastructure** (parks, water bodies, urban vegetation)
- **Key infrastructures** (energy, water, transport, ICT networks incl. data & telecom)
- **Mobility systems** (roads, railways, ports, airports)
- **Water systems** (supply, wastewater treatment, drainage)
- **Energy systems** (generation, transmission, conversion, storage)

The classification is aligned with EUCRA sectoral definitions and further adapted in the BCRA framework to allow a granular (i.e., by subsystem) assessment of climate and ecosystems degradation-related impacts.

While the focus was on those risks deemed most impactful and best documented within the available resources (Cerac, 2025), several known or emerging risks were not prioritised at this stage. For instance, storm- and wind-related impacts were excluded due to the relatively low confidence in the impact of climate change on these hazards.

As for key infrastructure, the initial scope – which broadly encompassed various infrastructure domains – was subsequently narrowed to energy and transport systems, as these areas provided the most robust literature and evidence base.

In the case of flooding, the assessment of severity focused on non-monetary impacts, since the analysis. This is because the analysis of the 'Risk to property insurance markets due to flooding' (see chapter 3.5.2) already covers economic aspects. Similarly, the water scarcity risk was restricted to civil and domestic use, with the impacts on agriculture and industry addressed in other assessments – specifically 'Risk to industry from water stress' (see chapter 3.5.2) and Risk to crops due to adverse weather conditions (see 3.2.2).


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Key messages

1. Flooding, pluvial and fluvial as well as rising sea levels, emerge as a major hazard across multiple subsystems, significantly threatening key infrastructures and buildings in Belgium.
2. Key climate and biodiversity risks to infrastructure include physical damage from floods, structural degradation due to changing moisture regimes and invasive alien plant species such as Japanese knotweed causing costly maintenance issues and structural weaknesses.
3. Transport and energy infrastructure faces compounded risks from extreme heat, flooding and drought. Heatwaves impact energy production efficiency, strain transportation networks and increase energy demand, potentially leading to significant socioeconomic disruptions.
4. Water scarcity poses a substantial risk to domestic and civil water use in Belgium, particularly due to drought-driven reductions in groundwater recharge. It also degrades water quality (due to less water for dilution), potentially requiring restrictive measures on water usage.
5. Slow-onset climate risks, like drought-induced subsidence and soil moisture changes, have emerged as concerns with substantial financial implications, particularly affecting older buildings and lower-income communities due to the high cost of adaptation and repair.
6. Climate-induced hazards such as flooding, extreme heat and drought interact and compound across sectors, amplifying overall economic and social impacts, underlining the need for integrated and coordinated risk management strategies.
7. Floods are particularly well addressed in Belgium, notably through the implementation of the EU Floods Directive, which requires member states to regularly update their flood hazard maps and risk management plans. Each Belgian region has developed its own flood management plans in line with this directive. Although there is no equivalent EU directive for droughts, many drought-related measures overlap with those designed for flood management. In practice, each region has established a dedicated "drought cell" that is activated during periods of water scarcity. Despite these frameworks, climate-related risks are not always fully integrated into broader risk management plans or renovation strategies for buildings and infrastructure. There remains a gap in ensuring that adaptation to climate hazards – such as flooding and drought – is systematically included in planning and investment decisions.

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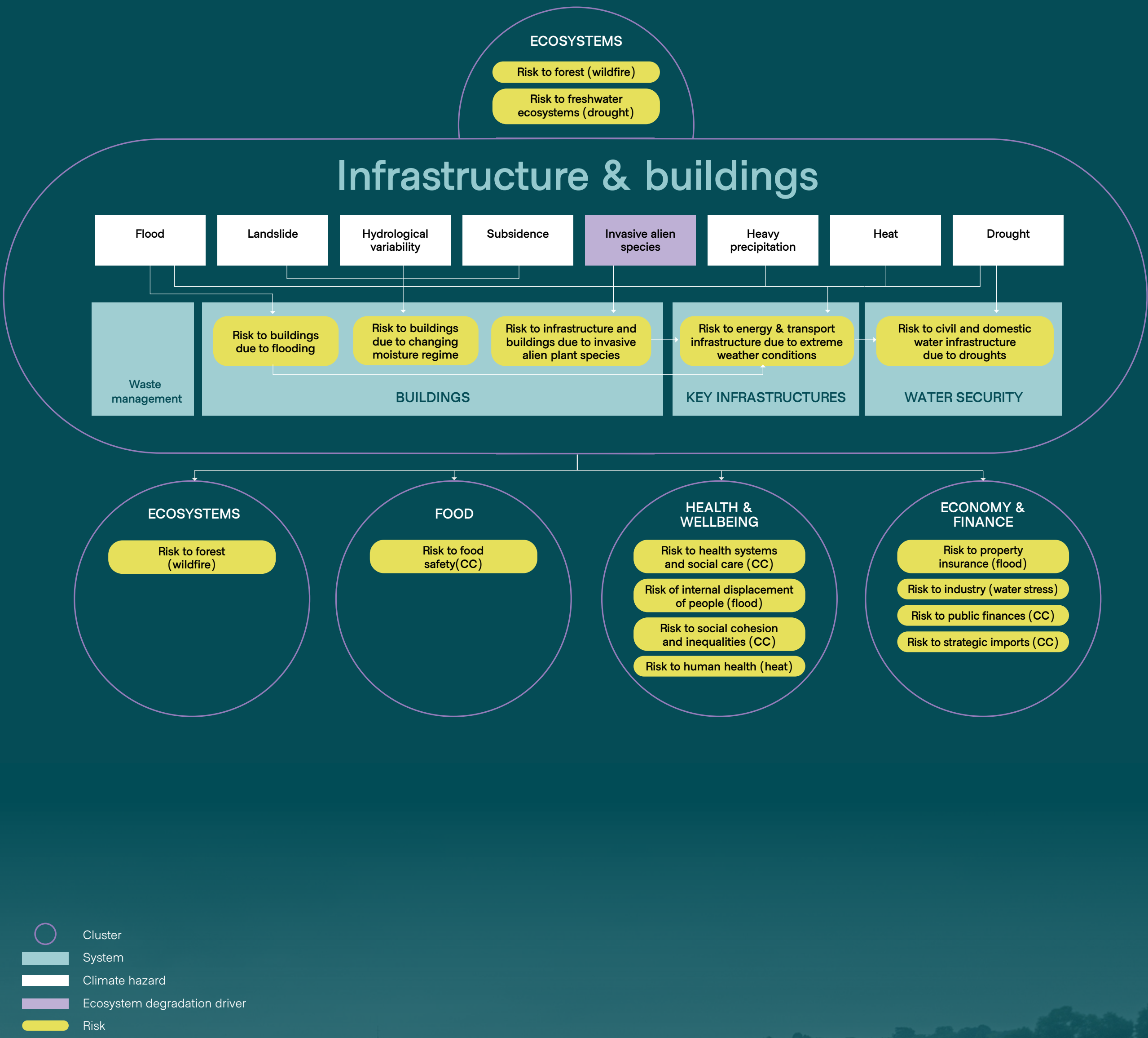

Figure 18. Infrastructure & buildings impact chain and interlinkage with other systems

3.3.2. Risk assessment factsheets

Table 6 . Summary of risk assessments for "Infrastructure and buildings"

Climate and ecosystems degradation risk	Urgency to act	Risk severity			Policy characteristics	
		2°C	3°C	4°C	Policy readiness	Risk ownership
Risk to **infrastructure and buildings** due to **invasive alien** plant species (ecosystems degradation)	More action needed	+ +			Low	Co-owned
Risk to **buildings** due to **flooding**	Urgent action needed	+ + +	+ + +	+ + +	Advanced	Regional
Risk to **buildings** due to **changing moisture** regime	Precautionary action needed	+ +	+ +	+ +	Low	Regional
Risk to **energy and transport infrastructure** due to **extreme weather conditions**	More action needed	+ +			Medium	Co-owned
Risk to **civil and domestic water** infrastructure due to droughts	More action needed	+ +	+ +	+ +	Medium	Regional

Urgency to act

- Urgent action needed
- More action needed
- Precautionary action needed
- Enhance vigilance
- Operationalise existing policies

Risk severity

- Catastrophic
- Critical
- Substantial
- Limited

Confidence

Low: +
Medium: + +
High: + + +

RISK TO INFRASTRUCTURE AND BUILDINGS DUE TO INVASIVE ALIEN PLANT SPECIES

Description

Invasive alien plant species (IAPS) present a significant and growing threat to infrastructure in Belgium, with Japanese knotweed (*Reynoutria japonica*) being a prominent example. These plants damage built-environments by exploiting small structural weaknesses – such as cracks in concrete, masonry and asphalt – and expanding through their vigorous root systems. This leads to escalating maintenance costs and structural degradation, particularly along transport corridors like roads, railways and waterways. Knotweed's rhizomes contribute to soil destabilisation, drainage blockages and heightened erosion risk along embankments and dikes. Other aggressive invaders such as *Ailanthus altissima, Rhus typhina* and *Robinia pseudoacacia* similarly damage pavements, walls and underground networks, while aquatic species like *Elodea* and *Ludwigia* clog watercourses, threatening flood management systems.

Figure 19. Japanese knotweed growing in cracks and damaging bridges (left) and railway platforms (right).
Source: Thoonen & Willems (2018)

Belgium's dense infrastructure and high urbanisation make it particularly vulnerable. Knotweed is already widespread in urban and peri-urban zones, causing both physical damage and management difficulties. Mechanical removal methods often worsen infestations, while chemical control is limited due to environmental regulations. Biological control strategies show promise but require long-term validation. Overall, invasive alien plant species are increasingly understood not just as ecological threats but also as causes of economic harm and contributors to the erosion of essential ecosystem services, especially in areas where native vegetation previously played a stabilising role.

The risk severity score is considered ***substantial*** with ***medium*** confidence. Policy readiness is considered ***low***. This leads to an urgency score of "more action needed".

Risk Severity

The risk severity of invasive alien plant species to infrastructure in Belgium was rated ***substantial***. A rough estimation – based on UK data and adjusted for inflation, population and currency – suggests annual costs of around €60 million in Belgium. These figures likely underestimate the full burden, as invasion-related costs across Europe have shown exponential growth and data gaps persist. The impacts encompass a wide range of damages, from road and railway degradation, to delays in development projects, property devaluation and erosion of flood defences. Japanese knotweed alone contributes significantly to this burden due to its persistence, rapid spread and high remediation costs.

Spatially, invasive alien plant species are closely tied to human activity. They flourish and spread rapidly along linear infrastructure such as motorways, railways and waterways. Urban and peri-urban areas, disturbed lands and ports are particularly affected. Belgium ranks among the European countries with the highest invasion pressure, reflecting the extent of exposure (see Figure 20)

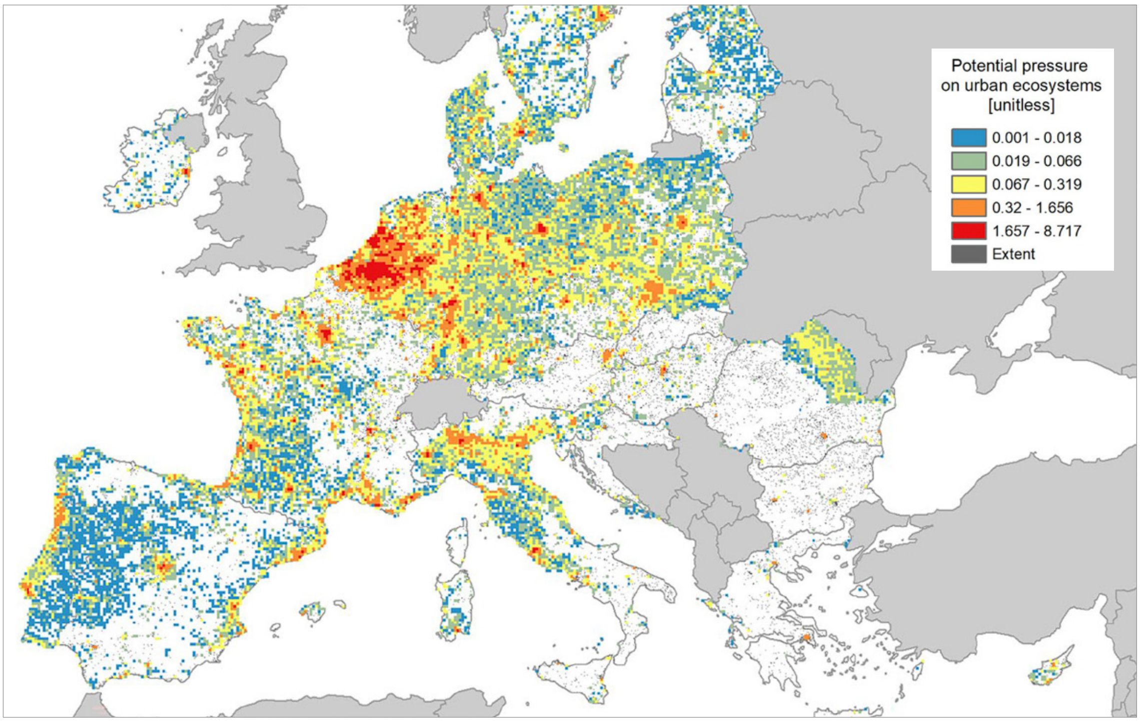

Figure 20. Spatial distribution of invasive species pressures in urban ecosystems. Source: Polce et al. (2023)

From a societal perspective, invasive plants disproportionately affect lower-income homeowners and under-resourced municipalities. For example, they have led to mortgage restrictions and property value losses in the UK. Thus, this risk compounds existing social inequalities by placing additional burdens on vulnerable groups and public services.

Confidence Level

The confidence level in these assessments is ***medium***. While numerous peer-reviewed studies and international reports confirm the widespread impact of invasive alien plant species – particularly Japanese knotweed – data specific to Belgium are limited and management effectiveness remains uncertain.

Policy readiness

The policy readiness for addressing the risk of invasive alien plant species to infrastructure in Belgium is ***low*** as it does not adequately support proactive or integrated risk management. While a comprehensive regulatory framework exists at EU and national levels, it is primarily designed for biodiversity and ecosystems conservation and lacks integration into infrastructure planning and management. Governance challenges further limit effectiveness: responsibilities are fragmented across federal, regional and sectoral actors, with limited coordination mechanisms between environmental and public engineering authorities.

Sector-specific responses remain limited, with only the railway sector showing some operational awareness. Yet, the absence of binding obligations for public infrastructure operators undermines consistency in public policy and sets a weak precedent for other sectors. Overall, the infrastructure sector lacks clear and standardised protocols as well as operational guidelines for IAS management among contractors and public authorities, leading to inconsistent practices and reactive responses.

Belgium benefits from robust surveillance tools such as Harmonia, which supports risk assessment of potentially invasive alien species and policy decisions. However, these are rarely used in infrastructure decision-making and there are no binding obligations for infrastructure managers to act on IAS risks.

Fragmentation across regions further undermines policy coherence. Each region maintains its own IAS list and applies distinct management rules, with significant variation in scope and legal implications. The only harmonised reference, Harmonia, is a scientific tool with no legal status, limited coverage and infrequent updates. This fragmented landscape complicates cross-sectoral and interregional coordination, especially for infrastructure-related risks.

RISK TO BUILDINGS DUE TO FLOODING

Description

Flooding presents an increasing hazard to buildings in Belgium, resulting from three main sources: fluvial, pluvial and coastal flooding. Each type of flooding has distinct drivers and consequences, yet all contribute significantly to physical damage, functional disruption and economic losses in the built environment. Climate change and urbanisation further amplify these risks by intensifying extreme weather events and increasing the exposure of vulnerable structures.

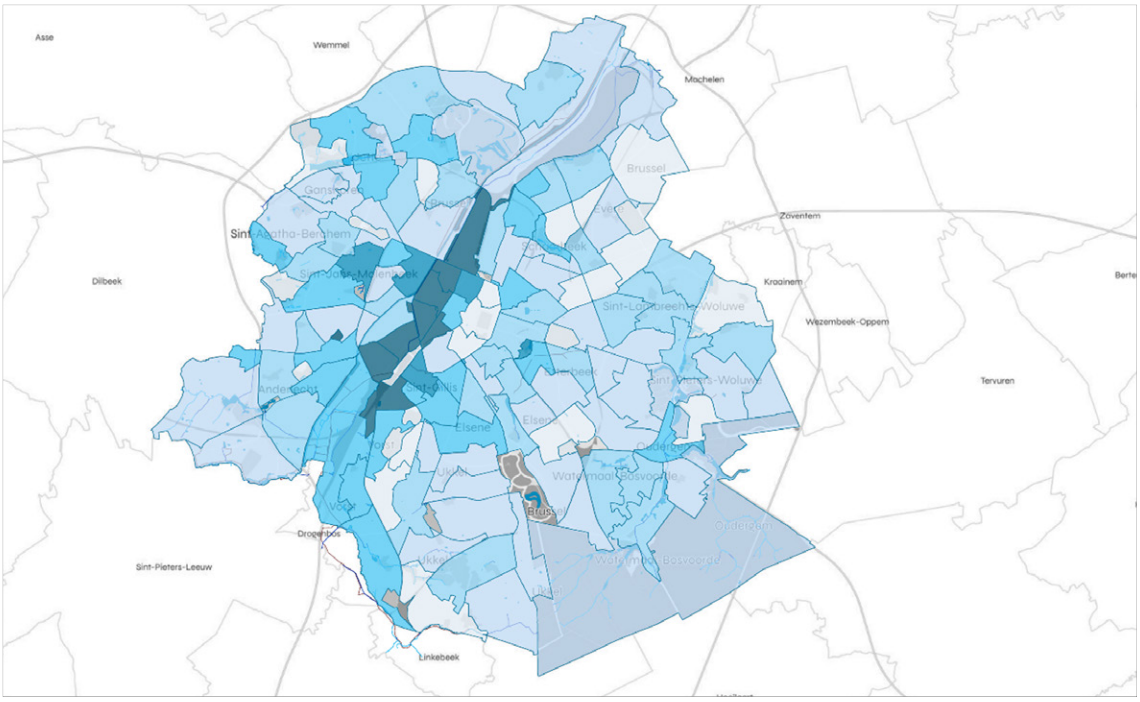

Figure 21. 100-year pluvial risk in the Brussels Capital Region, the blue shades ranging from 0% (light blue) to 100% (dark blue) of the population potentially affected. Source: https://geodata.environnement.brussels/client/view/1a3cae6b-dd04-4b28-a3e2-c432dc83e24f

Projections of flood damages underline the scale of the threat. Coastal flooding alone is expected to escalate sharply, with annual damages increasing from around €200 million at 2°C warming to nearly €4 billion by 2100 under high-end scenarios, reflecting the non-linear impacts of sea-level rise and the potential overtopping of defences after mid-century. Fluvial flooding could cost Belgium up to €753 million annually at 3°C warming, while pluvial flooding in Flanders alone may add €240-340 million per year by mid-century. Taken together, even the lowest estimates indicate combined damages well exceeding €500 million annually, with residential buildings accounting for more than 80% of losses. These figures, which all reflect conditions without additional adaptation, underscore the urgency of intervention and support the classification of flood risk to buildings and infrastructure in Belgium as catastrophic across all warming levels.

Pluvial flooding, caused by intense rainfall exceeding the capacity of drainage systems, is becoming increasingly common in urbanised regions. Short-duration, high-intensity rainfall events can lead to rapid surface water accumulation, especially in areas with low permeability due to dense construction. Major urban centres in Belgium are especially affected, with frequent episodes of standing water on streets, in basements and around building perimeters. The damage extends beyond visible inundation; water ingress leads to degradation of interior materials such as insulation, plaster and untreated wood. The slow drying of moisture trapped within walls and floors encourages mould growth and can introduce contaminants, particularly where sewer systems overflow. Façades are a notable point of vulnerability: even in newly constructed masonry buildings, water can enter via fine cracks or through the porous structure itself. This capillary action allows significant volumes of water to permeate, often over extended periods, compromising structural integrity and delaying recovery.

Finally, coastal flooding along Belgium's North Sea coast is driven by a combination of storm surges, sea-level rise and tidal effects. Low areas, particularly in West Flanders and the Antwerp region, are at heightened risk, with some zones additionally affected by land subsidence. Coastal flood events can rapidly erode shorelines, displace foundation soils and expose underground infrastructure such as pipelines and electrical conduits. Structural stability is threatened when building support is undermined and saltwater intrusion can damage materials and corrode systems. In extreme cases, the simultaneous occurrence of elevated sea levels and inland runoff creates backwater effects, hindering river drainage and compounding the impact of both coastal and fluvial flooding inland.

The risk severity score is considered ***catastrophic*** at all global warming levels with ***high*** confidence. Policy readiness is considered ***advanced***. This leads to an urgency score of 'urgent action needed'.

Risk Severity

Flood risk severity in Belgium, when assessed through non-monetary impacts such as human exposure and damage to buildings and infrastructure, is projected to rise sharply under climate change. Historically, about 5% of Flanders experienced flooding between 1988 and 2016, including cities like Leuven, where one-third of the historic centre and major institutions are at risk. The Vesdre Valley floods in 2021 led to 39 deaths, with 100,000 people affected and 45,000 homes damaged – illustrating the human and infrastructural toll of extreme events.

Future projections suggest that by 2080, fluvial flooding alone could affect over 23,000 people annually under a high-end warming scenario. Coastal flood exposure is expected to increase even more dramatically, with annual exposure rising from 500 today to as many as 25,500 people by 2100. Even at 2°C of global warming, **coastal flood** risks are considered ***critical*** and at 3°C or more, catastrophic. When **pluvial and fluvial floods** are added, risk severity at all warming levels likely reaches a ***catastrophic*** threshold.

Social and spatial inequalities compound flood vulnerability, with disadvantaged communities often residing in flood-prone areas that lack adequate protective infrastructure.

Confidence level

Quantifying the physical and functional damage to buildings from flooding remains challenging due to uncertainties in local drainage conditions, urban development patterns and future climate projections. Nevertheless, strong evidence indicates a robust increase in both the likelihood and severity of flood-inducing events. While predicting specific local events, such as the Vesdre floods of July 2021, remains complex, regional analyses confirm that such extreme rainfall events are becoming more probable in a warming climate. The IPCC projections increase in pluvial flooding for global warming scenarios as low as 1.5°C and further rises in river and coastal flooding with warming beyond 2°C, all with ***high*** confidence. Consistent findings across European Commission publications, peer-reviewed studies and Belgian-specific assessments support a high-confidence conclusion: Flood risks – fluvial, pluvial and coastal – are expected to intensify significantly across all warming scenarios.

Policy readiness

Flood risk management for buildings in Belgium is supported by a robust and multi-layered policy framework, shaped by the EU Floods Directive and implemented through region-specific strategies and instruments. All three regions have adopted flood risk management plans, developed hazard maps and integrated flood considerations into spatial planning and permitting procedures. Technical tools and data platforms are widely available and stakeholder consultation mechanisms are well established, notably through structures such as sub-basin technical committees, river contracts and other relevant coordination platforms. Financial support mechanisms such as the FRMP (Flood Risk Management Plan) subsidies and the regional initiatives (e.g. Blue Deal) contribute to local resilience efforts through various projects, while initiatives like the INONDEA trade fair and reference frameworks reflect growing public engagement and awareness.

However, several structural challenges persist. Implementation remains uneven due to limited financial and human resources, particularly at the municipal level. Non-structural funding schemes under the FRMP lack long-term visibility and flood resilience is not yet systematically embedded in infrastructure development or renovation strategies. Protective infrastructure often lacks all-hazard design criteria and upstream land use practices continue to exacerbate vulnerabilities. Moreover, gaps in data and outdated flood maps undermine the effectiveness of planning tools. In light of these strengths and limitations, the policy readiness for the risk to buildings from inland and coastal flooding is assessed as ***advanced***, reflecting the existence of a solid framework and growing engagement, but also the need for improved implementation, coordination and long-term planning.

RISK OF DAMAGE TO BUILDINGS FROM CHANGING MOISTURE REGIMES

Description

Recent climate projections for Belgium show a shift toward wetter winters and drier summers, with annual precipitation remaining relatively stable. This seasonal change increases risks to buildings, particularly from excess winter moisture and summer drought.

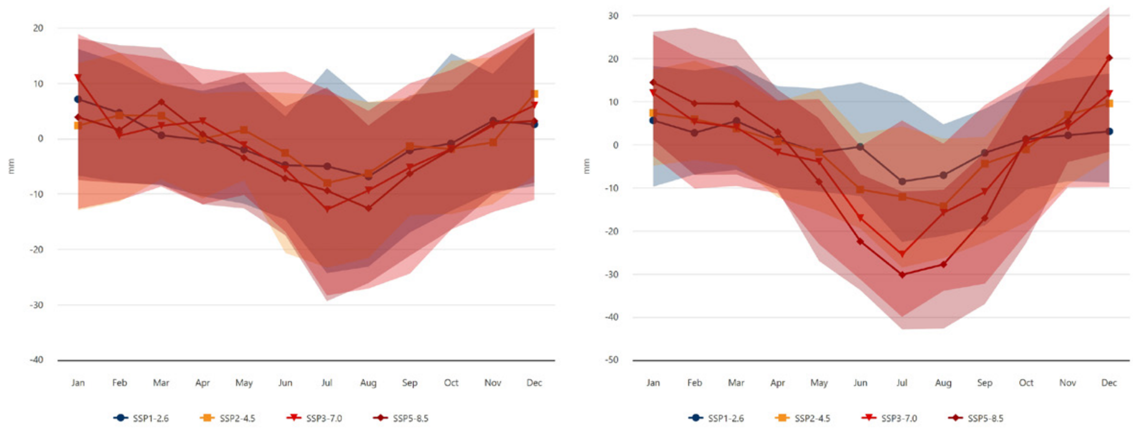

Figure 22. Projected monthly precipitation anomaly for Belgium for a range of IPCC scenarios for the periods 2040-2059 (left) and 2080-2099 (right). Figures generated with the Climate Change Knowledge Portal (https://climateknowledgeportal.worldbank.org/country/belgium/climate-data-projections)

The impact of excess moisture on buildings includes accelerated deterioration of materials due to increased rainfall, humidity and wind-driven rain. Infiltration through cracks weakens façades and internal structures, while masonry becomes more conductive and decays faster. Freeze-thaw cycles cause cracking in porous materials and high humidity fosters mould growth and wood decay – especially in basements affected by rising groundwater. Salt crystallisation in walls further adds mechanical stress, exacerbating damage.

The effects on foundation stability are also significant. Saturated soils lose strength, causing uneven settlement and cracking, particularly in older buildings. Prolonged rainfall can raise groundwater levels, exerting upward pressure on foundations not designed to resist it. In fine-grained soils like loam, water movement along subsurface infrastructure may erode particles and form voids that undermine structural support.

Drought-related subsidence and cracking arise as clay-rich soils shrink during dry spells and swell when rehydrated, leading to movement and foundation stress. Tree roots near buildings intensify this desiccation, while depleted groundwater reduces subsoil stability. In Flanders, almost half of reported building defects are already linked to moisture-related issues.

Slow-moving landslides are becoming more common in clay and marl regions such as the Flemish Ardennes and Pays de Herve. Prolonged droughts reduce slope cohesion and subsequent intense rainfall increases pore pressure, triggering gradual ground movement that misaligns foundations and deforms structures.

The impact on historic buildings is particularly severe due to the use of porous materials and the absence of modern damp-proofing. Moisture ingress and salt crystallisation degrade structural integrity and thermal performance. Additionally, energy retrofits without adequate ventilation may trap moisture, raising the risk of mould and internal decay.

The risk severity score is considered ***substantial*** at +2°C and +3°C global warming levels and reaches ***critical*** at +4°C global warming level with ***medium*** confidence. Policy readiness is considered low. This leads to an urgency score of '**precautionary action needed**'.

Risk Severity

Future building damage in Belgium from shifting moisture regimes is expected to reach ***substantial*** to ***critical*** severity, though exact costs remain uncertain.

Simulations suggest that mould growth and wood decay may increase by up to 51% and 45% respectively, particularly in uninsulated or poorly ventilated buildings. With over 21% of Belgian buildings constructed before 1919, even partial damage across this vulnerable stock could result in significant national costs, especially for repairs like basement waterproofing and foundation reinforcement.

Landslide risks are locally concentrated but financially significant. In an area west of Brussels, current losses exceed €3 million annually, while high-risk regions elsewhere may face €44-74 million in yearly damage – though these are not tied to specific climate scenarios.

Drought-related subsidence is rising sharply, especially in clay-rich regions such as West and East Flanders. Projections estimate annual costs climbing from €20 million at 1.5°C warming to nearly €100 million at 4°C. Attribution remains complex due to overlap with non-climatic factors like construction or drainage changes.

Spatial vulnerability is highest in areas with older buildings and clay-rich soils, though actual damage patterns often diverge from risk maps. Local conditions – such as tree presence or soil de-sealing – can intensify damage, highlighting the need for site-specific assessments.

Confidence level

Confidence in future damage projections is moderate, based on peer-reviewed studies using ensemble climate models and supported by the European Commission. The IPCC also expects more droughts in Belgium at 2°C warming and above.

Policy readiness

The current policy readiness to address the risk of damage to buildings from changing moisture regimes is ***low***. While the EU and Belgian Regions have begun to integrate climate resilience into adaptation, renovation and construction policies, these measures remain generic and largely focused on energy performance and decarbonation. Existing EU instruments offer entry points for mainstreaming resilience, but they do not yet provide clear or binding provisions for risks linked to changing humidity, soil subsidence or long-term moisture variation. At the national and regional levels, strategies and tools such as building passports and sustainability frameworks (e.g., GRO 2025) demonstrate progress but continue to overlook chronic moisture-related vulnerabilities.

In practice, there are no effective measures currently implemented to anticipate or reduce the impacts of changing moisture regimes on the building stock. While insurance law ensures compensation for damage caused by natural disasters such as drought-related subsidence (e.g., the shrink-swell phenomena), this mechanism remains reactive rather than preventive. Data and monitoring also remain insufficient, existing building tools mainly track energy performance and lack indicators for climate-related vulnerabilities. At the same time, there is no comprehensive mapping of landslide or subsidence risks in Belgium.

Taken together, these gaps confirm that policy readiness remains at an early stage, with scattered achievements but without a systematic framework, dedicated measures or robust monitoring systems in place. The ongoing revision of building standards (notably Eurocodes at EU level and their national transpositions) could provide a crucial starting point. Although norms are by nature voluntary and reflect good construction practices rather than binding regulation, they are often the basis upon which public authorities later build regulatory requirements. By first embedding climate-related moisture risks into technical standards, the construction sector could progressively integrate resilience into its practices, paving the way for potential future incorporation into regional strategies and regulatory frameworks.

RISK TO ENERGY & TRANSPORT INFRASTRUCTURE DUE TO EXTREME WEATHER CONDITIONS

Description

Energy and transportation infrastructure in Belgium is increasingly vulnerable to climate-related hazards – particularly extreme heat, drought and flooding – with each stressor affecting infrastructure performance, safety and reliability across multiple sectors.

Extreme heat reduces the efficiency of nuclear, coal, oil and gas power plants by impairing cooling systems and increasing energy losses. Gas turbines suffer from reduced air density and increased compressor load, while solar PV systems generate less power at high temperatures. Power transmission lines expand and sag, transformers are thermally stressed and demand surges, due to air conditioning needs further strain the grid and raise the risk of blackouts. If grid failures occur, critical transport systems such as swing and draw bridges, railway crossings and tunnel pumps may also shut down. High temperatures may also damage transport infrastructure directly – softening asphalt, deforming concrete pavements and rail tracks and degrading airport runways – leading to speed restrictions, maintenance delays or flight limitations due to reduced lift and longer take-off requirements.

Drought impacts the energy sector by reducing water availability for thermal and nuclear plant cooling, potentially forcing capacity reductions or even shutdowns. Underground cables and gas pipelines become vulnerable to soil drying, shrinkage and subsidence, reducing capacity and increasing failure risk. In transportation, the most significant drought impact is on inland waterways – low water levels restrict vessel size and cargo capacity, increase shipping costs and disrupt supply chains. Road subsidence and cracking also increase maintenance needs.

Flooding – whether coastal, fluvial or pluvial – poses broad and severe risks to both energy systems and transportation networks. It can damage roads, railways and electrical infrastructure, flood airports and substations and disrupt both mobility and power supply. Flood impacts are not limited to immediate damage – infrastructure repairs can take months, with economic ripple effects that significantly amplify total costs. The 2021 floods in Belgium illustrated this clearly, as major energy and transport assets such as railways and power systems remained non-operational for months or years in the worst cases. Some facilities took months to reconstruct, with the full restoration of roads and electricity networks taking almost a year, highlighting the systemic vulnerability of interconnected infrastructure under future climate extremes.

The risk severity score is considered ***critical*** at all global warming levels with ***medium*** confidence. Policy readiness is considered ***medium***. This leads to an urgency score of "more action needed".

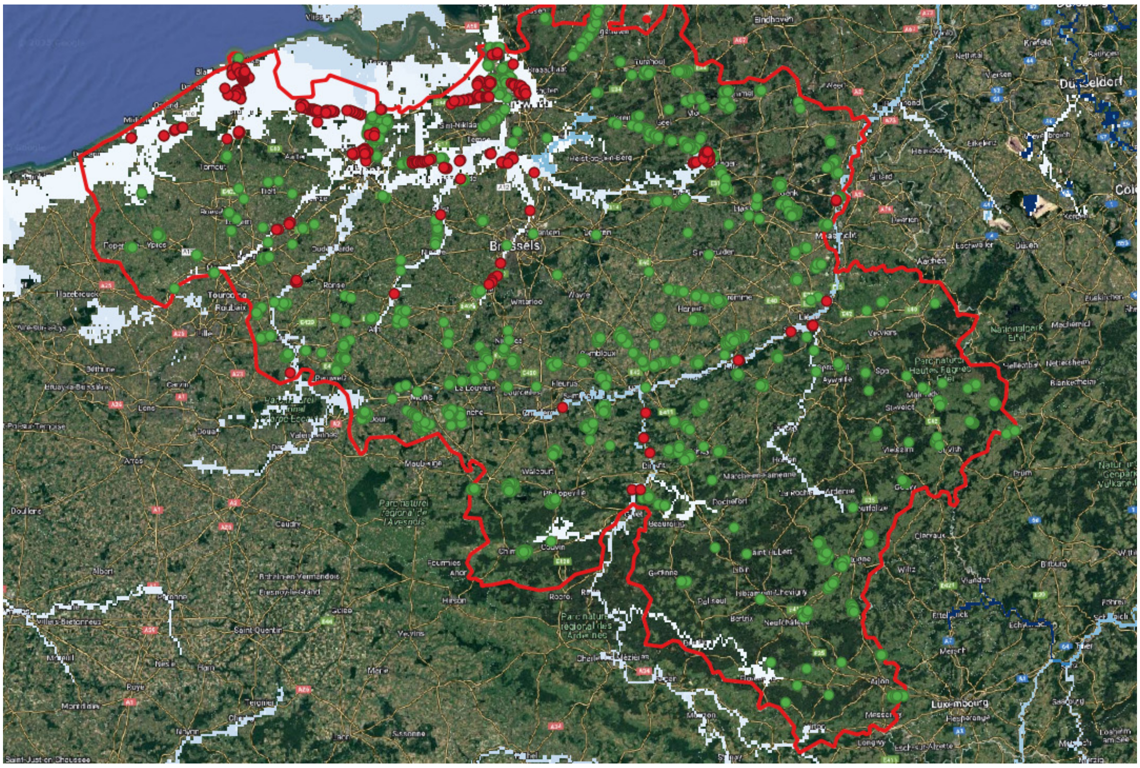

Figure 23. The map shows the position of electricity generators, red dots indicating those exposed to coastal or riverine flooding (RCP 4.5, 2050, GWL ~2°C) and green dots representing all existing generators

Risk Severity

Risk severity for energy and transport infrastructure under climate change is likely to reach a ***critical*** level across all warming scenarios. Temperature-induced losses in energy production are the most substantial with estimated annual financial losses ranging from €78 million (2°C) to over €155 million (4°C), primarily due to efficiency drops in nuclear, gas and solar power generation. These figures exclude indirect impacts and cascading failures, such as blackouts affecting railway operations or bridge systems, which are likely to amplify total costs substantially. Increased demand for cooling during heatwaves puts additional strain on already overburdened electricity systems. This greatly heightens the risk of blackouts, which can result in societal costs of tens of millions of euros per hour – quickly mounting to hundreds of millions in severe cases. The large-scale blackout that recently affected Spain and Portugal illustrates just how vulnerable energy systems are under extreme heat conditions.

Drought impacts, while more uncertain, may become significant through reduced water availability for cooling, soil-induced cable failure and transport disruptions (e.g., waterway restrictions). Recurrent droughts similar to those in 2018 could generate losses in the tens to hundreds of millions of euros annually. Flooding, although more geographically localised, has caused substantial infrastructure damage in the past. The 2021 floods disrupted 66,500 electricity and 15,150 gas connections and caused €30-62 million in transport repair costs. While such events are rare, their frequency is expected to increase under climate change, potentially reducing return periods from 400 years to a few decades.

Spatially, heat impacts are widespread, though electrical grid stress will be highest near urban centres, due to the higher demand. Flood vulnerability is highly localised, especially along the coast and in the Antwerp region, where many power plants and substations are at risk. Transport systems – particularly Walloon railways built in flood-prone river valleys – also face heightened exposure.

Confidence level

Confidence in the climate impact (more heat, drought and flooding) is ***high***, but confidence in cost projections remains moderate, due to missing data on indirect and cascading effects. Many components (e.g., airport performance reductions, load restrictions on rail or road) lack quantified estimates.

Policy readiness

Belgium's policy readiness to address climate-related risks to energy and transport infrastructure is currently assessed as ***medium***. While achievements are noteworthy, limited sectoral consistency and gaps in anticipatory adaptation reduce the overall robustness of the framework. The current policy trajectory shows promising progress, but systematic, harmonised implementation of climate resilient measures for all key infrastructure is still required to reach an advanced level of readiness.

Key infrastructures demonstrate relatively advanced preparedness to climate change, supported by EU legislation such as the recent CER Directive, sector-specific policies (e.g. electricity and gas risk preparedness plans) and some proactive operator strategies. Moreover, federal initiatives like the Climate Change Impact Programme (CCIP) and the 2023-2026 Adaptation Plan demonstrate institutional willingness to integrate climate scenarios into key infrastructure planning. These efforts reflect growing political and operator awareness and signal a shift toward more structured resilience-building, particularly in the energy domain, where technical regulations and monitoring practices are increasingly aligned with climate risk considerations.

However, readiness remains uneven across sectors and regions. Integration of climate change as a structural risk remains partial, with most implementation efforts happening at the level of individual operators. The transport sector, particularly road infrastructure, lags behind in systematic climate risk integration. While rail and air transport operators have begun incorporating climate risks into continuity planning, many initiatives remain fragmented and reactive. The delayed transposition of the CER Directive into Belgian law further hampers harmonised implementation and cross-sector coordination. The sectoral risk analyses are expected in January 2026. Finally, financial constraints, inconsistent sectoral monitoring and limited policy coherence with spatial planning and water management weaken the overall resilience framework.

RISK TO CIVIL AND DOMESTIC WATER INFRASTRUCTURE DUE TO DROUGHTS

Description

Belgium ranks among the world's most water-stressed countries, placing 18th globally and the highest in Western Europe. Water demand puts particularly high pressure on available resources in Flanders and Brussels, while even Wallonia faces "extremely high" levels of stress. During droughts, restrictions are introduced, especially in Flanders, where critical water sources like the Albert Canal, which supplies 40% of the region's needs, are increasingly vulnerable to reduced flows and saltwater intrusion from sea-level rise.

While overall consumption has declined, peak usage during dry periods is rising, further straining infrastructure. Experts note that seasonal imbalances in water use – rather than absolute scarcity – limit the system's flexibility under changing climate conditions.

Drought also deteriorates water quality. Lower river flows reduce dilution, concentrating pollutants such as nutrients, pharmaceuticals and organic matter. This increases water treatment complexity and cost, with elevated levels of dissolved organic carbon contributing to harmful by-products during disinfection. Groundwater recharge slows during droughts and its quality declines as contaminant mobility increases. Urban growth adds to the problem through sewage leaks and industrial runoff. These impacts are especially concerning given the competition between households, industry, agriculture and inland shipping for water resources.

The risk severity score is considered ***substantial*** at +2°C and ***critical*** at +3°C and +4°C global warming levels with ***medium*** confidence. Policy readiness is considered ***medium***. This leads to an urgency score of "more action needed".

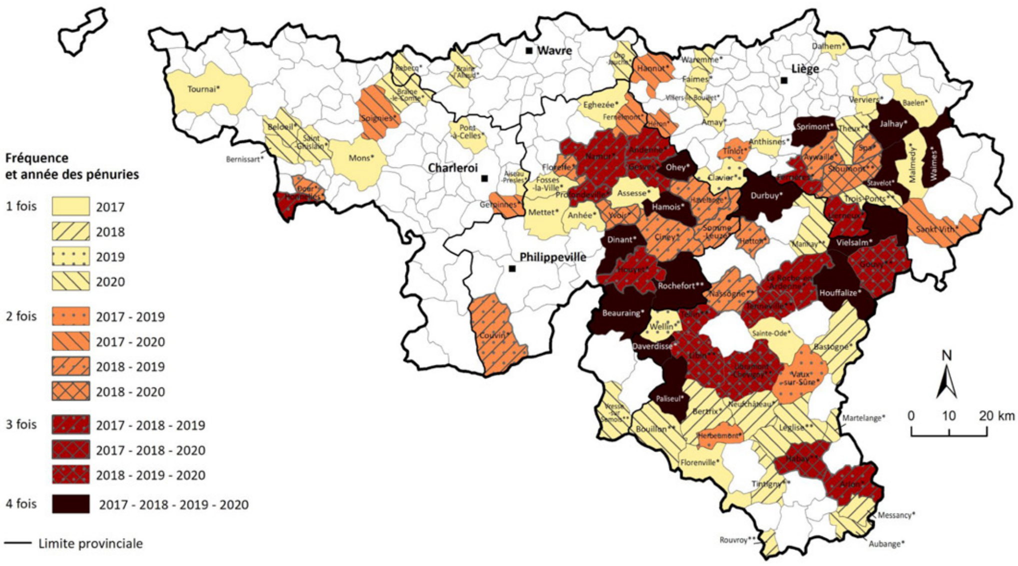

Figure 24. Walloon municipalities impacted by drought between 2017 and 2020
(Source: État de l'environnement wallon – Schéma régional des ressources en eau)

Risk Severity

Belgium faces a ***substantial to critical*** risk of climate-induced water scarcity for domestic and civil uses, with severity increasing under higher global warming scenarios (though overconsumption and poor management remain the main causes, with climate change acting as an amplifier). Projections under a 2°C warming scenario (SSP2-4.5) indicate a 10% decrease in summer precipitation and a 7.5% reduction in soil moisture by 2050, intensifying meteorological and hydrological drought conditions. These changes will reduce the availability of surface and ground water for household consumption, particularly in summer. Although domestic and civil water use accounts for only 15-20% of Belgium's total water abstraction, its societal relevance and essential nature heighten the impact. Under a 2°C scenario, estimated annual economic losses for public water supply reach €73 million, rising to €216 million at 4°C – crossing into the critical risk category. It should be noted that if the full cross-sectoral damage costs are accounted for, which include industry and agriculture, the severity levels increase to critical (2°C warming) and catastrophic (3-4°C warming).

Spatially, Flanders is more exposed due to lower rainfall, higher economic activity and reliance on vulnerable sources like the Albert Canal. Coastal areas face added pressure from salinisation and eastern Wallonia from reduced inflows into dam reservoirs. Isolated municipalities in the Ardennes relying on local systems also face supply risks.

Socially, water scarcity disproportionately affects low-income households, renters and people in poor health or marginalised conditions. Over 13% of Belgian households already face water insecurity, with rates over 20% in Brussels and Wallonia. Rising prices and reduced availability during droughts would further deepen inequalities and health risks, especially for children, the elderly and the immunocompromised.

Confidence level

Confidence in the severity estimate is ***high***: based on multiple peer-reviewed and institutionally backed studies. Confidence in the projected economic and social impacts is moderate, reflecting uncertainties in indirect costs and adaptation responses.

Policy readiness

Belgium demonstrates a growing and structured commitment to addressing the risk of water scarcity affecting civil and domestic use, with a policy readiness level assessed as ***medium***. This reflects the presence of a solid foundation of policies, strategic plans and governance mechanisms that are actively evolving. The implementation of the EU Water Framework Directive and related instruments has catalysed integrated water management across the country, supported by regionally tailored strategies and operational frameworks. In the absence of a dedicated drought European directive, drought management relies on regionally driven approaches, which reflect the specific needs and contexts of Flanders, Wallonia and Brussels. The three regions are also reinforcing their governance frameworks through the establishment and regular activation of drought coordination units. These structures support a proactive and data-informed approach based systematic monitoring in dry periods. Moreover, infrastructure investments illustrate a proactive approach to managing water stress and enhancing resilience. For example, Flanders has taken proactive steps through comprehensive initiatives like the Blue Deal.

While awareness of water scarcity and its implications is growing, the policy landscape is still developing across Belgium. Several structural challenges also continue to limit the full effectiveness of Belgium's drought governance. The absence of a coordinated national framework contributes to fragmented responses across regions. While regional policies are increasingly robust, they remain at different stages of development. Additionally, some key policy instruments are still in draft form or lack legally binding commitments, hindering consistency and accountability in implementation. Finally, although overarching goals have been defined, the translation into concrete actions and funding mechanisms remains incomplete. These financial constraints restrict the capacity to scale up adaptation measures and invest in long-term resilience.

As climate pressures intensify, strengthening interregional coordination, formalising drought-specific legal frameworks and securing sustainable financing will be essential to consolidate existing efforts and move toward more advanced water management policies.

3.3.3. Qualitative assessment of the cluster

Climate change introduces a diverse set of risks to infrastructure in Belgium. Most subsystems – from energy production and distribution to water provision and buildings – are already exposed to climatic pressures that are expected to intensify. While some impacts will be incremental and seasonal, others may be disruptive, abrupt and cascading. The complexity and interdependency across systems increase the overall vulnerability.

A major concern is the increasing exposure of infrastructure to hydrometeorological extremes, particularly flooding. Both fluvial and pluvial flooding events are projected to become more frequent and intense, with severe impacts on buildings and energy infrastructure, especially in low areas or those located along river valleys. The 2021 Vesdre flood serves as a concrete example: widespread physical and functional damage to residential structures, critical installations (like electricity substations) and transport infrastructure illustrated how such events can compromise large parts of the system. Despite the limited recurrence interval of such events historically, climate projections suggest these extremes will occur more often.

Pluvial and coastal flooding, in particular, show marked regional variability. Northern Belgium, including the Antwerp metropolitan area and the coastal zones, appears especially exposed to combined risks due to sea level rise, high population and infrastructure density and a significant number of energy-generating installations near flood-prone zones. Simultaneously, the energy grid, already facing elevated loads from climate-induced cooling demands, becomes more susceptible to failure under such combined stressors.

Drought and heat form another major climate stressor group. Rising temperatures cause efficiency losses in power generation and transmission systems, while also increasing cooling demand – thus stressing electricity infrastructure from both the supply and demand side. Particularly under 3-4°C warming scenarios, energy losses and transport disruption costs are projected to reach critical levels, with expected annual losses in the range of hundreds of millions of euros. Furthermore, cascading failures – for instance, energy blackouts affecting railway operation – can amplify direct damage significantly. Yet current assessments only partially account for such cascading risks.

The shift in moisture regimes adds another layer of complexity. Seasonal imbalances in precipitation, such as wetter winters and drier summers, are projected to increase. Droughts and prolonged dry periods not only reduce water availability but also alter ground stability and infrastructure reliability. Groundwater recharge will suffer in already-vulnerable areas like Flanders, which is compounded by its downstream position in Belgium's hydrological network. This leads to both structural challenges (e.g., soil shrinkage and embankment instability) and water supply stress. Terrestrial coastal and canal-fed systems, including the Albert Canal, face new threats from saline intrusion, which may impair freshwater inlets.

The available information on invasive alien plant species (IAPs) provides an ecosystem-focused layer of concern. Human disturbance, land-use changes and connectivity in infrastructure corridors facilitate the spread of invasive plants. IAPs can affect infrastructure functionality by damaging roads, buildings and waterworks.

A recurring limitation is the uneven availability of quantified risk assessments. While numerical estimates are available for energy losses, drought-related sectoral damages and some flood probabilities, several interlinkages remain poorly understood. Notably absent are system-wide simulations that consider compounding events or interactions between infrastructure types – e.g., how drought and heat together affect electricity production and transport simultaneously or how energy disruptions affect water pumping.

To deal with these systemic risks, the main focus should be on reinforcing the resilience of critical nodes in the infrastructure network, reducing exposure in high-risk zones (especially floodplains) and improving the redundancy and adaptive capacity of systems. Localised adaptation (e.g., flood-proofing in Wallonia's valleys) must be coupled with national-level strategies (e.g., resilient grid design and water governance reforms). Importantly, greater attention should be given to the social dimension of infrastructure vulnerability, recognising that access to water, energy and shelter during disruptions is not equally distributed.

3.4. Human health & population wellbeing

3.4.1. Description

This chapter summarises the risks for the Human health and population wellbeing cluster. This cluster contains five systems:

- Health system
- Social cohesion & inequality
- Education
- Cultural heritage
- People displacement

Potential risks for "Education" and "Cultural Heritage" systems were excluded from this analysis.

Regarding risks to education in Belgium, literature is limited and partly integrated under "risk to human health due to heat stress" and "risk to mental health due to climate change". This is the case for concerns about impaired cognitive abilities due to classroom overheating, reduced school access during extreme weather and increased climate anxiety among youth.

Cultural heritage was excluded because it was considered to have lower urgency compared to other risks, despite the availability of multiple studies. Still, impacts of climate change on cultural heritage have been recognised as an important issue during the floods in July of 2021. Other countries such as New Zealand emphasise the centrality of this system for social cohesion in their risk assessment. Damage to building cultural heritage is included under the "Infrastructures and Buildings" cluster. The importance of cultural heritage is further recognised under 'risk to social cohesion and inequalities due to climate change' but is not explored in detail.

Key messages

1. Climate change will have considerable impact on human health. The risk severity is highest for exacerbated heat stress, which is considered catastrophic and would cause over a thousand excess deaths each year – even under the most optimistic scenario.
2. Invertebrate vectors and the infectious diseases they can transmit are expanding in Belgium. However, quantitative information on the risk is limited. Our health care system is estimated to cope relatively well with rising infections but surveillance only partly covers the threat.
3. There are strong indications that non-communicable diseases will increase through increased UV radiation, increased air pollution and increased pollen allergy.
4. Increases in mental health problems aggravated by heat, as a consequence of other extreme weather events, and the rise of eco-anxiety result in a substantial to critical risk. However, the little available research yields a low confidence level and Belgium is considered currently unprepared to face this risk.
5. The risk of zoonotic disease emergence due to anthropogenic impact on ecosystems is important, with significant potential for global pandemics. However, the role of loss of biodiversity per se is less obvious. Severity is potentially catastrophic but confidence on the role of biodiversity loss is low.
6. The delivery of health and social care is directly and indirectly impacted. Extreme events such as floods and heatwaves will impact crucial infrastructure directly. Indirectly, the system will be additionally strained by the rise in demand for care following the risks outlined above.
7. Internal people displacement is still a largely undocumented issue in Belgium, although the 2021 floods led to short- and long-term displacement of thousands of persons. Evidence of strong increase in coastal and fluvial floodings will exacerbate this risk.
8. A large body of evidence makes it clear that vulnerable groups will be disproportionately affected by climate change impacts, thereby deepening inequalities and threatening social cohesion. Vulnerable groups were identified in all risks analysed in this BCRA.
9. Key policy recommendations include:
   - Integrate health and social justice into all climate policies; align social and environmental measures to ensure resilience and equity.
   - Strengthen heat-health action plans with real-time surveillance, covering vulnerable groups and non-mortality outcomes; expand early warning systems.
   - Improve risk communication on lesser-known impacts (maternal health, heat–air pollution, mental health, social vulnerabilities).
   - Adopt a One Health approach by reinforcing inter-federal coordination, expanding zoonotic and vector-borne disease surveillance and linking with NCD prevention.
   - Invest in co-benefit measures, especially urban greening and passive cooling, while phasing out heat- and pollution-intensive technologies.
   - Advance research and training on compound climate-health stressors; embed climate-health knowledge in healthcare, urban planning and social support curricula.
   - Strengthen governance of disasters; evaluate policies after extreme events, improve recovery systems and monitor long-term impacts of displacement.

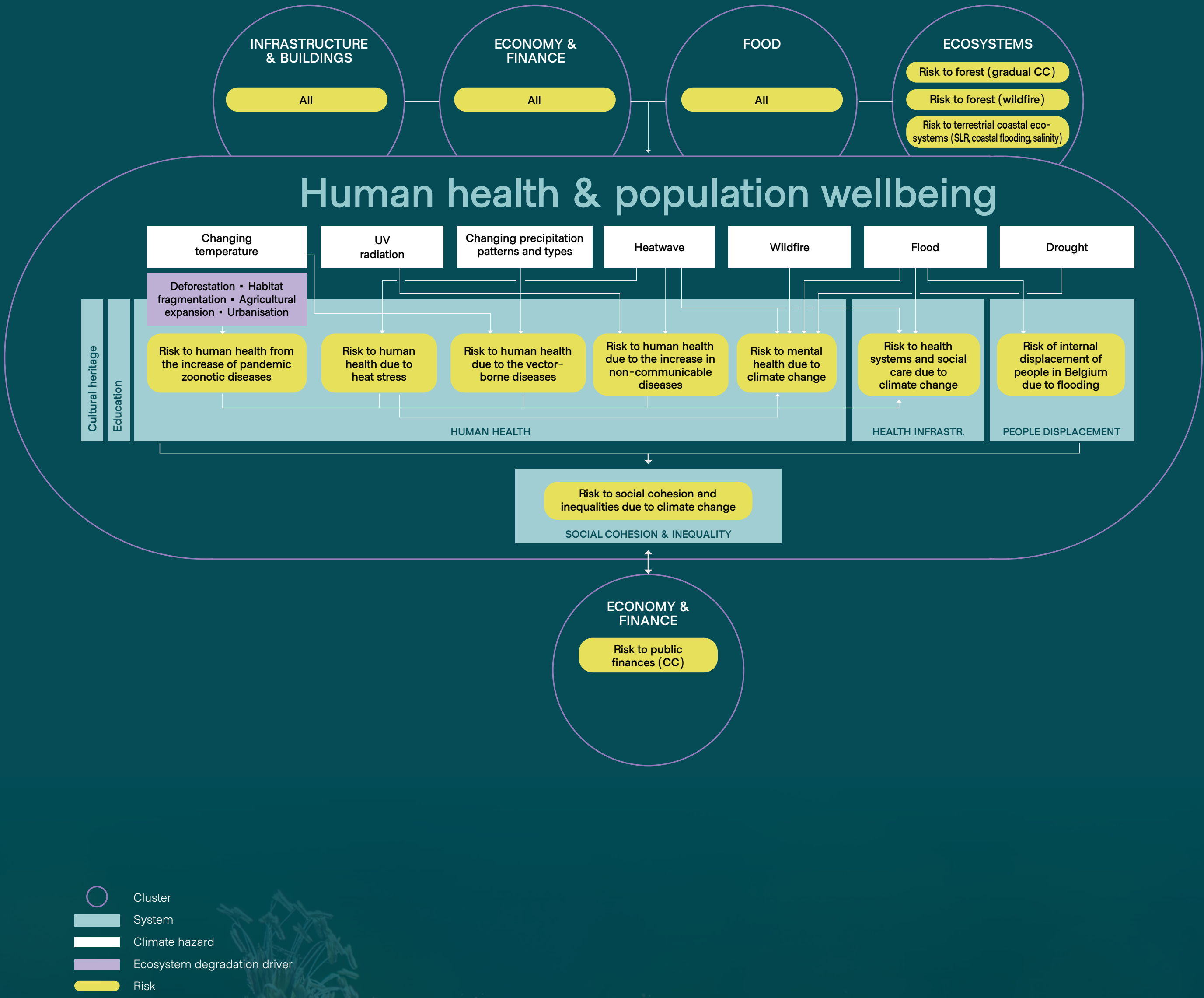

Figure 25. Human health and population wellbeing impact chain and interlinkage with other clusters

3.4.2. Risk assessment factsheets

Combining the 6 systems above with 24 climate hazards gave rise to identification of 59 potential risks. For ecosystems degradation, 76 potential risks were identified. A brief review of available literature on the identified risks was then carried out. In parallel, the climate risks analysed in the European Climate Risk Assessment (EUCRA) for human health were considered as guidelines for the formulation and selection of risks. Based on this, and on preliminary expert consultation, seven major risks caused by climate change and one related to ecosystems degradation on the human health and population wellbeing cluster have been identified:

Climate change risks:
- Risk to **human health** due to **heat stress**;
- Risk to **human health** due to the increase of **vector-borne disease**;
- Risk to **human health** due to the increase in **non-communicable disease**;
- Risk to **mental health** due to climate change;
- Risk to **health systems** and **social care delivery** from **climate change**;
- Risk to reduced **social cohesion** and **inequalities** from climate change;
- Risk of **internal people displacement** in Belgium due to **floodings**.

Risks of ecosystems degradation:
- Risk to **human health** due to the increase of **pandemic zoonotic diseases**.

Table 7. Summary of risk assessments for "Human health and population wellbeing"

Climate risk	Urgency to act	Risk severity			Policy characteristics	
		2°C	3°C	4°C	Policy readiness	Risk ownership
Risk to **human health** due to **heat stress**	Urgent action needed	+ + +	+ + +	+ + +	Medium	Co-owned
Risk to **human health** due to the increase of **vector-borne diseases**	Precautionary action needed	+	+	+	Medium	Co-owned
Risk to **human health** due to the increase in **non-communicable diseases**	More action needed	+ +	+ +	+ +	Medium	Co-owned
Risk to **mental health** due to **climate change**	Precautionary action needed	+	+	+	Low	Co-owned
Risk to **health systems** and **social care** delivery due to **climate change**	Precautionary action needed	+ +	+ +	+ +	Medium	Co-owned
Risk to **human health** due to the increase of **pandemic zoonotic diseases** (ecosystems degradation)	Urgent action needed	+ +			Medium	Co-owned
Risk to **social cohesion** and **inequalities** due to **climate change**	More action needed	+ + +	+	+	Low/Medium	Co-owned
Risk of **internal displacement of people** in Belgium due to **flooding**	Precautionary action needed	+	+	+	Low	Regional

Urgency to act
- Urgent action needed
- More action needed
- Precautionary action needed
- Enhance vigilance
- Operationalise existing policies

Risk severity
- Catastrophic
- Critical
- Substantial
- Limited

Confidence

Low: +
Medium: + +
High: + + +

RISK TO HUMAN HEALTH DUE TO HEAT STRESS

Description

Studies at various scales show that heat will become increasingly prevalent in Western Europe as climate change progresses, even for a Global Warming Level (GWL) of only 2°C. At the scale of Flanders, the IMPACT-tool (VMM, 2022) projects an increase of heatwave days going from a current (baseline 2000-2019) situation of 4 days, rising to 11 days in 2030, 19 days in 2050 and 51 days in 2100 under the 'high' Flemish scenario, which corresponds to Global Warming Levels of 1.5°C (2030), 2.5°C (2050) and 5.4°C (2100), respectively[2].

The human body is strongly impacted by ambient temperature, making heat stress one of the most direct threats of climate change to human health. Under high temperatures, both day and night, our bodies are under pressure to stay adequately cooled and hydrated, impacting the functioning of the cardiovascular, renal and respiratory body systems. This is especially the case under persistent warm daytime and nighttime conditions. Heat-related health effects range from mild symptoms such as weakness or vertigo to more serious symptoms such as heat cramps, exhaustion and heat strokes. Exposure to heat also exacerbates pre-existing chronic health conditions including cardiovascular, respiratory and kidney diseases, can aggravate mental and psychosocial conditions, affect maternal, foetal and neonatal health, affect sleep quality and negatively affect general wellbeing. In severe cases, heat exposure leads to fatal outcomes.

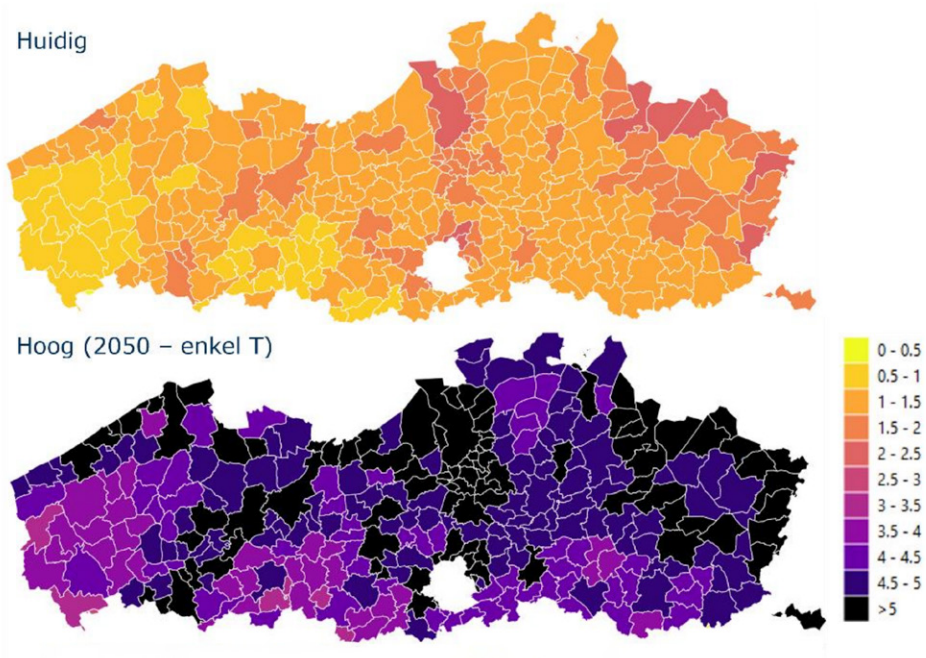

Figure 26. Relative heat-related mortality in the population aged 85+ in the Flemish Region, for current conditions (upper panel), for the Flemish 'high' scenario in 2050. Source: Verachtert et al. (2023)

Heat stress also significantly impacts the health and wellbeing of outdoor workers. Direct sun exposure and prolonged physical exertion lead to dehydration, heat exhaustion, increased risk of heat stroke, kidney disease and cardiovascular strain. Indoor workers in poorly ventilated office buildings are at risk of heat-related illness and discomfort. Higher indoor temperatures in schools can lead to decreased student performance. Finally, reduced alertness and concentration problems can lead to more traffic accidents.

2 See https://vmm.vlaanderen.be/diensten-producten/impact-tool/veelgestelde-vragen-impact-tool, under "Vind ik in de IMPACT-tool ook data voor lagere temperatuurtoenames?"

The risk severity score is considered ***catastrophic*** at all global warming levels with a high confidence level. Policy readiness is considered ***medium***. This leads to an urgency score of "urgent action needed".

Risk Severity

The risk severity is considered ***catastrophic*** at all global warming levels. Several analyses for Belgium as a whole or at regional level have shown an increase in mortality risk, all-cause mortality as well as cardiovascular and respiratory mortality. The elderly, women and residents of the most built-up municipalities are most at risk. Detailed analyses that predict heat-related mortality according to various climate change scenarios for the whole of Belgium have not been performed so far.

Mortality predictions in function of GWLs are presented in Table 8.

Table 8: Number of annual deaths in Belgium according to the studies mentioned in the left column, for different global warming levels. It should be noted that these numbers carry considerable uncertainty (not shown here)

Climate risk	2°C	3°C	4°C
Verachtert, et al. (2023)[1]	-	2904	-
Crouzier et al. (2024)[2]	-	1619	-
García-León et al. (2024)[3]	1194	1986	3092
Masselot et al. (2025)[4]	1404	2925	5616

[1] This figure relates to the Flemish Region only and accounts for ageing of the population.
[2] Extrapolated from figures for Brussels.
[3] Based on 15 Belgian cities only.
[4] Adapted for the Belgian population in 2025 of 11.7 million.

Even the most optimistic warming scenario consistently involves well over 1,000 annual fatalities and a very consequential economic cost to society at +2°C.

Urban areas are clear hotspots, due to the urban heat island phenomenon and enhanced vulnerability of urban populations. Low-income urban areas are prone to overheating due to poor housing, a lack of urban green infrastructure and low overall adaptive capacity.

Multiple vulnerable populations are disproportionately affected, including the elderly, pregnant people, young infants and people with psychiatric disorders. Outdoor workers are also significantly impacted.

Confidence level

Overall, the confidence in the risk direction and severity is high, making this one of the most certain and well-documented risks in Belgium.

Policy readiness

Belgium has made notable progress in recognising and addressing the health risks associated with excessive heat. A multi-level governance framework is in place, supported by national and regional plans, coordinated institutional mechanisms and a growing set of data and tools. The existence of the Federal Ozone and Heat Plan, the integration of climate-health concerns into NEHAP and the mobilisation of key actors such as the Royal Meteorological Institute, IRCELINE and Sciensano reflect a clear commitment to managing this risk.

At the regional level, important initiatives have been developed. Flanders has invested in high-resolution heat mapping and vulnerability assessments, while Wallonia has launched studies and planning efforts focused on urban heat islands and greening strategies. Brussels has also taken steps to identify cool zones and improve local preparedness. These efforts demonstrate regional engagement but their implementation and integration into broader planning frameworks remain uneven.

Despite these achievements, the overall policy response still tends to focus on short-term crisis management and awareness raising rather than long-term adaptation. Preventive measures – such as structural investments in cooling infrastructure, urban greening and targeted support for vulnerable populations – are not yet systematically embedded across all levels of governance. Moreover, the institutional complexity of Belgium's federal structure can pose challenges to coordination and consistency in implementation.

In light of these observations, policy readiness is assessed as ***medium***, reflecting a system where key components are in place but where further efforts are needed to enhance coherence, strengthen long-term resilience and ensure equitable protection across regions and population groups.

RISK TO HUMAN HEALTH DUE TO THE INCREASE OF VECTOR-BORNE DISEASES

Description

Climate change is increasing the risk of vector-borne diseases (VBDs) in Belgium by altering the distribution, survival and activity of disease-carrying vectors such as ticks, mosquitoes and sandflies. Warmer temperatures, milder winters, wetter springs and changes in land use and urbanisation are creating more favourable conditions for vectors and their pathogens, with notable exceptions.

Ticks (e.g., Ixodes ricinus) are already widespread in Belgium and are the primary vectors of Lyme disease and tick-borne encephalitis (TBE). While Lyme disease is mostly mild, untreated cases can lead to severe neurological and joint complications. TBE, though currently rare, can cause serious neurological illness and long-term damage. Even though climate change may extend the active season of ticks and therefore increase human exposure, hot and dry summers may reduce tick survival. Because of these counteracting effects, the future Lyme disease prevalence due to climate change is uncertain but nonetheless warrants caution.

Mosquitoes, particularly alien Aedes albopictus (tiger mosquito), are expanding their range into Belgium and higher temperatures may accelerate virus development. Ae. albopictus can transmit dengue, chikungunya and zika viruses. Although no local transmission has been reported in Belgium yet, overwintering populations have been confirmed and neighbouring countries have already experienced outbreaks. According to recent analyses and reports, the first local outbreaks in Belgium are expected in the next few years. Urban heat islands and artificial breeding sites (e.g., ponds, containers) increase the risk in cities. Culex pipiens, the common house mosquito, is a potential vector for West Nile virus (WNV), which has caused outbreaks in Germany and France. While most WNV infections are mild, severe neuroinvasive disease can occur in about 1% of cases.

Sandflies, vectors of leishmaniasis, are expanding northward due to climate change. Though rare in Belgium, their presence has been confirmed and imported cases are increasing.

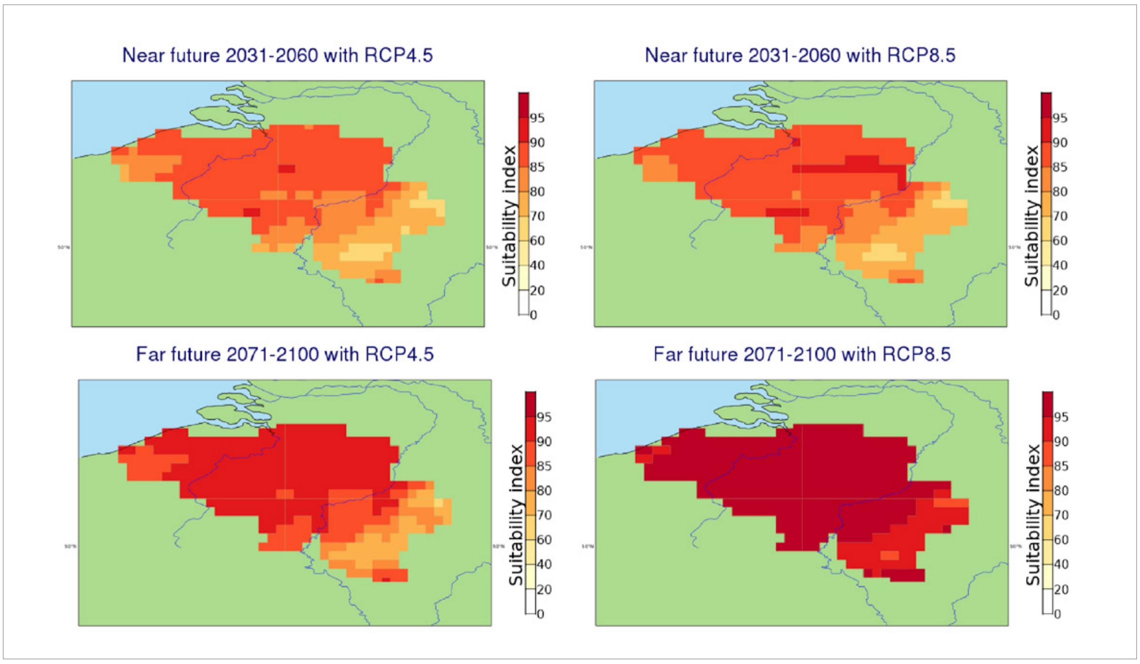

Figure 27. Projected suitability for the survival of Aedes albopictus in Belgium. Source: De Ridder et al. (2020)

The risk is further amplified by international travel and trade and changes in human behaviour (e.g., more outdoor activities with fair weather caused by climate change). However, the complex ecology of vectors and pathogens and the interplay of climatic and non-climatic factors, make projections highly uncertain.

The risk severity is considered ***limited*** at a global warming level of +2°C and substantial at +3 and +4°C with a low confidence level. Policy readiness is considered medium. This leads to an urgency score of "**precautionary action needed**"

Risk Severity

The severity of this risk is assessed as ***limited to substantial***, depending on the warming scenario and disease, with mosquito-borne diseases causing more concern. While the presence of vectors is increasing, actual disease transmission depends on multiple factors, including vector density, pathogen presence and human exposure.

Lyme disease is endemic in Belgium, with an estimated annual economic burden of €5.6 million. However, no clear upward trend in incidence has been observed. TBE is emerging, with sporadic autochthonous cases reported since 2018.

No local outbreaks of mosquito-borne diseases of dengue or chikungunya have occurred in Belgium yet, but the risk of first autochthonous transmissions is expected in the next few years. Whereas Aedes albopictus is known to have established in eight well-defined locations as of the summer of 2025, modelling suggests that larger parts of Belgium will become climatically suitable for tiger mosquitoes by mid-century. WNV outbreaks in neighbouring countries suggest that Belgium could face similar risks in the near future.

Confidence level

Despite the growing presence of vectors, the lack of disease incidence projections and the uncertainty around transmission dynamics result in a low confidence estimation about the exact magnitude of the risk and limit the ability to assign a higher severity level.

Policy readiness

Policy readiness is rated as ***medium***. NEHAP3 currently serves as the central policy for VBD management in Belgium. Nevertheless, the lack of a unified, long-term legal framework undermines the effectiveness of existing policies. While various surveillance systems, preventive and control measures are in place, they remain fragmented, underfunded and poorly coordinated[3].

Belgium has several surveillance systems in place (e.g., Ticknet, MEMO+, VectorNet), combining citizen science, environmental monitoring and laboratory testing. However, surveillance is mostly passive and limited in scope. Monitoring efforts largely focus on ticks and (tiger) mosquitoes, with limited attention given to other vectors and associated diseases such as West Nile Virus. Initiatives led by Sciensano, including MEMO+ and TickNet, generate valuable data, yet their scope is limited and integration across ecological, clinical and entomological domains is weak.

Public awareness and prevention efforts also remain insufficient. The Belgian healthcare system is relatively well-equipped to manage VBDs, vaccination recommendations exist for travellers (e.g. TBE, dengue) and public awareness campaigns are in place, though coverage and targeting remain uneven, especially for vulnerable groups. More robust citizen outreach and improved communication between government levels and the healthcare sector are also needed urgently to prevent the spread of VBDs. Moreover, control and early detection measures remain critical. Regional authorities are responsible for vector control but efforts are fragmented, underfunded and not systematically evaluated.

Governance is complex, with responsibilities spread across federal, regional and community levels. A stronger One Health approach is needed to improve policy coherence and effectiveness. This would involve integrating human, animal and environmental health data into a single surveillance and response framework, supported by sustainable funding and clear accountability mechanisms. The current siloed system, with responsibilities divided across multiple federal and regional entities, hampers the ability to anticipate and respond to emerging threats. To build a more resilient and proactive approach to vector-borne disease management in the context of climate change, it is essential to strengthen intersectoral collaboration, clarify institutional roles and invest in integrated monitoring and predictive tools.

[3] Note that the NEHAP working group on Exotic Mosquitoes and Other Vectors will address part of these limitations following decisions taken at the interministerial conference in Autumn 2025 (not yet communicated at the time of writing).

RISK TO HUMAN HEALTH DUE TO THE INCREASE IN NON-COMMUNICABLE DISEASES

Description

Increased **UV radiation** may lead to harmful effects on skin and eye health, including skin cancer (melanoma and squamous cell carcinoma) as the most prominent risk. UV radiation is mainly determined by the position of the sun, the thickness of the stratospheric ozone layer, presence of clouds and aerosols in the air. Increased sunshine duration and intensity may lead to more outdoor activities and heighten UV exposure but, at the same time, extreme heat events could lead to people staying indoors and adopting protective measures.

The daily maximum UV index has increased by 5.8% in Uccle in the period 1997-2022. Skin cancer is the type of cancer with the fastest increasing incidence (more than 90% increase in the period 2012-2022). However, the increase cannot be explained by demographic changes nor by the increase in UV radiation. Other factors such as more leisure time spent outdoors and/or evolutions within medicine (e.g. improved diagnostics) may explain the increase.

Climate change may lead to higher concentrations of **air pollutants** through decreased removal of air pollutants by precipitation during prolonged drought periods and more frequent episodes of stagnant air. Increasing temperature may further lead to increased ozone concentrations. Wildfire smoke, even coming from Southern Europe or elsewhere, is a source of increased (and more toxic) particulate matter.

Higher temperatures, dry summers, heavy precipitation and higher CO_2 concentrations lead to higher **pollen concentrations** and an earlier and longer pollen season. Higher temperatures may also lead to the establishment of new (invasive) alien plant species and increased sensitivity to these new species, e.g. Ambrosia artemisiifolia or ragweed.

The severity of the risk is considered ***critical*** for all global warming levels with a medium confidence level. Policy readiness is considered ***medium***. This leads to an urgency score corresponding to "more action needed" at +2°C.

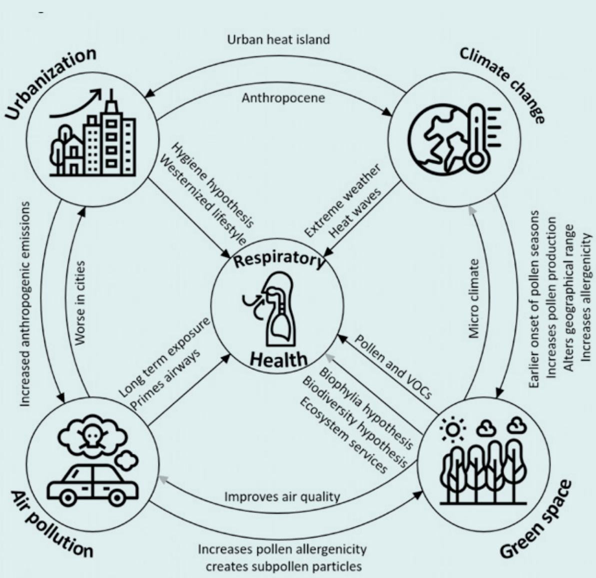

Figure 28. Impacts of air pollution, pollen allergenicity, urbanisation and climate change and their interactions, on respiratory health. Source: Somers et al. (2021)

Risk Severity

The severity of the risk is considered ***critical*** for all global warming levels.

Projected trends in UV-radiation are highly uncertain. For Belgium, climate models predict that the increasing trend in the amount of short-wave radiation (which includes UV radiation) at the earth's surface will continue in the summer while this is more ambiguous in winter. Under various SSP climate scenarios, the radiation intensity of short-wave radiation in the summer will be 5% higher in 2050 than in 2020, which would lead to 200 extra cases of melanoma and 500 extra cases of squamous cell carcinoma.

The human health impact due to exposure to particulate matter (PM), nitrogen dioxide (NO2) and ground-level ozone (O3) is significant. The increase in ozone-related premature mortality has been estimated for France and Germany to be at least 6% for GWL 2 to 3°C, compared to the period 2010-2014. Applying this to the reported 1,380 ozone-related deaths in Belgium in 2022, results in over 70 additional premature deaths in 2050. For PM2.5 no quantitative assessment of the impact of climate change on PM2.5 concentration levels and related health effects is available. There is an increase in wildfire likelihood. Due to Belgium's fragmented landscape and urban proximity to natural areas, the risk of human exposure to wildfire smoke is relatively high. Wildfire smoke can also travel to Belgium from Southern Europe or elsewhere.

Long-term observations of allergenic pollen levels in Belgium indicate a clear trend of increase in seasonal intensity for various trees. In Brussels long-term shifts in absolute pollen concentrations, earlier pollen onset and longer pollen periods have been observed, as well as a significant synergistic increase in asthma-related hospital admissions due to increasing concentration of allergenic pollen species and air pollution. Invasive plants (e.g., ragweed) may amplify allergy risks in the future. No quantitative projections are available for the impact of climate change on pollen-related diseases. However, the sheer number of people in Belgium allergic to grass pollen, or pollen from the Betulaceae family, is considerable (10 to 20%) and the impact of climate change is expected to increase this number further. For ragweed alone, more than 200,000 Belgians may have allergic symptoms by 2050.

Confidence level

Aggregating the confidence rating across the three impacts, the confidence level of the estimated severity level is medium. Determining the confidence level for the risk of NCDs is challenging, given that the three diseases relate to distinct scientific literature.

Policy readiness

The overall policy readiness to address health risks from non-communicable diseases (NCDs) linked to climate and environmental change is ***medium***. While Belgium has developed relevant frameworks and monitoring systems, the level of integration, coherence and implementation varies significantly across the three domains.

Policy readiness for **UV-radiation** is assessed as advanced. Belgium has committed to international treaties such as the Vienna Convention and Montreal Protocol, which have significantly reduced ozone-depleting substances. Nationally, UV exposure is monitored through RMI forecasts and supported by public awareness campaigns and cancer data collection via the Belgian Cancer Registry. The Royal Decree recognising UV-induced skin cancer as an occupational disease marks a major achievement in integrating UV risks into health policy. However, UV radiation is still not systematically embedded in national heat and ozone plans, limiting the scope of preventive measures.

Policy readiness for **air pollution** is assessed as medium. Belgium aligns with EU air quality directives and has implemented sectoral measures such as vehicle emission standards and energy efficiency measures. Monitoring systems are well developed, with IRCELINE and Sciensano providing real-time data and health-related research. Nevertheless, pollution levels remain above WHO guidelines in many areas and the awareness of the related health impacts, especially long-term morbidity, remains limited. Climate change interactions with air pollution are also poorly understood and under-represented in current strategies.

Policy readiness for **aeroallergens** is assessed as low. Despite the existence of long-term monitoring through Sciensano's AirAllergy network and regional initiatives like the Observatoire Wallon des Ambroisies, there is no structured national policy or legal framework. Data gaps, lack of systematic diagnosis and treatment and poor integration of climate-related risks further weaken the response. Emerging threats such as invasive allergenic plants and fungal spores remain largely unaddressed, underscoring the need for stronger governance and health sector engagement.

RISK TO MENTAL HEALTH DUE TO CLIMATE CHANGE

Description

A growing body of research has pointed to climate change's current and potential consequences on mental health. Climate change can have direct or indirect effects on mental health. Direct effects arise from first-hand experiences of climate change, whereas indirect effects stem from awareness or bearing witness to changes caused by the climate crisis.

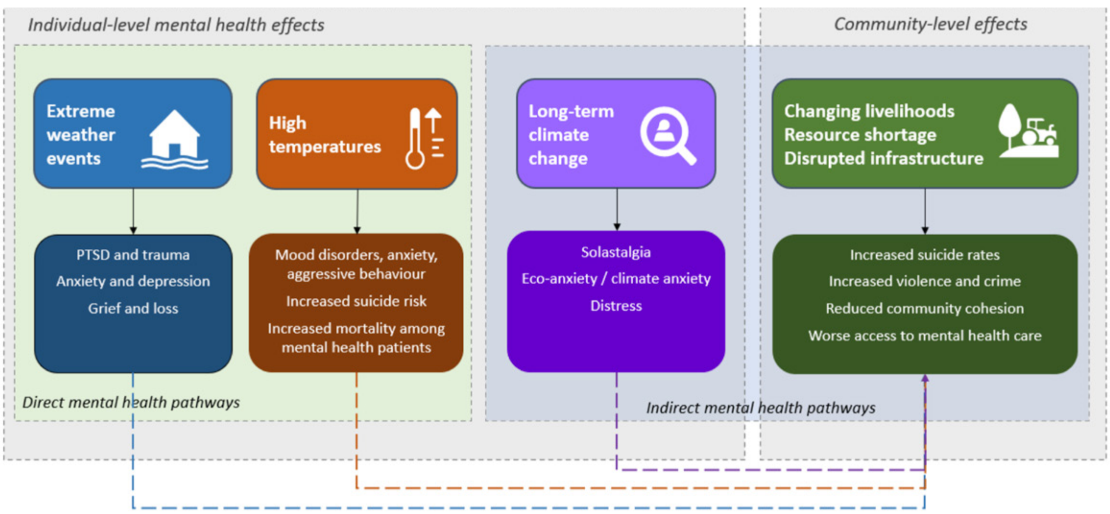

Figure 29. The main pathways of climate change impacts on mental health in Europe. Source: EEA (2022)

Exposure to heat exacerbates mental and psychosocial problems and impairs general wellbeing. Evidence for deteriorating mental, psychological and neurological conditions due to heat is found in several international and European studies. Ambient outdoor temperature is positively associated with attempted and completed suicides, hospital attendance or admission (especially among older adults) for mental illness and worse outcomes for community mental health and wellbeing.

In several European countries there is evidence that heat-related morbidity (hospitalisation) and mortality increase for people with mental, psychological and neurological conditions, as well as some (contradicting) evidence for the use of psychotropic drugs. Dementia, schizophrenia as well as drug/alcohol abuse are significant risk factors.

Other extreme weather events, such as flooding, wildfires and droughts and their related health impacts, damage to (residential) buildings or crops, fear, stress and uncertainties, also lead to impacts on mental health, such as PTSD, anxiety, depression, sleep problems, substance use disorder and even suicide. A major stress factor is forced displacement. A recent study based on the flooding of July 2021 in Belgium found adverse psychosocial effects persisting more than two years post-event. More than 50% of the respondents reported a deterioration in their psychosocial wellbeing after the floods. Impacts of the flooding in the Netherlands included increases in stress, anxiety, fear and higher rates of absenteeism related partially to stress and shock. High stress levels remained up to six months after the floods. One year after the floods receded, many houses were still damp or wet, affecting the mental health of inhabitants.

Climate change anxiety is the overall worry about the anticipated impacts of climate change and the related uncertainty. It is a normal emotion that can contribute positively to climate change action and provide active, adaptive coping mechanisms that prepare a person for climate change. However, it can also be accompanied by negative emotions. In some people, climate change anxiety can take the form of a specific anxiety disorder. Specific anxiety disorders are long-term, excessive forms of anxiety focused on a single situation or object. Feelings of climate-anxiety response can impair or negatively affect a person's mental wellbeing and daily life and functioning and can be associated with outcomes such as insomnia, anxiety and depression in some people.

The risk severity is considered ***substantial*** at a global warming level of +2°C and ***critical*** at +3 and +4°C, however, with a low confidence level. Policy readiness is considered ***low.*** This leads to an urgency score of "precautionary action needed".

Risk Severity

In several European countries there is evidence that morbidity (hospitalisation) and mortality increase for mental, psychological and neurological (dementia) conditions. For Belgium there is evidence for an increased number of suicides with increasing temperature (Casas et al., 2021) and rather weak evidence for deterioration in psychosocial wellbeing after flooding in up to 50% of the affected people. Climate anxiety might affect about 10% of the Belgian youth.

It can be expected that the impact on morbidity and mortality will be significant in all global warming scenarios due to increasing temperatures, an aging population and the increase of multimorbidity. However, a quantitative analysis is not possible as this requires the formulation of risk functions derived from a retrospective analysis of health data (currently being performed for Flanders) and the application of these risk functions on future demographic climate data. There is no such analysis available yet in Belgium or in a similar context on which we could base our judgment.

Confidence level

The risk severity scores (substantial at +2°C and critical at +3°C and +4°C) are based, with low confidence, on the broad consensus for increase in morbidity and mortality due to climate change, very partial data for Belgium and expected rising level of incidences with increasing global warming level.

Policy readiness

The current level of policy readiness regarding the mental health impacts of climate change in Belgium is assessed as ***low.*** While mental health is increasingly recognised as a public health priority, its intersection with climate change remains largely unexplored in policy frameworks.

There is no systematic monitoring of climate-related mental health outcomes and data gaps persist, especially regarding eco-anxiety, heat-related psychiatric impacts and post-disaster trauma.

While some relevant frameworks exist, current initiatives remain fragmented with limited coordination across governance levels and sectors. For instance, the Psychosocial Intervention Plan (PIPS) provides a clear framework for emergency response but offers limited support for long-term mental health follow-up after disasters. Some plans (e.g. NEHAP3, Wallonia's health promotion strategy) refer to mental health and green-blue infrastructure is increasingly promoted for its co-benefits. However, concrete measures and financing mechanisms are still lacking.

Belgium lacks a cohesive, proactive approach to mental health in the context of climate change and significant improvements are needed in surveillance, planning and cross-sectoral integration. The absence of robust data, the lack of targeted preventive measures and the reactive nature of current mechanisms limit Belgium's capacity to anticipate, monitor and respond to climate-related mental health risk.

RISK TO HEALTH SYSTEMS AND SOCIAL CARE DELIVERY DUE TO CLIMATE CHANGE

Description

Climate change will affect future health care delivery through the direct effects of extreme events such as heat waves and flooding and indirectly due to more induced changes in the extent and type of demand for health care (such as vector-borne diseases and heat-related conditions) which put a burden on the existing health care system. Flooding and heatwaves have the most important impact on the health system in Belgium. They have effects on built, social and institutional infrastructures that support health and health care. Power failures, IT disturbances, water supply losses or road damages lead to reduced accessibility to, and disruptions in, health and care services (both inpatient and outpatient services in residential and home settings). At the same time, they increase the demand for health care services, both directly and, in the case of flooding, indirectly through contaminated surface water or floodwater, which can promote infectious disease outbreaks or through psychiatric morbidity.

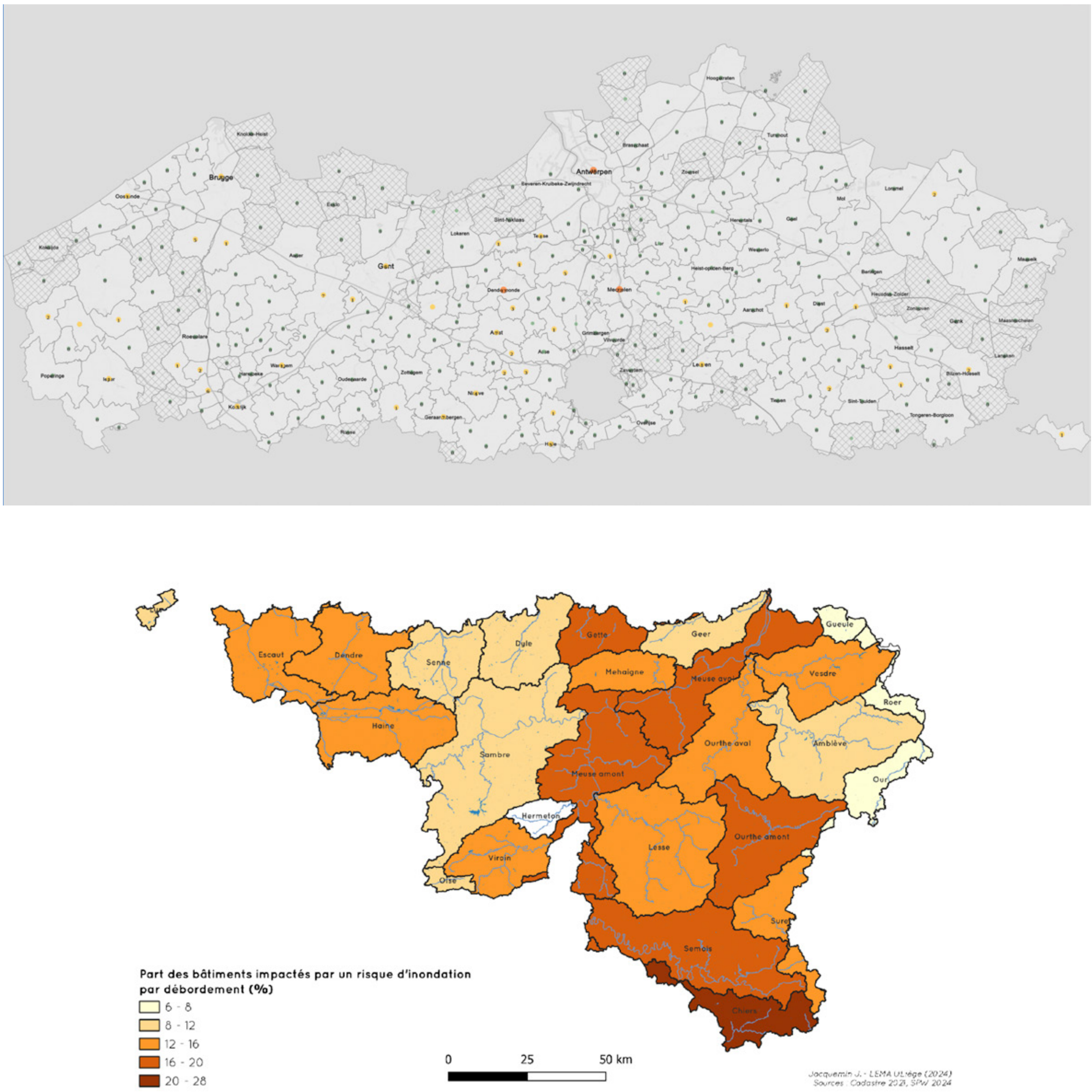

Figure 30. Top: number of vulnerable institutions at risk of inundation through fluvial flooding in 2050 in a high-impact scenario. Source: Klimaatkaartencatalogus. Kaartcatalogus – Klimaatportaal Vlaanderen.. Bottom: share of buildings in Wallonia in zones at risk of fluvial flooding per hydrographic sub-basin. Source: Harchies et al. (2025)

A significant part of the healthcare workforce may be unable to work (efficiently), both in hospitals and residential settings or in home care (due to transport and ICT problems, personal impact of the event, increased levels of stress, system breakdown), causing further disruption and stress on those who remain working. Heatwaves can also affect the personal health of members of the workforce and their ability to perform normally.

Hospitals in Belgium have emergency power supply and priority energy supply. However, this is not the case for psychiatric hospitals and other (residential) care centres. In addition, important aspects are not implemented in all hospital emergency plans.

The risk severity is considered ***substantial*** at a global warming level of +2°C and +3°C and ***critical*** at +4°C. The confidence level is considered medium. Policy readiness is considered medium to advanced. This leads to an urgency score of "precautionary action needed" to face +2°C and +3°C global warming levels and "more action needed" in the case of +4°C.

Risk Severity

The risk severity is considered ***substantial*** under +2°C and +3°C GWL scenarios and ***critical*** at +4°C. No information was found on the number of people that would not receive appropriate medical or social care leading to untreated conditions, delay in treatment or worsening of existing conditions and the severity of these impacts in terms of increased morbidity and mortality or costs. What is generally known, is that floods (see Technical Paper "*risk to buildings due to flooding*") and especially heatwaves ("*risk to human health due to heat stress*") will become increasingly prevalent.

To assess how the functioning of health and social care infrastructure and services would be affected by future flooding, a first proxy is the number of potentially affected vulnerable institutions (day care centres, homes for the elderly and hospitals). The number of institutions in Flanders that are vulnerable to flooding due to extreme precipitation will double in a scenario of +2.5°C. At GWL +4°C, about 3,000 health and care institutions in Flanders could be directly vulnerable to 'dangerous' flooding. In certain urban areas in Flanders the proportion of institutions becoming vulnerable could be as high as 40%. Flooding would lead to direct impacts on the healthcare of patients or residents in the affected institutions and to decreased capacity to manage the influx of patients caused by the flood. The number of institutions that are vulnerable to heat stress will multiply by ten.

One German study on the 2021 flood reported power failure in 97% of outpatient care practices, water supply damage in more than 50% and loss of patient records in nearly 40%.

Confidence level

The confidence level is considered medium. There is little quantitative information on disruptions in access to and functioning of health and social care infrastructure and services. Expected impacts, partially based on recent floodings, are mostly described in qualitative terms. Available literature and data are mainly focused on hospitals.

Policy readiness

Belgium demonstrates a ***medium*** level of policy readiness in addressing climate-related risks to the health system and social care delivery. A comprehensive policy framework exists at international, European and national levels, covering both preventive and emergency response measures. Surveillance systems are robust and diversified, enabling early detection of health threats. Emergency planning is legally anchored and multi-level, supported by plans and protocols like the Medical Intervention Plan (MIP), Hospital Emergency Plans (HEP), as well as strategic inventories for medical supplies. The policy framework also addresses health infrastructure resilience through building standards (e.g., Energy Performance of Buildings Directive – EPBD) and the recent CER Directive, with the aim of improving thermal comfort, energy autonomy and operational continuity in healthcare facilities. Institutional coordination mechanisms like the Risk Assessment Group (RAG) and Risk Management Group (RMG) further strengthen crisis response capacity.

However, significant implementation gaps persist. Climate considerations are not systematically integrated into emergency planning and many healthcare facilities lack adequate infrastructure resilience. Retrofitting older infrastructure to meet resilience standards is technically complex and financially burdensome and no dedicated funding mechanism is in place to support this transition. Moreover, the absence of mandatory heatwave protocols and limited training on climate-related health risks leave healthcare professionals underprepared for emerging threats. Communication channels between authorities and frontline staff are fragmented and alert systems for extreme weather events are not consistently directed toward healthcare facilities. Governance fragmentation further hinders effective preparedness, with overlapping responsibilities between federal and federated entities leading to ambiguity in crisis response.

While the policy architecture is solid, operationalisation remains uneven and resource constraints limit the system's ability to adapt to increasing climate pressures. To move from strategic intent to operational resilience, Belgium must address these gaps through clearer governance, targeted investments and stronger implementation mechanisms.

RISK TO HUMAN HEALTH DUE TO THE INCREASE IN PANDEMIC ZOONOTIC DISEASES

Description

Land-use change, agriculture, climate change and wildlife use are the most important ecological drivers of both disease emergence and biodiversity loss (Figure 31).

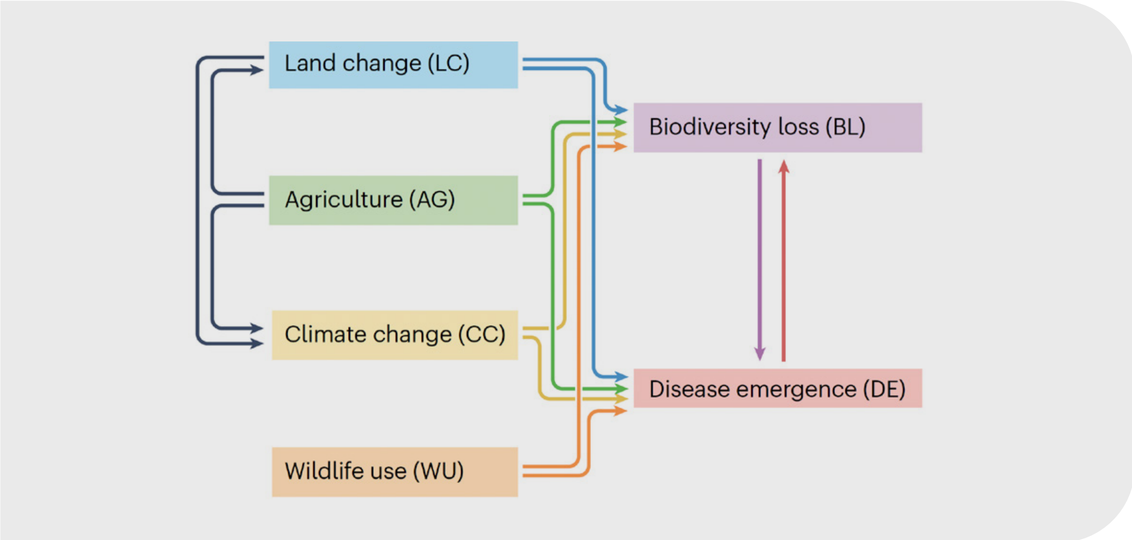

Figure 31. The relationships between zoonotic disease emergence, biodiversity loss and drivers of ecosystem degradation. Source: Carlson et al. (2025)

Land use change is cited as the cause of over 30% of emerging infectious diseases and correlates significantly with the emergence of novel zoonoses globally. Deforestation, agricultural expansion and urbanisation, create fragmented and novel ecosystems, force wildlife into closer contact with humans and livestock, and promote the expansion of human populations into landscapes where people usually lived at relatively low density, thus creating new human-livestock-wildlife interactions and increased potential for cross-species transmission. Climate change reshapes ecosystems as well, altering interactions between pathogens, vectors and hosts, causing changes in host and vector ranges, alterations to their life cycles and increased migration of people and domestic animals.

Wildlife farms, markets and supply chains amplify the risk of epidemics and pandemics by creating high-risk interfaces for zoonotic spillover, especially when animals are transported into large urban centres where high population density can accelerate outbreaks. The intensification of livestock and poultry production has also been linked to increasing potential for transmission of pathogens to people and disease emergence. Livestock often acts as a bridge across the wildlife-livestock-human interface.

The effects of biodiversity on disease emergence are complex and probably involve multiple mechanisms, sometimes simultaneously. On a broad scale, host biodiversity often increases disease risk. However, loss of host biodiversity within a given ecological community is typically followed by an increase in pathogen transmission. Across ecosystems, the species that are most resilient to anthropogenic change are also more likely to be hosts for zoonotic diseases.

Belgium, as a highly connected and urbanised country, remains highly susceptible to imported zoonotic outbreaks, as demonstrated during the COVID-19 pandemic.

The risk severity is considered ***catastrophic***. The confidence level is medium and policy readiness is evaluated as ***medium.*** This leads to an urgency score of "urgent action needed".

Risk Severity

The severity of this risk is classified as ***catastrophic***, primarily due to the potential for global pandemics. Historical data shows a rising trend in the frequency and severity of zoonotic spillovers. For instance, the annual number of high-consequence zoonotic events globally has increased by nearly 5% per year, with associated fatalities rising by almost 9% annually. Projections suggest that the probability of a COVID-like pandemic could triple in the coming decades, raising the lifetime risk of such an event to over 70% for future generations.

Belgium's dense population, urbanisation and global trade links make it particularly susceptible to the rapid spread of zoonotic diseases. Although the country may not be a primary origin point for new pathogens, its exposure to cascading global impacts is high. The COVID-19 pandemic demonstrated how quickly such diseases can overwhelm healthcare systems and disrupt economies.

Confidence level

The severity classification is based on a large quantity of high-quality global data and projections but there is little quantitative information at the Belgian level. The high ecological complexity makes future estimates difficult. This limits the ability to fully contextualise the risk at the national level, setting the confidence level to medium.

Policy readiness

Policy readiness for this risk is assessed as ***medium***. A wide range of relevant policies, strategies and legal instruments exist at international, European, federal and federated entities levels. These cover key domains such as biodiversity protection, animal and human health, food safety and crisis preparedness. However, the integration of these instruments into a coherent and operational framework remains limited.

Belgium has several surveillance systems and early warning mechanisms in place, including various mechanisms for zoonotic disease control and mandatory reporting. These systems are supported by institutions such as Sciensano, the Federal Agency for the Safety of the Food Chain (FASFC) or federated entity authorities and are integrated into broader EU and international frameworks like the WHO's GLEWS+ and the EU's ADIS and TRACES systems.

However, governance is fragmented across multiple levels, which complicates coordination. While policies exist in the domains of human, animal and ecosystem health, the integration of these under a unified One Health approach remains limited. Belgium's participation in the international PREZODE initiative since 2021, and the establishment of a national working group, mark important steps but several challenges persist. These include inconsistent disease reporting requirements across regions, the lack of clear crisis escalation protocols and the absence of interoperable surveillance mechanisms. Moreover, social dimensions of vulnerability are not yet sufficiently addressed in current frameworks.

Despite these challenges, there is strong awareness and willingness to improve preparedness. The Zoonotic Governance Plan represents a step forward even though it has not yet demonstrated full operational effectiveness. The recent simulation exercises and post-exercise reviews indicate a growing commitment to strengthening governance and coordination.

RISK TO SOCIAL COHESION AND INEQUALITIES DUE TO CLIMATE CHANGE

Description

The most vulnerable people are disproportionately at risk from climate change (EEA, 2024b, 2025; Lager et al., 2023). The unequal distribution of climate impacts and risks due to unequal exposure to hazard, pre-existing inequalities and differences in adaptive capacities and capabilities (due to e.g., socio-economic, historical and intersectional injustice) results in exacerbated vulnerabilities. The twin challenges Belgium is facing with accelerating ecological degradation and persisting social inequalities and poverty cannot be addressed independently, as the unequal distribution of the adverse consequences of climate change between populations finds its origin in pre-existing social inequalities and reinforces them (Fransolet and Vanhille, 2023; Laurent, 2023). Climate change is a systemic challenge that puts into question priorities and values agreed upon to organise national solidarity in the long term.

According to Eurofound (2014) a "cohesive" society is characterised by resilient social networks, positive emotional identification, trust in institutions and solidarity. Increasing inequalities caused by climate change or (lack of) adaptation policies and resulting distribution conflicts, put societies under pressure and generate loud calls for social justice (Adger et al., 2016). In times of social disruptions, absence of consideration for social justice generates a lowering of confidence, trust and solidarity (Wynen et al., 2022). Fair strategies to tackle unfair risks, on the other hand, support a perception of fairness at both individual and collective levels (EEA, 2025).

Each risk analysis within the BCRA identifies the most vulnerable groups. Some segments of the Belgian population accumulate factors of vulnerability to multiple climate risks, increasing their likelihood to be disproportionately affected by climate-related events such as heatwaves and flooding (Fransolet and Vanhille, 2023). For each hazard and exposed system, main reported tendencies in terms of enhanced vulnerabilities have been detailed in each technical paper; the main points are summarised in the technical paper for the risk to social cohesion and inequalities due to climate change.

The risk severity is considered ***substantial*** at a global warming level of +2°C, rising to ***critical*** at +3°C and ***catastrophic*** at +4°C. Confidence is considered high for +2°C GWL, but low for further warming levels as, although there is consensus that this risk is substantial at least, and will continue to increase with rising temperatures, it is difficult to assess by how much. Policy readiness is considered ***low*** to ***medium***. This leads to an urgency score of "more action needed".

Risk severity

Although a variety of indicators are available to measure different types of (pre-existing) inequalities and climate change projections, no aggregate national data is available to directly determine the impact, probability and intensity of the risk of increased inequalities and harm to social cohesion in Belgium according to different global warming levels.

However, an indicator of social vulnerability to climate change has been developed in Wallonia, integrating seven factors (Loozen et al., 2025). This indicates the level for each statistical sector and underscores that 62% of the Walloon population has a high to very high level of social vulnerability to climate change. This is particularly the case in the cities of the former "industrial belt" but also in the "Botte du Hainaut", which is a peripheral rural area with low economic activity.

These (sub-)regional differences were already visible through data from 2011, as shown on Figure 32; the Belgian Index of Multiple Deprivation (BIMD) provides a multidimensional view on social deprivation in Belgium, integrating six domains – education, employment, income, housing, crime and health - for assessing social inequalities in health and other outcomes. It is a relative measure of deprivation and is computed at the level of the statistical sector (Otavova et al., 2023). Although the map (Figure 32) does not consider vulnerabilities to climate change, it clearly shows that the differences in terms of deprivation are historical, as well as interregional and subregional.

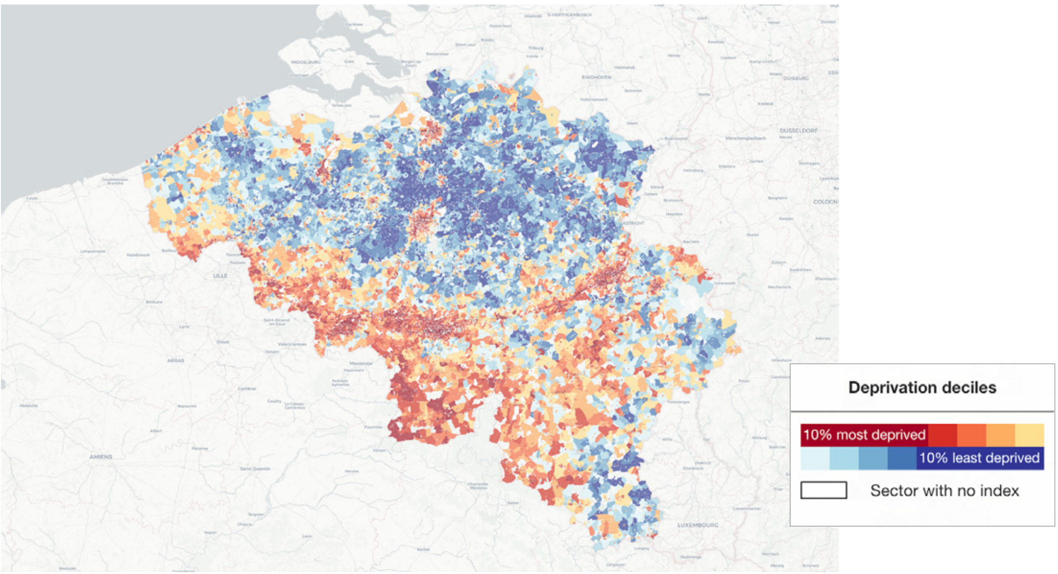

Figure 32. Map of the BIMD – Belgian Index of Multiple Deprivation. Data for 2011. Source: Sciensano (n.d.)

The risk of rising inequality due to climate change, as well as the associated potential for social cohesion loss is well established in the scientific literature. The risk severity is considered ***substantial*** at +2°C, rising to ***critical*** at +3°C and ***catastrophic*** at +4°C.

Confidence level

The overall confidence level is high for 2°C warming and low for 3°C and 4°C. There is strong expert and institutional consensus that climate change will exacerbate existing social inequalities (Cardona et al., 2012; De Muynck et al., 2025; EEA, 2025; Fransolet and Vanhille, 2023; Laurent, 2023) and thus weaken social cohesion (Adger et al., 2016). Evidence from Belgium and other European contexts consistently shows that vulnerable populations face disproportionate physical and mental health impacts (including financial worries). The experts consulted agree that the risk is at least substantial but it is uncertain how quickly this will be manifested for the different GWLs. However, holistic studies on the cascading links from climate change to reduced social cohesion are lacking for Belgium.

Policy readiness

Policy readiness for addressing the risk to social cohesion from climate change in Belgium is assessed as ***medium to low***. While a wide array of policies, plans and strategies exist, these are often general in nature and integrated into broader sustainability and inclusion frameworks. Existing policies are rarely operationalised with concrete measures targeting climate-related social vulnerabilities. Moreover, overall implementation remains partial and financing is limited with few policies prioritising vulnerable populations in a systematic way.

A major challenge lies in the siloed nature of policymaking. Social cohesion and climate adaptation are addressed separately, resulting in missed opportunities for synergy and increasing the risk of maladaptation. Monitoring and evaluation frameworks are in place but do not adequately assess the intersection of climate change and social cohesion. Existing indicators are indirect and fragmented, failing to capture the compounded vulnerabilities of disadvantaged populations.

Moreover, while participatory practices are emerging, vulnerable groups remain under-represented in decision-making processes. Finally, under-investment in the social dimensions of climate policy undermines Belgium's capacity to build resilience. Experts warn that recent budgetary reforms affecting essential services, such as social security, education and culture, may further exacerbate structural inequalities. Without stronger integration of social justice principles, targeted financing and inclusive decision-making, the current policy framework risks failing to prevent or mitigate the erosion of social cohesion under climate stress.

RISK OF INTERNAL DISPLACEMENT OF PEOPLE IN BELGIUM DUE TO FLOODING

Description

Flooding – fluvial, pluvial and coastal – presents an increasing hazard in Belgium (Gabriels et al., 2022; Vousdoukas et al., 2020). Fluvial flooding is currently one of the most damaging forms of flooding in Belgium and the catastrophic floods of July 2021 in Wallonia testify to the great impact severity of this risk for Belgium.

The July 2021 floods led to 39 deaths, with 100,000 people affected and 45,000 homes damaged in Belgium (CSR, 2022). In the most affected areas (the hydrographic basin of the Vesdre and the Lesse rivers) infrastructure networks were also damaged, limiting access to transport, telecommunication, electricity, gas and drinking water supply (CSR, 2022). It is estimated that almost 16,000 people in Flanders and Wallonia were displaced, at least temporarily, in the aftermath of the floods, with some 10,000 people from the city of Verviers alone (IMDC, 2022). One year after the disaster, the Walloon government announced that it had relocated 3,521 people for a maximum of one year (Belga, 2022). This figure does not include those who found refuge with relatives or whose relocation was covered by insurance. There is no detailed study (yet) on the fate of these displaced people, nor the conditions and the duration of their forced displacement, nor their economic and social living conditions.

The impact on residents varies over time. During a critical event, people may have to escape flooded areas for their own safety. After the event, damage to buildings and public infrastructures (such as water and power networks) could be too serious to allow for an immediate return. In severe cases, residents may have to permanently relocate when repair is not possible. In neighbouring countries, Truedinger et al. (2023) show that one year after the July 2021 floods in the Ahr Valley in Germany, more than a quarter of the surveyed population had not returned to their original homes. The desire to permanently leave a high-risk area depends on several factors. Homeowners are much less inclined to move (88% will stay) because they are attached to the place but also because they are financially trapped and do not know where to go, while tenants are more mobile, with 40% of them having moved after the flood and not planning to return (ibid.).


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Belgium's North Sea coastline is highly vulnerable to coastal flooding from storm surges and sea-level rise, posing a significant threat to coastal cities, including Antwerp (Wahl et al., 2018). Coastal infrastructure faces risks from both gradual mean sea-level rise and extreme sea-level events, which result from the combined effects of tides, storm surges and waves. Under RCP8.5, which corresponds to a global warming level exceeding 4°C, extreme sea levels in the region could rise by nearly 1 metre by 2100, making what were once 100-year flooding events occur multiple times per decade. Without adaptation measures, Belgium's coastal flood risks will increase substantially, requiring major upgrades to flood defences (Vousdoukas et al., 2020). Thus, without comprehensive adaptation measures along the coast, a +4°C warming scenario would entail major and irreversible damage to the coast and Antwerp area with major consequences to the industry, infrastructure, public and social services and the habitability of the area.

Preventive relocations can be organised in flood prone areas, as has happened in the Maas valley and is currently being programmed in the Dender area (Flanders). However, a shift towards a spatial reorganisation of territories is often met with resistance from local populations, entailing high financial and political costs. Such preventive relocations present a major impact on the lives of people, as communities may become fragmented, disturbing the social and economic system of both the displaced and receiving communities.

Socio-spatial inequalities compound flood vulnerability with disadvantaged communities often residing in flood-prone areas that lack adequate protective infrastructure (Ozer, 2019). Lower socio-economic status was correlated to a higher probability of living in a flood zone in both Flanders (Coninx & Bachus, 2009) and Wallonia (see Figure 33) and this has been confirmed in the case of the 2021 floodings (de Goër de Herve & Pot, 2024). The most important vulnerability factor thus seems to be economic precariousness.

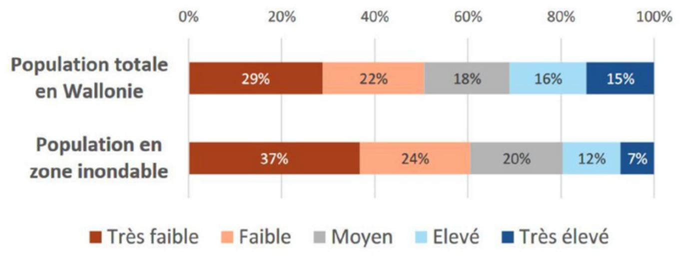


Figure 33. Distribution of the total population in Wallonia and the population living in floodable zones according to socio-economic level (ranging from very low in dark red, to very high in dark blue). Source: SIGENSA as shown in Jamar (2023)

Additionally, cost-benefit analyses tend to undervalue the socio-economic impacts of flooding; the social, physical, financial or psychological characteristics that determine someone's capacity to deal with floods are often overlooked and such understanding remains incomplete (Paauw et al., 2025).

The risk severity is considered ***substantial*** at a global warming level of +2°C and +3°C and ***catastrophic*** at +4°C. The confidence level is considered ***low***, however. Policy readiness is also considered low. This leads to an urgency score of "precautionary action needed".

Risk severity

Flood risk severity in Belgium, when assessed through human exposure is projected to rise sharply under climate change. The European Climate and Health Observatory (2025) estimates that between 2008 and 2023, over 317,000 people were (temporarily) displaced by floods in the EU. The IDMC estimates that in Belgium 1,900 people are currently likely to be displaced per year on average due to riverine flooding and 4,400 on average due to coastal flooding (IDMC, 2025). Future projections suggest that by 2080, fluvial flooding alone could affect over 23,000 people annually under a high-end warming scenario (Alfieri et al., 2015). Coastal flood exposure is expected to increase with an annual exposure rising to as many as 25,500 people by 2100. Thus, tentative estimates may indicate that at 2°C GWL, over 2,700 people will be affected annually by floods and therefore be at risk of displacement, with this number potentially increasing to 15,900-18,000 at 3°C GWL and 23,000-43,000 at 4°C GWL.

While these estimates are presented with a low level of confidence, their evolution is steep enough to open the way for increased attention to planned relocation, which is a major transformation to the dominant strategy of on-site protection, with long term impacts on the territorial functionality for the inhabitants and presents a disruption of local system functionality. For these reasons, the risk is considered as ***substantial*** for 2°C and 3°C GWL. The severity increases to potentially ***catastrophic*** at 4°C GWL due to the increase in coastal flooding leading to a major and irreversible loss of system functionality, particularly in the Antwerp area.

Confidence level

The confidence for these severity assessments is low as quantitative projections of people displacement remain tentative.

Policy readiness

Although several regional instruments in Belgium address climate risks through spatial planning and climate adaptation, the issue of population displacement is not yet recognised as a distinct policy domain. Existing frameworks primarily focus on environmental and infrastructural aspects of flood management with limited attention to the social, legal and operational dimensions of displacement. While there are plans for short-term evacuation in case of disaster, longer-term displacements are not considered. There is currently no national or interfederal strategy in place and coordination across levels of governance remains limited. As a result, the current policy landscape does not provide sufficient basis to anticipate, manage or reduce the risk of displacement linked to floodings and its readiness is considered ***low***.

3.4.3. Qualitative assessment of the cluster

Climate change is starting to reshape the determinants of health in Belgium, not as isolated spikes but as interacting pressures that compound across people, places and services. The eight risks in this cluster form one connected risk landscape. Their interplay determines whether health and wellbeing can be protected or whether concurrent crises push systems beyond their coping capacity.

Heat stress is the most immediate and severe risk to human health. Even the best-case warming scenario will lead to substantially higher night time temperatures, longer and more intense heatwaves and urban heat islands that will increase mortality and morbidity, aggravate cardiovascular and respiratory disease, reduce sleep and cognitive performance and diminish labour productivity. Heat risk interacts tightly with **non communicable diseases** – ozone peaks and particulate pollution worsen chronic conditions, especially on hot days. Furthermore, longer pollen seasons amplify allergic disease and higher UV exposure increases skin cancer risk. Heat stress also elevates **mental health** burdens and can lead to increased violence and suicides, adding to the mental burden posed by eco-anxiety and the sustained anxiety, depression and post traumatic stress disorders that can follow extreme climatic events such as floods.

Infectious disease risks add further layers. **Vector borne diseases** expand as climate suitability changes for ticks and mosquitoes with uneven but rising probability of local outbreaks in urban and peri urban hotspots. Although projections remain uncertain concerning ticks in particular, the risks posed by (tiger) mosquitoes warrant higher preparedness. **Zoonotic pandemics** are low probability but catastrophic – Belgium is unlikely to be the origin, but another COVID like event is increasingly plausible due to global drivers of ecosystem degradation, including land use change, habitat fragmentation and wildlife trade.

Together, these trends translate into surging demand for care, precisely when service capacity is potentially most constrained. That is because the **health system** itself is exposed and vulnerable. Heat compromises building performance, raises cooling loads and strains the energy supply whilst floods disrupt power, water, digital networks and access routes, delaying emergency response and continuity of care. Hospitals, care homes and community facilities are often situated in dense urban fabrics or flood prone valleys, with limited redundancy in back up power or cooling. Staffing becomes a pinch point – heatwaves, infectious disease surges and disaster responses occur in overlapping windows, amplifying absenteeism and burnout. What begins as a climatic hazard can cascade into service bottlenecks.

Flooding and displacement create additional cascades. The 2021 floods illustrated how quickly housing, livelihoods and local services can be compromised. Even when numbers of displaced people are uncertain, the functional disruption is clear – loss of records and medications, interrupted chronic and mental health care, increased exposure to damp and mould and elevated accidents, injuries and gastrointestinal or respiratory infections.

Across all risks, inequalities can be aggravated, leading to loss of **social cohesion**. The elderly, infants, people with pre existing physical or mental health conditions, low income households, migrants, outdoor workers and socially isolated individuals face higher exposure and lower adaptive capacity. Urban heat islands, substandard housing and language barriers concentrate risk, while fragmented governance can leave gaps in targeted action. Without explicit attention to fairness, adaptation can inadvertently exacerbate disparities, eroding trust and fuelling conflict.

What this means for preparedness is straightforward but demanding. Belgium needs to move from single hazard, reactive plans to scenario based, **multi hazard readiness** that recognises seasonal convergence – heat season plus ozone plus allergens plus vector activity – and the potential for overlapping infectious disease waves. In a similar vein, One Health governance is also essential to align human, animal and environmental surveillance for vectors and pathogens. Health and social care infrastructure must be climate proofed – cooling, ventilation, shading, flood safety, back up power and protected digital systems – with special attention given to care homes, hospitals and community clinics in heat and flood hotspots. Surge capacity must be planned for people, places and supplies – workforce, beds, medicines, oxygen, cooling spaces – and tested through regular exercises. Finally, every measure should be designed and evaluated through an **equity lens** – who benefits, who is left out and how to correct course – so that adaptation strengthens, rather than weakens, social cohesion.

3.5. Economy & finance

3.5.1. Description

This chapter explores economic and financial risks.
It focuses on international aspects and on national sectors that are not already analysed in other clusters. National aspects related to ecosystems, food, infrastructures, social and health are studied in their own respective clusters and are therefore considered out of scope here (Cerac, 2025).
As a result, this cluster has a limited scope and does not constitute an exhaustive analysis of the risks to the Belgian economy caused by climate change. Some elements, like the cost to the healthcare system, have not been studied despite their importance (for Belgium, there currently is a data gap concerning this specific important risk that requires a separate study).

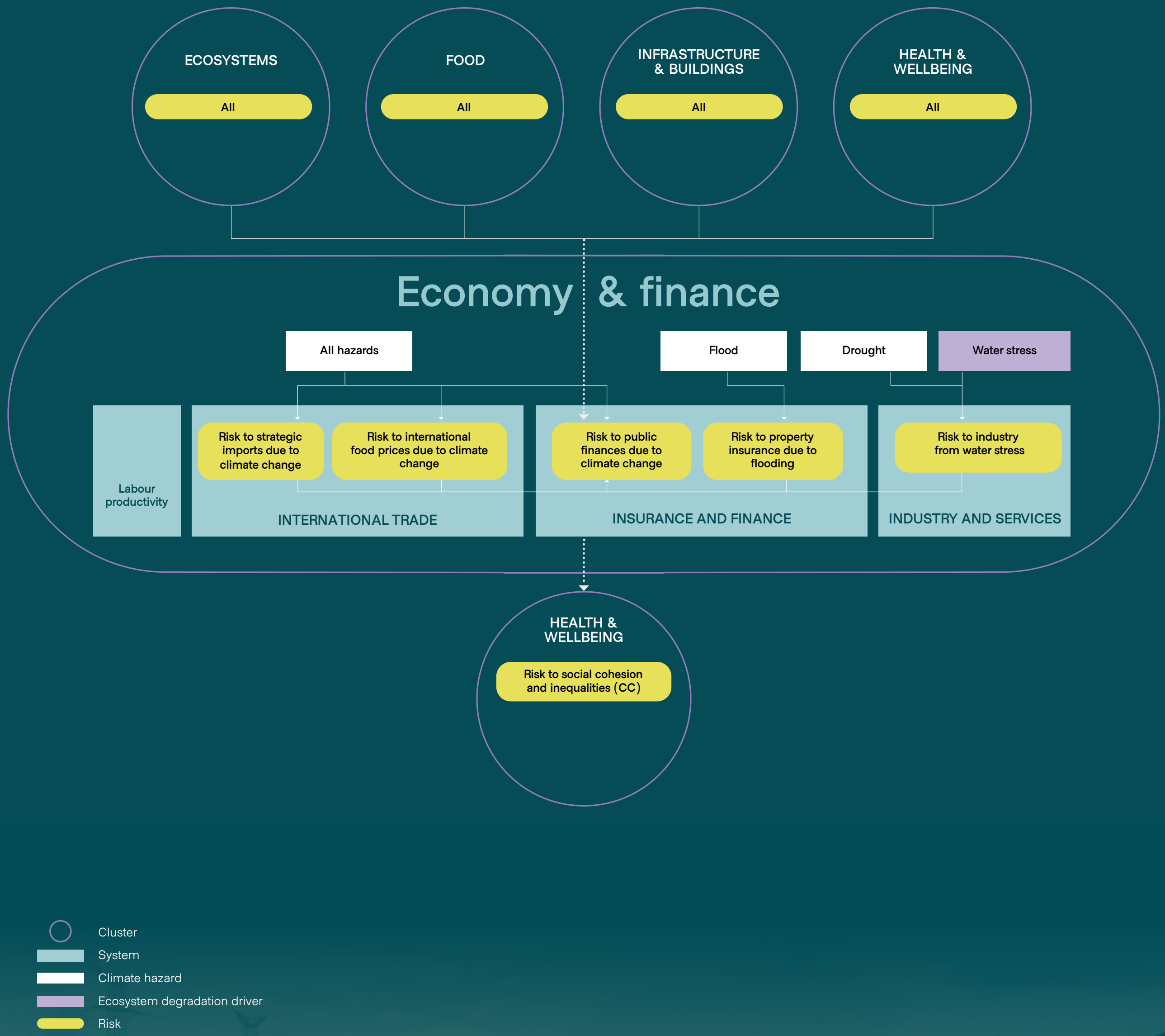
Considering those factors, five climate and ecosystems degradation-related risks with strong implications for the economy emerged during the structured literature review:

- Risk to **property insurance** due to **flooding**;
- Risk to **public finances** due to **climate change**;
- Risk to **strategic imports** due to **climate change**;
- Risk to **international food prices** due to **climate change**;
- Risk to **industry** due to **water stress**.

A sixth risk, the risk to "labour productivity due to heat" was initially selected for further investigation since it seemed relevant based on a Belgian study (De Ridder et al., 2020). However, this study was based on data from a single city and an additional literature review offered a more nuanced view of this risk. Another study about heat and work productivity, by the Joint Research Centre, in the context of Peseta 5, was published a year later (Szewczyk et al., 2021) with more granular data, at the NUTS 2 level (regional level). It highlighted that work in Belgium is mainly clerical (indoor office work) with very little physical work in every studied category (light, medium and heavy physical work) compared to other European countries. Work in Belgium is described as highly adaptable to heat (although adaptation solutions present their own set of challenges). This more nuanced view was corroborated by a study done by the National Bank of Belgium (2024) as well as by the European Risk Assessment (EEA, 2024b), which considers the risk from heat as less urgent, even for outside workers. As a result, it was decided to study the effect of heat in the health cluster where its effects, including mortality, seemed more prevalent and severe.

Key messages

1. Flooding is Belgium's most destructive natural hazard, with climate change expected to greatly increase damages and put strain on the non-life insurance sector. The 2021 Vesdre floods revealed systemic weaknesses in the "cat nat" framework – outdated flood maps and underfunded solidarity mechanisms. This resulted in legal uncertainty that forced insurers to absorb losses far beyond statutory limits, eroding trust from reinsurers in the Belgian legal framework. There is a large consensus among professionals, expert and scholars, reported by prudential authorities, that urgent action is needed to ensure the stable funding of solidarity mechanisms and legal certainty concerning the "cat nat" regime. Otherwise, rising premiums and reinsurer withdrawals could undermine insurability, destabilise mortgages, real estate and ultimately the wider financial system.
2. Climate change represents a systemic and growing risk to public finances, not only through immediate costs such as disaster relief and infrastructure repairs, but also via complex and layered transmission channels that can affect revenues, expenditures, debt sustainability and financial stability. Transmission pathways include direct damages, reduced tax revenues, increased government spending (including social and healthcare costs), disrupted economic activity, disrupted supply chains, inflationary pressures, damaged resources stock, cross-border contagion, impact on creditworthiness, etc., making the fiscal impact both multifaceted and difficult to quantify precisely. Recent quantitative estimates exist, including for Belgium, although they remain characterised by important quantitative uncertainties concerning exact cost and timeframe. Despite these quantitative uncertainties, there is a clear negative impact and trend for public finances and even the lowest estimates breach the "catastrophic" threshold for severity significantly, as defined in the methodology, for all global warming levels.
3. Belgium's strong dependence on non-EU countries for strategic imports exposes it to rising supply chain disruptions from climate hazards such as floods, droughts, storms and wildfires, which threaten production, transport and logistics worldwide. These risks are already emerging and are expected to escalate from substantial at +2°C warming to critical or worse at higher warming levels, with societal and economic consequences if imports are disrupted. Current policy readiness is only medium-low, with fragmented measures and limited preparedness, making diversification and resilience-building increasingly necessary.
4. Climate-driven shocks to global food production are becoming more frequent and severe. While Belgium currently enjoys strong food security, rising risks could lead to sharp price spikes, undermining affordability, especially for vulnerable households. Escalating from substantial at +2°C warming to critical, or even catastrophic, at higher warming levels. Existing EU and national instruments provide some protection but preparedness is limited.
5. Belgian industries face growing water stress due to reduced summer availability, declining water quality during droughts and weakened eco systems.
6. For some Belgian industrial sectors the risks are already substantial and projected to become critical in the mid- to long-term (2050-2100). Highly exposed sectors include agri-food, pharmaceuticals, chemicals and tourism, while Flanders and Brussels are geographic hotspots due to high demand and low storage, relying heavily on Wallonia's water supply. Current policies provide some support but fragmented regional management and limited coordination undermine resilience, making stronger long-term action essential.



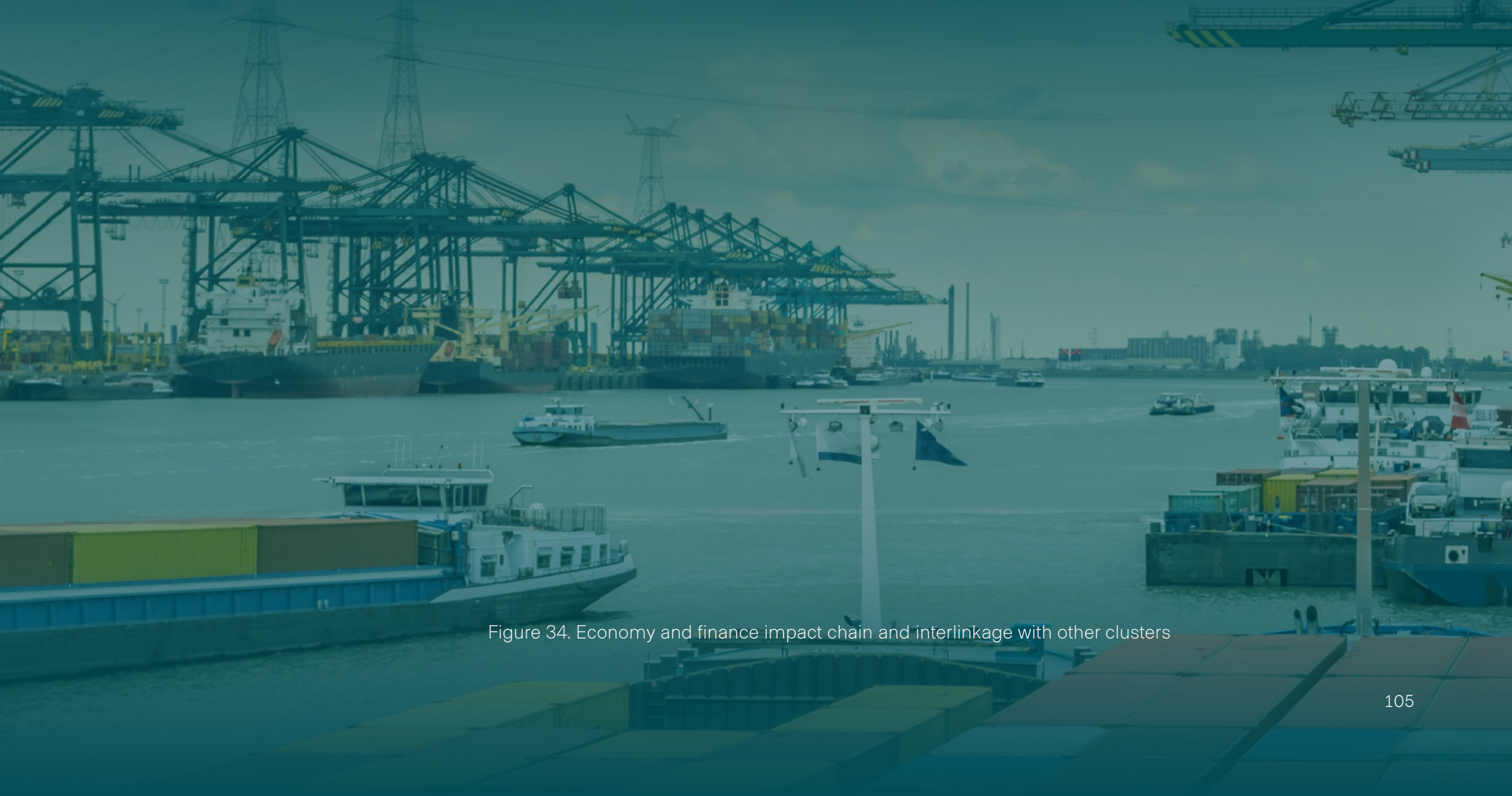


Figure 34. Economy and finance impact chain and interlinkage with other clusters

3.5.2. Risk assessment factsheets

Table 9. Summary of risk assessments for "Economy & finance"

Climate risk and ecosystems degradation risk	Urgency to act	Risk severity			Policy characteristics	
		2°C	3°C	4°C	Policy readiness	Risk ownership
Risk to **property insurance** due to **flooding**	Urgent action needed	+ + +	+ + +	+ + +	Medium	Co-owned
Risk to **public finances** due to **climate change**	More action needed	+	+	+	Medium	Co-owned
Risk to **strategic imports** due to **climate change**	More action needed	+ +	+ +	+ +	Low/Medium	Co-owned
Risk to international **food prices** due to **climate change**	More action needed	+ +	+ +	+ +	Medium	Co-owned
Risk to **industry** from **water stress** (ecosystems degradation)	Precautionary action needed	+			Medium	Regional

Urgency to act

- Urgent action needed
- More action needed
- Precautionary action needed
- Enhance vigilance
- Operationalise existing policies

Risk severity

- Catastrophic
- Critical
- Substantial
- Limited

Confidence

Low: +
Medium: + +
High: + + +

RISK TO PROPERTY INSURANCE DUE TO FLOODINGS

Description

Flooding is the most recurrent and economically destructive natural disaster in Europe and its impacts are projected to intensify under climate change (European Commission, 2025). In Belgium, flood risks stem from pluvial (heavy rainfall), fluvial (riverine) and coastal flooding, driven by extreme precipitation, sea-level rise and storm surges (Gabriels et al., 2022; Vousdoukas et al., 2018).

The material consequences for buildings include structural collapse, erosion, damage to essential technical systems, contamination and prolonged uninhabitability (see technical paper '*Risk to buildings due to flooding*').

The insurance sector is uniquely exposed because it must absorb increasing claims due to climate change globally (International Association of Insurance Supervisors, 2023; De Schutter, 2025). In Belgium, the insurance sector is functioning within a strained regulatory and financial framework, especially since the 2021 Vesdre floodings.

Due to the inclusion of flood risks in home insurance policies, Belgian insurers currently provide relatively high coverage compared to other European countries (EIOPA, 2025). However, the reliability of the system is undermined by underfunded solidarity schemes, weak enforcement of legal provisions and outdated flood maps.

The insurance risk from flooding is twofold – the physical hazard of rising flood damages (Assuralia, 2023; Lehmkuhl et al., 2022; Munich Re, 2021; SPW, 2022; Swiss Re, 2021) and the systemic vulnerability of financial institutions (National Bank of Belgium, 2019). Insurance claims in Belgium have already escalated with extreme events such as the 2021 Walloon floods challenging the natural catastrophe ('cat nat') insurance regime. Under the 'cat nat" regime, insurers are obligated to cover natural catastrophes as part of mandatory home insurance (so-called 'simple risks"), with regional solidarity funds meant to absorb excess costs. Yet these mechanisms have been inconsistently applied – Flanders has created and provisioned its fund with 100 million euros, while other regions didn't establish theirs despite legal obligations. Consequently, after the 2021 floods, due to a lack of sufficient funding, insurers were obligated to double their contributions beyond the statutory ceiling and extend interest-free loans to the Walloon government, undermining legal certainty for insurers and reinsurers (Assuralia, 2025).

This lack of legal certainty, after the 2021 floods, is the main reason reinsurance companies could leave the Belgian market. Reinsurance companies, which provide a critical buffer by underwriting catastrophic layers of risk, are increasingly wary of Belgian exposure due to the fact that the law was not respected in 2021 (Assuralia, 2025). As climate hazards manifest, insurability is already becoming a concern in neighbouring countries like France, where climate change has led to a significant increase in the number of insurance claims (Langreney, et al., 2023). One of the main risks is that reinsurers leave the national market. In Belgium, at least one reinsurer has already withdrawn and others may follow, leaving insurance companies with too little or even no capacity to cover themselves.

The erosion of insurability is a critical concern. Premiums are rising and in neighbouring European countries, coverage is becoming unavailable as reinsurers withdraw from national markets (AMF, 2024; Langreney, et al., 2023; Pauls, 2024). If reinsurers retreat from Belgium, local insurers could be unable to sustain coverage, ultimately destabilising the broader financial system through mortgage risk, asset devaluation and constrained credit supply. Insurance is not merely a risk-transfer mechanism – it accelerates post-disaster recovery and underpins financial stability. Its erosion could therefore produce cascading effects, potentially leading to systemic failures in mortgages, real estate development and long-term investments under higher warming scenarios.
The risk severity is considered critical at +2°C and catastrophic at +3°C and +4°C global warming levels with high confidence. Policy readiness is considered medium. This leads to an urgency score of "urgent action needed".

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Risk Severity

This risk severity has been assessed based on the materiality of damages already incurred (Assuralia, 2023; Lehmkuhl et al., 2022; Munich Re, 2021; SPW, 2022; Swiss Re, 2021) and based on projections and risk assessments about future impacts of river floods and coastal floods on real estate properties (De Vlaamse Waterweg, 2022; EEA, 2024b; European Commission, 2022a; Grandey et al., 2024). Current policy readiness (or lack thereof) was also taken into account (National Bank of Belgium, 2024).

The 2021 Vesdre Valley floods provide a paradigmatic case of severity. They caused 39 deaths, affected 100,000 people, damaged 45,000 houses and left 15,000 homeless. Infrastructure destruction was immense – nearly 10,000 hectares were flooded, 559 bridges damaged, 160 sports facilities impaired and tens of thousands of utility connections disrupted. In 2022, the Special Reconstruction Commission published its estimate of the cost – €5.2 billion (SPW, 2022), of which approximately €2.4 billion were insured losses.
The Belgian Insurance law of 4 April 2014 (Article 130) caps insurer liability at roughly 45% of premiums collected annually, which for 2021 meant a collective ceiling of around €360 million. However, the absence of a functional solidarity fund forced insurers to cover damages well beyond this threshold. After negotiations with the government

of the Walloon region, insurers doubled their statutory contribution to €720 million and provided an additional €1 billion in loans to the Region. This precedent of overriding the legal ceiling created profound legal uncertainty, deterring reinsurers and threatening future market stability.

Damages from natural catastrophes are highly concentrated in time (Assuralia, 2025). The European Commission (2022b) similarly notes that, in Europe, over 60% of reported economic losses from weather and climate extreme stem from less than 3% of events. This concentration exacerbates liquidity risks – extraordinary funds must be mobilised instantly, which neither insurers nor governments are always capable of doing.

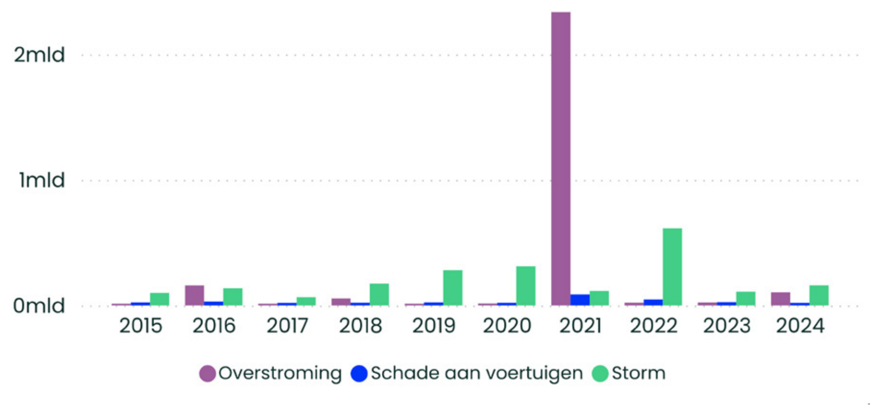


Figure 35. Total cost of losses per main category (flood in purple, damage to vehicles in blue, storms in green). Source: Assuralia (2025)

Projections for future damages reinforce the catastrophic potential. A 2022 Flemish study estimated that a "water bomb" event similar to Vesdre's could cause €8.1 billion in damages in Flanders alone (De Vlaamse Waterweg, 2022). Such figures dwarf existing insurance and solidarity capacities. At the European level, the European Insurance and Occupational Pensions Authority (EIOPA) has already raised Belgium's flood risk parameters by 20% since its last calibration (EIOPA, 2025).

In terms of severity classification, a warming of +2°C already renders flood damages ***critical***, while +3°C and above makes them ***catastrophic***. The Vesdre case demonstrates not only the physical and economic magnitude of losses but also the systemic vulnerabilities of Belgium's insurance framework. Unless structural reforms and adequate funding are introduced, similar or worse events will strain both insurers and public finances beyond sustainability.

Confidence level

The risk is well documented by a variety of high-quality sources. There is strong consensus concerning this risk among experts, professionals and scholars. Prudential authorities have reported those concerns (National Bank of Belgium, 2024). Therefore, the confidence level of this risk can be considered high.

Policy readiness

Policy readiness for the risk to property insurance due to floodings is ***medium***.
Belgium benefits from a high level of insurance penetration compared to other European countries due to the mandatory inclusion of natural catastrophe coverage as part of house insurance for homeowners (so-called "simple risks" insurance policy).

Insurer's contribution in case of natural disaster is capped by law and, in each region, a solidarity fund is supposed to cover excess damages. However, despite being mandated by law, a regional solidarity mechanism was only created and funded in one region.

This layered system is reinforced by the pricing bureau, an organisation financed by contributions from the insurance sector, which offers coverage for homeowners not able to secure insurance elsewhere.
Despite those multiple layers, the overall framework remains insufficiently robust to manage large-scale climate events and, in two regions of the country, the fact that the regional solidarity mechanisms were not funded considerably weakens the framework.

An EU directive mandates member states to maintain and update flood maps. Those official flood maps serve as a legal basis for insurers (insurers are only allowed to refuse coverage for constructions in designated flood areas). In accordance with EU law, each region maintains its flood map. In some regions, however, those maps have not been updated for several years.

After the 2021 flood of the Vesdre valley, it became apparent that the current policy framework is not sufficiently resilient to face future climate disasters and prudential authorities are calling for urgent reform.

RISK TO PUBLIC FINANCES DUE TO CLIMATE CHANGE

Description

Climate change is increasingly recognised as a major macroeconomic, fiscal and financial risk, with significant implications for public budgets (Office for Budget Responsibility, 2024). Economic losses from climate-related disasters affect not only private agents, such as insurers, households and firms but also, because the state ultimately acts as the lender of last resort, public finances too. The fiscal exposure results from both direct and indirect channels, operating through complex, multilayered mechanisms (European Commission, 2022b).

Direct impacts primarily stem from acute physical risks, notably extreme weather events driven by climate change. These generate immediate budgetary costs in the form of disaster relief, reconstruction of infrastructure, support to affected households and firms. The 2021 floods in Germany, the Netherlands and Belgium illustrate this dynamic, with damages estimated at €44 billion overall, including €2.4 billion in insured losses for Belgium alone (Assuralia, 2025; EEA, 2023) and broader costs estimated by the Special Reconstruction Commission of €5.2 billion (SPW, 2022). Expenditure extended beyond rebuilding to economic support, housing, waste management, prevention policies, land-use planning, etc. This is a paradigmatic case of how acute events can generate direct, substantial stress on public budgets.

Indirect and chronic impacts emerge from complex, multilayered, channels. Climate change may produce some chronic effects like reduced GDP growth, disrupted trade flows and impaired productivity, leading to lower tax revenues and higher government spending (Feyen et al., 2020; Gagliardi et al., 2022). Additionally, complex transmission pathways result in indirect effects. Floods, for example, not only depress activity in directly affected areas but also negatively impact upstream supply chains, with substantial negative effects on sales and employment even for firms outside flooded areas, reducing fiscal revenues (National Bank of Belgium, 2024). Measures have also shown that in the euro area, weather spikes can have inflationary effects in the food, energy and services sectors, resulting in seasonal prices increase (Ciccarelli et al., 2023). Ultimately, climate change can increase the cost of borrowing and capital for the country by affecting sovereign bond yield (EEA, 2024b).

At a systemic level, climate change can pose risks to debt sustainability, raise borrowing costs, weaken creditworthiness and may ultimately lead to downgrades in sovereign ratings (Avgousti et al., 2023; Dunz & Power, 2021). It can increase the risk of financial contagion. Historical precedents, such as the 2008 global financial crisis or the COVID-19 pandemic, show how external crises can spill across borders and overwhelm public budgets. Climate risks may also destabilise financial institutions, amplify sovereign debt concerns and push governments into deeper fiscal stress (EEA, 2024b).

The risk severity score is considered ***catastrophic*** at all global warming levels with low confidence. Policy readiness is considered ***medium***. This leads to an urgency score of "more action needed".

Risk Severity

The projected economic costs of climate change in Europe are expected to rise substantially in the coming decades (CCOACH, 2020; Feyen et al., 2020). Assessing the precise fiscal impact of climate damages is, however, methodologically challenging. Outcomes depend on economic projections, policy choices, mitigation and adaptation pathways and the distribution of costs between public and private actors. As the European Commission (2022b) notes, the integration of climate risks into fiscal sustainability frameworks has so far been limited, reflecting the inherent uncertainty and complexity of such estimates.

Historical data from the European Environment Agency (EEA, 2024b) indicates that Belgium suffered nearly €17 billion in climate and weather-related losses between 1980 and 2023, of which 39% were insured, and over 4,600 fatalities. Belgium also records among the highest damages per square kilometre in Europe (EEA, 2024b). However, averages based on historical data may not capture the full picture, especially with Europe warming twice as fast as the rest of the world (WMO, 2025).

Projected damages rely on different methodologies and therefore yield diverging results. Reinsurer Swiss Re (2021) provides macroeconomic projections, estimating that in a severe warming scenario of 3.2°C, Belgian GDP could contract by up to 8.5% by mid-century. According to those projections, under more moderate assumptions of a 2.6°C increase, GDP losses could reach 6.3% of GDP by 2050 (Swiss Re, 2021).
While these projections provide aggregate economic costs, they do not disaggregate the share borne by public finances.

Temperature path	Well below 2°C increase			2.0°C increase			2.6°C increase			3.2°C increase		
	Paris target			*The likely range of global temperature gains*						*Severe case*		
Omitted channels	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
(Un)known unknowns	✗	✓x5	✓x10	✗	✓x5	✓x10	✗	✓x5	✓x10	✗	✓x5	✓x10
World	−0.5%	−2.2%	−4.2%	−1.3%	−5.7%	−11.0%	−1.7%	−7.2%	−13.9%	−2.2%	−9.4%	−18.1%
OECD	−0.4%	−1.6%	−3.1%	−0.8%	−3.9%	−7.6%	−0.9%	−4.1%	−8.1%	−1.1%	−5.4%	−10.6%
North America	−0.5%	−1.7%	−3.1%	−0.9%	−3.7%	−6.9%	−1.0%	−4.0%	−7.4%	−1.2%	−5.1%	−9.5%
South America	−0.4%	−2.0%	−4.1%	−1.1%	−5.5%	−10.8%	−1.4%	−6.6%	−13.0%	−1.8%	−8.6%	−17.0%
Europe	−0.2%	−1.4%	−2.8%	−0.7%	−3.8%	−7.7%	−0.8%	−4.0%	−8.0%	−1.0%	−5.2%	−10.5%
Middle East & Africa	−0.7%	−2.5%	−4.7%	−2.4%	−7.6%	−14.0%	−4.6%	−12.1%	−21.5%	−5.2%	−15.0%	−27.6%
Asia	−0.7%	−2.8%	−5.5%	−1.7%	−7.7%	−14.9%	−2.4%	−10.5%	−20.4%	−3.0%	−13.7%	−26.5%
Advanced Asia	−0.4%	−1.7%	−3.3%	−1.1%	−4.8%	−9.5%	−1.3%	−5.9%	−11.7%	−1.7%	−7.7%	−15.4%
ASEAN	−0.8%	−2.3%	−4.2%	−2.4%	−9.0%	−17.0%	−4.1%	−15.4%	−29.0%	−5.0%	−19.7%	−37.4%
Oceania	−0.5%	−2.2%	−4.3%	−1.3%	−5.8%	−11.2%	−1.7%	−6.5%	−12.3%	−2.0%	−8.3%	−16.3%
Argentina	−0.4%	−1.6%	−3.1%	−0.8%	−3.9%	−7.7%	−0.9%	−4.3%	−8.6%	−1.2%	−5.7%	−11.3%
Australia	−0.5%	−2.2%	−4.4%	−1.4%	−5.8%	−11.3%	−1.7%	−6.6%	−12.5%	−2.1%	−8.4%	−16.5%
Austria	0.1%	−0.8%	−2.0%	0.0%	−2.6%	−5.9%	0.4%	−2.3%	−5.7%	0.2%	−3.3%	−7.9%
Belgium	−0.1%	−1.2%	−2.5%	−0.4%	−3.0%	−6.4%	−0.2%	−2.9%	−6.3%	−0.4%	−4.0%	−8.5%
Brazil	−0.4%	−1.9%	−3.7%	−1.0%	−5.1%	−10.3%	−1.2%	−6.3%	−12.8%	−1.6%	−8.4%	−16.8%
Canada	−0.3%	−1.4%	−2.8%	−0.7%	−3.4%	−6.8%	−0.6%	−3.5%	−6.9%	−0.9%	−4.6%	−8.9%
Chile	−0.9%	−4.1%	−8.0%	−2.1%	−9.9%	−19.2%	−2.3%	−10.8%	−21.0%	−3.0%	−14.1%	−27.0%
China	−0.7%	−3.3%	−6.6%	−1.6%	−7.7%	−15.1%	−1.9%	−9.2%	−18.1%	−2.5%	−12.1%	−23.5%
Colombia	−0.6%	−2.5%	−4.8%	−1.7%	−7.4%	−14.2%	−2.1%	−8.8%	−16.7%	−2.7%	−11.4%	−21.7%
Czech Republic	−0.1%	−1.3%	−2.9%	−0.5%	−4.0%	−8.5%	−0.3%	−3.8%	−8.3%	−0.5%	−5.2%	−11.1%
Denmark	0.1%	−0.3%	−0.8%	0.0%	−1.4%	−3.1%	0.3%	−1.1%	−2.8%	0.2%	−1.6%	−3.9%
Egypt	−0.8%	−2.0%	−3.5%	−1.3%	−4.3%	−7.9%	−1.6%	−5.2%	−9.6%	−1.9%	−6.7%	−12.4%
Finland	−0.1%	−0.7%	−1.4%	−0.2%	−2.1%	−4.4%	0.0%	−1.8%	−4.1%	−0.1%	−2.5%	−5.5%
France	−0.3%	−1.7%	−3.5%	−0.9%	−4.9%	−9.9%	−0.9%	−4.9%	−10.0%	−1.2%	−6.5%	−13.1%
Germany	−0.3%	−1.6%	−3.3%	−0.7%	−4.0%	−8.1%	−0.6%	−4.0%	−8.3%	−0.9%	−5.4%	−11.1%
Greece	−0.5%	−1.7%	−3.2%	−1.3%	−4.9%	−9.3%	−1.6%	−5.4%	−10.1%	−1.9%	−6.8%	−13.1%
Hong Kong	−2.6%	−3.0%	−3.8%	−3.9%	−6.4%	−10.1%	−5.9%	−10.3%	−16.3%	−6.3%	−12.0%	−21.2%
Hungary	−0.2%	−1.5%	−3.0%	−0.7%	−4.2%	−8.5%	−0.6%	−4.1%	−8.6%	−0.9%	−5.5%	−11.4%
India	−0.8%	−3.0%	−5.7%	−2.0%	−8.9%	−17.4%	−3.2%	−13.9%	−27.0%	−4.0%	−18.0%	−35.1%
Indonesia	−0.6%	−2.1%	−4.0%	−2.0%	−8.5%	−16.7%	−3.4%	−15.4%	−30.2%	−4.4%	−20.0%	−39.5%
Italy	−0.5%	−2.3%	−4.5%	−1.2%	−5.6%	−11.0%	−1.3%	−5.9%	−11.4%	−1.7%	−7.7%	−14.8%
Japan	−0.3%	−1.6%	−3.2%	−0.8%	−4.2%	−8.4%	−0.8%	−4.5%	−9.1%	−1.1%	−6.0%	−12.0%
Malaysia	−1.2%	−2.8%	−4.8%	−4.0%	−12.3%	−22.3%	−6.8%	−20.1%	−36.3%	−7.8%	−25.2%	−46.2%
Mexico	−0.5%	−1.9%	−3.6%	−1.1%	−4.4%	−8.5%	−1.4%	−5.2%	−9.8%	−1.7%	−6.7%	−12.6%
Netherlands	−0.1%	−0.8%	−1.8%	−0.3%	−2.4%	−5.2%	−0.1%	−2.3%	−5.1%	−0.3%	−3.2%	−7.0%
New Zealand	−0.4%	−1.9%	−3.7%	−1.0%	−4.9%	−9.7%	−1.1%	−5.2%	−10.4%	−1.4%	−6.9%	−13.6%
Norway	0.1%	−0.8%	−1.9%	−0.2%	−2.4%	−5.2%	−0.4%	−2.6%	−5.4%	−0.5%	−3.5%	−7.3%
Peru	−0.5%	−2.5%	−5.1%	−1.0%	−5.1%	−10.0%	−1.1%	−5.7%	−11.3%	−1.4%	−6.9%	−13.7%
Philippines	−1.3%	−3.1%	−5.4%	−3.5%	−11.8%	−21.6%	−5.8%	−19.5%	−35.0%	−6.9%	−24.6%	−43.9%
Poland	−0.2%	−1.4%	−3.0%	−0.6%	−3.8%	−7.9%	−0.5%	−3.8%	−7.9%	−0.8%	−5.1%	−10.6%
Portugal	−0.4%	−1.3%	−2.3%	−0.9%	−3.2%	−6.2%	−1.0%	−3.3%	−6.3%	−1.2%	−4.3%	−8.4%
Romania	−0.5%	−1.8%	−3.3%	−1.1%	−4.5%	−8.7%	−1.3%	−4.7%	−8.9%	−1.6%	−6.0%	−11.5%
Russia	−0.2%	−1.5%	−3.2%	−1.3%	−4.7%	−8.9%	−2.3%	−5.8%	−10.1%	−2.6%	−7.2%	−12.8%
Saudi Arabia	−0.9%	−2.9%	−5.3%	−4.8%	−10.7%	−17.8%	−11.6%	−19.4%	−29.2%	−12.2%	−22.5%	−35.5%
Singapore	−1.0%	−2.7%	−4.9%	−2.9%	−10.6%	−20.2%	−5.0%	−18.6%	−35.6%	−6.1%	−23.9%	−46.4%
South Africa	−0.8%	−3.5%	−6.9%	−1.7%	−7.7%	−14.9%	−2.1%	−9.2%	−17.8%	−2.7%	−12.0%	−23.1%
South Korea	−0.2%	−1.3%	−2.7%	−0.8%	−4.2%	−8.5%	−0.8%	−4.7%	−9.7%	−1.1%	−6.3%	−12.8%
Spain	−0.4%	−1.3%	−2.5%	−0.9%	−3.6%	−7.0%	−1.0%	−3.8%	−7.3%	−1.2%	−4.9%	−9.7%
Sweden	0.0%	−1.1%	−2.5%	−0.3%	−3.1%	−6.6%	0.0%	−2.8%	−6.5%	−0.2%	−4.0%	−8.8%
Switzerland	0.0%	−0.6%	−1.4%	−0.1%	−1.9%	−4.2%	0.1%	−1.8%	−4.4%	0.0%	−2.6%	−6.1%
Taiwan	−0.6%	−2.6%	−5.2%	−1.7%	−7.5%	−14.8%	−2.6%	−11.3%	−22.2%	−3.3%	−14.7%	−29.2%
Thailand	−1.2%	−2.9%	−4.9%	−3.0%	−10.4%	−19.5%	−4.9%	−17.8%	−33.7%	−6.0%	−22.9%	−43.6%
Turkey	−0.2%	−1.2%	−2.5%	−0.6%	−3.3%	−6.7%	−0.6%	−3.8%	−7.8%	−0.9%	−5.0%	−10.3%
UAE	−0.9%	−3.0%	−5.5%	−2.1%	−8.5%	−16.6%	−3.3%	−13.3%	−25.8%	−4.1%	−17.3%	−33.7%
UK	−0.1%	−1.1%	−2.4%	−0.5%	−3.2%	−6.6%	−0.3%	−3.1%	−6.5%	−0.6%	−4.2%	−8.7%

Figure 36. Mid-century GDP changes with different temperature rises and economic impact severity, relative to a no-climate change world (including figures for Belgium). Source: Swiss Re (2021)

A different macro-fiscal assessment (Cerac & Federal Planning Bureau, 2025), incorporates both GDP impacts and fiscal indicators for Belgium. Using NGFS scenarios and climate damage functions (Kotz et al., 2024), the study estimates that under a warming trajectory of +3°C by the end of century (RCP 5.3 and GWL 2.9°C by the end of century), climate change could reduce Belgian GDP by up to 5% by 2050. This estimate, however, only accounts for damages caused by slow-onset change (without accounting for acute events like climate-driven natural catastrophes).

This could translate into a sharp deterioration in public debt dynamics. Under this scenario, instead of falling below 90% of GDP (as expected if Belgium follows all its budgetary engagements), debt could rise above 105% by mid-century under climate change pressures, with fiscal adjustments of 1.4% of GDP per year required merely to stabilise debt trajectories. Under this scenario, the damages identified by Kotz et al. (2024) continue to increase over time (Cerac & Federal Planning Bureau, 2025). Debt sustainability in this situation appears unrealistic, highlighting that there is a "significant risk to sovereign debt sustainability, particularly under high climate damages, that are large from mid-century" (Calcaterra et al., 2024).

Under a climate adverse scenario, primary balance containment and debt stabilisation could prove challenging. Maintaining current levels of public spending through borrowing appears "unrealistic" with adjustments unavoidable. Adaptation financing, both public and private, has a positive effect on debt sustainability without being a silver bullet (Bachner et al., 2019; Calcaterra et al., 2024).

Concerning acute climate events, NGFS simulations (using Kotz et al., 2024) suggest that worst-case extreme weather damages could reach between 3.5% and 12% of Belgian GDP by 2050 in extreme years.

It should be noted that these estimates are characterised by a high level of quantitative uncertainty and should be considered with caution. While there is a clear trend of negative impacts on public finances caused by climate change, these estimates represent the higher end of projections and the results can vary drastically when using different damage functions (Cerac & Federal Planning Bureau, 2025).

Finally, as already mentioned for insurance, natural catastrophes like floods pose specific challenges for public finances as they require public authorities to be able to mobilise vast amount of funds suddenly, due to the concentration of damages in time, which creates an additional liquidity risk.

Confidence level

There is a clear trend of negative impacts on public finances due to climate change, in the literature.

The potential cost to public finances, expressed as percentage of GDP exceed, both for the lower end estimates and the higher end estimates, the maximum threshold (500 million euros) for severity defined by the methodology (Cerac, 2025). This is due to the fact that when it comes to public finances, amounts (expressed as percentage of GDP) are an order of magnitude more substantial than for any other risk.

However, damage functions can output vastly different results (Cerac & Federal Planning Bureau, 2025) and future impact on public finances depends on current choices. Therefore, since important quantitative uncertainties remain as to what the precise cost to public finances will be, and how exactly it will manifest, the confidence level for the quantitative estimate can only be considered low.

Policy readiness

Policy readiness for the risk to public finances is assessed as ***low***.

Although Belgium is a developed economy and not among the most climate-vulnerable "lower income" regions of the world, it is rather ill-prepared for climate change according to a multifactor analysis (Mochizuki et al., 2016).

While the country currently benefits from a high degree of insurance coverage, it performs poorly in broader resilience indicators. Notably, a high public debt and demographic pressure from an ageing population constitute preexisting vulnerabilities for Belgian public finances.

Although not a silver bullet, adaptation investments can help mitigate negative climate impacts to public finances by preventing future damages and losses while providing co-benefits that can help alleviate other climate risks. They offer a positive return on investment, notably when applied to disaster prevention, the agricultural sector and forestry (Bachner et al., 2024). In Belgium, the Sigma Plan, for example, can be considered a successful implementation of an adaptation measure with a positive cost-benefit return (World Bank, 2025).

RISK TO INDUSTRY DUE TO WATER STRESS

Description

Biodiversity and ecosystems, such as wetlands and forests, are essential for regulating water flow, enhancing water quality, mitigating flood impacts by absorbing excess rainwater and supporting groundwater recharge (IPBES, 2019; Russi et al., 2013). The degradation and loss of ecosystems decrease their capacity to provide critical water-related ecosystem services. When combined with the effects of climate change, these losses can significantly increase regional vulnerability to water-related risks, including water stress.

Compared to scarcity, which refers to the volumetric abundance, or lack thereof, of freshwater resources, water stress is a more inclusive and broader concept. Water stress occurs when there is insufficient water of adequate quality to meet human and ecological requirements for freshwater. This encompasses reduced availability of drinking water, groundwater and surface water and includes considerations of water availability, quality and accessibility. Indicators such as water consumption and withdrawals offer valuable insights into the extent of water stress. It's important to note that physical pressures such as flooding are not included within this concept. Water stress is often associated with the degradation of surface water quality due to lower river flows and more frequent episodes of severe low water levels (CEO Water Mandate, 2014).

Thus, within this assessment, water stress in Belgium encompasses availability, quality and accessibility (not flooding) and, in short, the risk arises from:

- Reduction in summer water availability and baseflows;
- Deterioration of water quality and reduced dilution capacity during droughts; and
- Loss of ecosystem capacity to regulate the water cycle and assimilate pollution.

Water scarcity
Agri-food and other industries

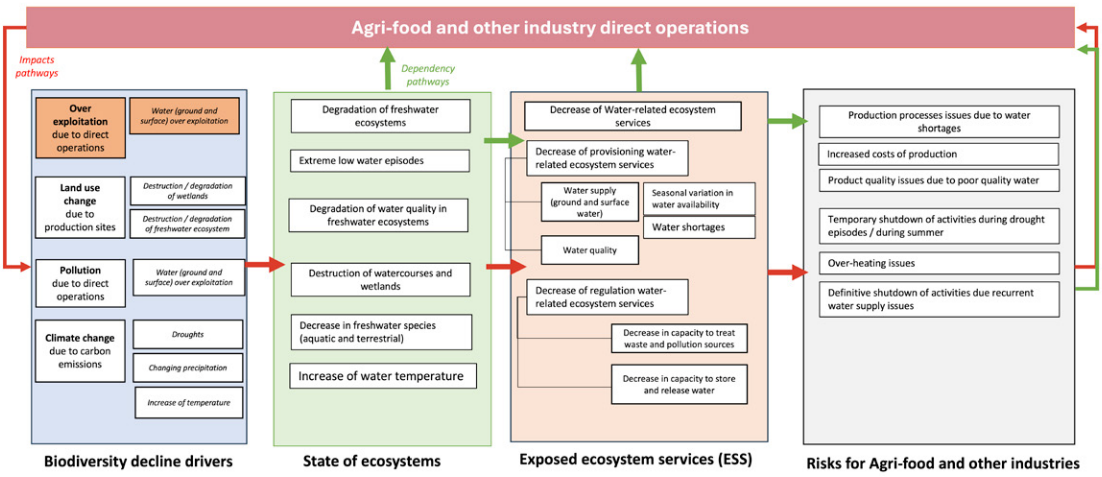


Figure 37. Water stress pathways for agri-food and other industries

Exposure and dependency vary by sector: agri-food, pharmaceuticals and chemicals are highly water-intensive and quality-sensitive; metals and wider manufacturing rely on process/cooling water; tourism depends on both quantity and quality; IT services/data centres can partially substitute to air cooling at present scales. Spatially, stress is more acute in Flanders and Brussels given high demand, urbanisation and lower storage, with Wallonia supplying a substantial share of drinking water (Brussels +/- 97%).

- Risk severity – limited to substantial in current / near term (2030) and critical in both mid- and long-term (2050-2100);
- Dependency level (by sector) – critical for agri-food & beverages, pharmaceuticals, chemicals and tourism; substantial for metals/manufacturing and IT services (data centres);
- Urgency to act – precautionary action is needed in current / near term, but more action is needed in the long-term.

The risk severity is considered substantial with low confidence. Policy readiness is considered medium. This leads to an urgency score of "precautionary action needed".

Risk severity

Main elements leading to the severity score:

- Belgium faces significant risks related to water scarcity and reduced flow during frequent summer droughts, affecting all stakeholders including industries. Restrictions could lead to shutdowns or failures due to overheating, with substantial risk in the current/near term, escalating to critical in the mid/long term, especially for agri-food, pharmaceuticals, chemicals, metals and tourism. Data centres face limited risk in the current/near-term but substantial risk in the mid/long-term, as air-cooling alone "may be insufficient for larger centres";
- Drought-driven deterioration impacts industries reliant on high water purity, such as pharmaceuticals, agri-food/beverages and tourism, with substantial risk now/near term and critical mid/long term (safety, corrosion, compliance costs). Chemicals/manufacturing impact are likely to be limited in the near term and substantial in the mid/long term. IT services do not face a significant risk related to water quality;
- Except for IT Services, all industries assessed discharge effluents relying on ecosystems to detoxify pollutants. Climate change and repeated droughts worsen water quality, making risk substantial in the current/near term and critical in the mid/long-term.

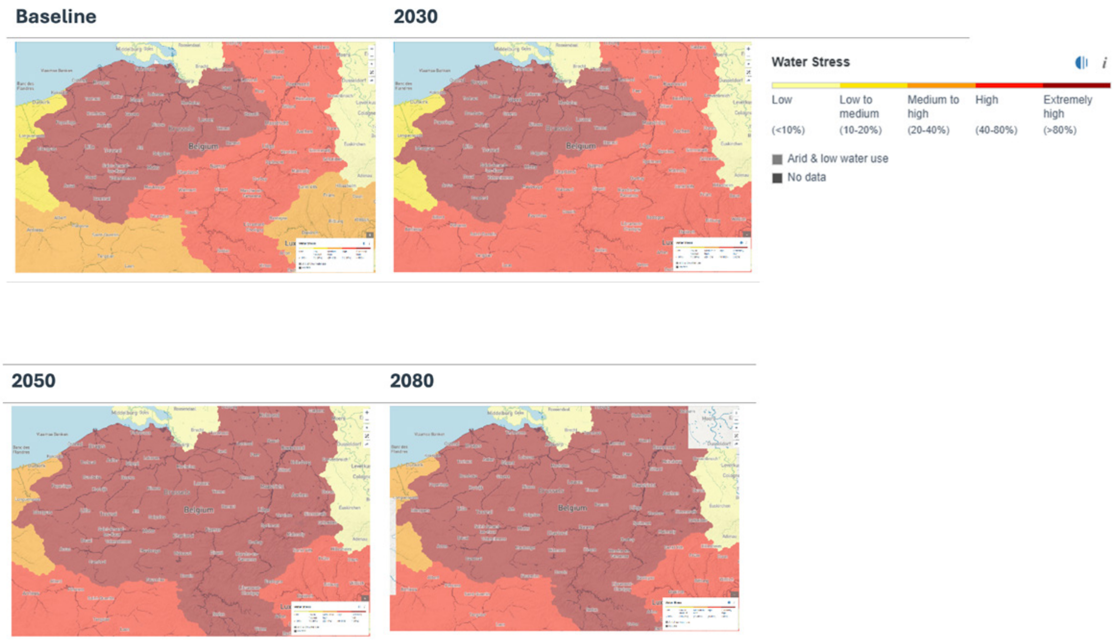


Figure 38. Water stress risk in 2030, 2050, 2080 according to a pessimistic scenario.
Source: World Resources Institute (2025)

The hotspots of water stress in Belgium are the Flanders region, particularly the most industrialised provinces of Antwerp, East Flanders and Limburg, and Brussels. Wallonia supplies around 55% of national drinking water and has higher rainfall and storage; Brussels relies on Wallonia for 97% of its needs.

Societal vulnerabilities are not well documented but the research highlights plausible pathways such as that increased water stress could lead to higher domestic prices, economic challenges, job losses, privatisation of water resources, competing demands between farmers, industries and citizens and increased conflict over water usage, exacerbated by regional disparities in water availability.

Confidence level

Overall confidence is medium for qualitative sectoral linkages and low for quantitative disruption/cost estimates, reflecting location-specific effects and data gaps. Most of the information used is recent (post-2020). The credibility level of these sources can be rated as high, yet quantitative data on industrial disruptions due to water stress is not well documented.

Policy readiness

Policy readiness on water stress and industries in Belgium is considered ***medium*** – policies, plans or strategies are in place but their targets and objectives are vague or only short-term actions are considered.

Water scarcity is increasingly recognised as a strategic risk, particularly in Flanders, where recurrent droughts have prompted sustained policy attention. The European Union provides a robust legal framework through instruments such as the Water Framework Directive, the Water Reuse Regulation and the Water Resilience Strategy 2025. These have been transposed into regional legislation with each Belgian region developing its own water management strategies and instruments. Despite this structured foundation, implementation remains uneven. Regional approaches vary significantly and coordination across regions is limited. The absence of a unified national strategy hinders the development of coherent responses to water stress, particularly in the face of transboundary challenges and upstream-downstream dependencies. Monitoring systems are well developed. However, these tools are not always integrated into decision-making processes and data gaps persist.

Private sector mobilisation is growing with companies increasingly reporting on water use and adopting stewardship frameworks. However, corporate adaptation remains partial, especially regarding water quality and long-term resilience planning. Financial constraints also limit progress – capped water tariffs restrict investment capacity in infrastructure upgrades and climate adaptation, while local budgets often lack the resources to implement strategic plans.

RISK TO STRATEGIC IMPORTS DUE TO CLIMATE CHANGE

Description

Climate change and ecosystems degradation processes affect the Belgian national economy through both internal and external factors, namely by impacting the economy of other countries on which the Belgian economy is dependent. This creates a risk of disruption for Belgian strategic imports.

This analysis focuses on strategic goods for which Belgium presents a persistent dependency on non-EU countries over several years (Dumont et al., 2024), with the United States and China being the most important (United Kingdom, Switzerland and India follow). Physical climate hazards threaten business operations across all sectors, because of disruptions to all aspects of supply chains. Increasing temperatures, sea-level rise, floods, droughts, wildfires and storms affect, both directly and indirectly, key infrastructures, factories, transportation systems and the workforce in the countries where those goods are produced and transit on their way to Belgium.

Logistics themselves can be exposed and vulnerable to climate hazards around the world and impacts go beyond physical losses to include increasing insurance premiums and operational, financial and reputational challenges for freight companies. Demand for some strategic goods is also rising in Europe due to societal transformations such as the green energy transition.

The risk severity is considered ***substantial*** at +2°C and ***critical*** at +3°C and +4°C global warming levels with medium confidence. Policy readiness is considered ***low to medium***. This leads to an urgency score of "more action needed".

Risk Severity

Disruptions to international supply chains of strategic goods are already happening. Given the worsening conditions for production and transportation of those goods, the more Global Warming Levels (GWL) rise, the more the risk is expected to increase from substantial to critical and even catastrophic when combined with other factors affecting supply chains, such as geopolitics. These levels of severity are justified by the fact that strategic goods are essential for the smooth functioning of the Belgian society and the goods required lead to a persistent dependence on specific countries outside of the EU. An interruption of those importations is therefore expected to affect the entire Belgian society, from businesses using those products to governmental actors having a hard time providing services critical to the wellbeing of the population and individuals facing higher prices for covering essential needs.

Exposure and vulnerability of the main economic sectors to climate change and water stress are well established (see the technical paper "Risk to strategic import due to climate change"). The sector that has the largest proportion of assets exposed worldwide to climate hazards is manufacturing industry, with the most exposed segments being the manufacturing of electronic and electrical products, petroleum and coal, non-metallic mineral products, food and chemicals. International supply chains are vulnerable to climate change in several aspects: the physical and social vulnerability of manufacturing, labour force and transportation systems; dependencies on other key infrastructures such as energy and telecommunication; and ripple effects along upstream networks. Demand-side pressures (e.g., clean-tech material needs) may tighten markets further.

Confidence level

The assessment considers a medium confidence level. Studies converge and point out increasing international supply chain disruptions due to climate change and water stress and there is high confidence that this phenomenon is going to get worse the higher the GWL. However, there is no study providing evidence concerning the specific case of strategic imports to Belgium. There is uncertainty in terms of the future needs of those imports and many other factors are at stake that can influence the severity of supply-chain disruptions in addition to climate change, such as the geopolitical situation. Consequently, there is low confidence in where and when the supply chains of strategic imports to Belgium specifically will be disturbed. Given the highly reliable consensus in the general trend but the limited knowledge for specific events, the confidence is estimated as medium.

Policy readiness

The policy readiness for addressing the risk of climate-induced disruptions to strategic imports in Belgium is assessed as ***low***.

While the risk is increasingly acknowledged at the European level, climate-related risks to strategic imports remain insufficiently addressed in the policy frameworks. Existing instruments focus primarily on geopolitical dependencies and crisis response with limited integration of climate and water stress dimensions.
At the national level, Belgium has limited leverage over trade-related risks, which fall under the exclusive competence of the European Union. However, Belgian authorities and private actors retain responsibility for anticipating and mitigating the domestic consequences of supply chain disruptions. In practice, this responsibility is not clearly structured. There is no dedicated national strategy and monitoring systems remain fragmented. Industries are not systematically supported to assess their exposure to climate-induced supply chain risks and adaptation efforts at the business level remain underdeveloped.

Despite some promising initiatives – such as R&D mobilisation on critical raw materials, strategic stockpiling of oil reserves and growing awareness in the pharmaceutical sector – implementation remains weak. Climate risks are not yet systematically integrated into EU resilience policies and national coordination mechanisms are insufficient to ensure preparedness across sectors. Structural challenges such as export restrictions, resource nationalism and environmental limits to domestic production further complicate the development of effective mitigation strategies.

RISK TO INTERNATIONAL FOOD PRICES DUE TO CLIMATE CHANGE

Description

Climate-driven crises and long-term trends in global agriculture transmit through international markets to Belgian food prices.

Gradual warming and altered precipitation change crop suitability and average yields; extreme events (heatwaves, droughts, floods) generate abrupt harvest losses and increase inter-annual variability.

The way these impacts affect Belgium are influenced by trade flows, stockholding behaviour, freight costs and policy reactions (e.g. export restrictions), which can dampen or amplify transmission to domestic prices.

The emphasis in this assessment is on economic access to food for consumers in Belgium; the research frames food security using the FAO/HLPE concept (availability, access, utilisation, stability, agency, sustainability), but narrows operationally to economic access for consumers in Belgium. It treats Belgium primarily as an importing country – the key pathway of interest is how external production spikes transmit through global markets into domestic prices and purchasing power. Direct impacts on Belgian production are addressed elsewhere in the food cluster.

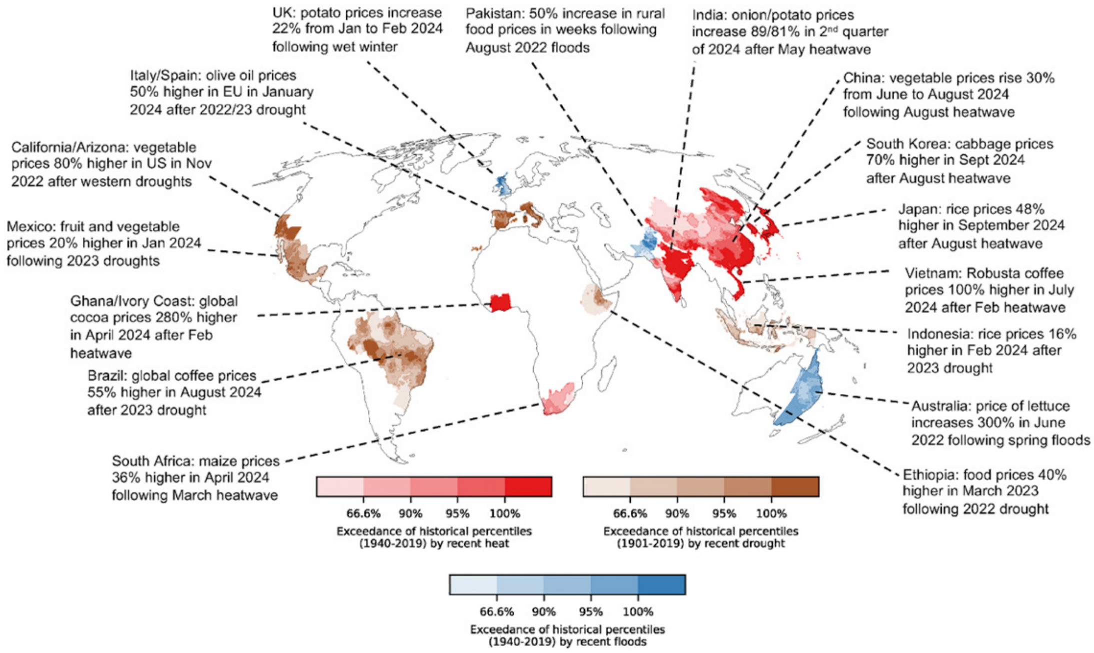


Figure 39. Climate change is already impacting international food prices in several countries, for Belgium cascading effects are expected to materialise through international markets. Source: Kotz et al. (2025)

The risk severity is considered ***substantial*** at +2°C and ***critical*** at +3°C and +4°C with medium confidence. Policy readiness is considered ***medium***. This leads to an urgency score of "more action needed".

Risk Severity

This risk severity has been assessed based on evidence from international and national climate risk assessments (EEA, 2024b; Nationale Interdisziplinäre Klimarisiko-Einschätzung, 2025), sectoral projections of food production and trade (FAO & OECD, 2024; Kotz et al., 2025; Sulser et al., 2021) and case studies of climate-driven crises already affecting food prices in Belgium and the EU (National Bank of Belgium, 2024). The Belgian context of social vulnerability and dependence on imported commodities has also been taken into account.

Recent episodes illustrate the severity of this risk. The 2021 frost and drought in Brazil cut coffee and soy harvests, pushing up global prices and filtering directly into Belgian consumer costs. Similarly, Spain's 2022-2023 drought reduced olive oil production to its lowest level in a decade, causing retail prices to more than double across Europe, including Belgium. These events show how climate extremes in producer regions can rapidly transmit through international markets and impact Belgian households and industries.

The systemic nature of the risk is underscored by Belgium's reliance on imported feedstocks (soy, maize) for its livestock and dairy sector and on tropical commodities (coffee, cocoa, fruits) from highly climate-vulnerable regions. A disruption in any of these supply chains not only raises consumer food prices but also threatens major Belgian export industries such as chocolate and meat.

Assessments converge that, under low levels of global warming (+2°C), risks to food affordability in Belgium are ***substantial*** to ***critical***. Under higher warming scenarios (+3°C and +4°C), the probability of simultaneous crises across multiple regions rises sharply, pushing risks to ***critical*** or ***catastrophic*** levels. In such scenarios, global markets may fail to buffer production shortfalls and compound crises could overwhelm coping mechanisms. Even if Belgium performs well on international food security metrics, large or prolonged food price spikes could push significant numbers of households into food insecurity, while broader inflationary pressures strain the economy.

Policy readiness

Policy readiness is assessed as ***medium***.

Policy readiness is discussed in qualitative terms and centres on the fact that the physical drivers of the risk occur outside Belgium, which limits the scope for direct domestic adaptation. Preparedness is therefore framed around two main aspects: monitoring and anticipation of climate-related production risks and vigilance over trade policy reactions that can amplify market crises; and the ability to implement domestic measures to protect food affordability during international price spikes. Existing instruments at EU and Belgian level, such as the Common Agricultural Policy crisis tools and national social protection schemes, provide some capacity to respond but these mechanisms are generally reactive rather than anticipatory in relation to climate-driven volatility.

The analysis found that Belgium benefits from a robust food safety and market framework but that specific tools to address climate-induced international price spikes are limited. There are no fully developed automatic stabilisers linked to climate triggers for food affordability and contingency planning for prolonged or repeated crises remains underdeveloped. Strengthening early warning systems, building pre-agreed response protocols and enhancing coordination between economic, agricultural and social policy domains are identified as key needs to improve readiness.

3.5.3. Qualitative assessment of the economy and finance cluster

Who is going to bear the cost of climate change?

The risks concerning insurance and the one concerning public finances are fragments of a broader underlying distributive question – "who is going to bear the costs of climate change?". At the forefront, insurers, exposed to acute events that can generate massive and sudden costs, are sounding the alarm.

While some of the negative impacts caused by climate change are going to affect private economic agents (households, enterprises, etc.), as the lender of last resort, the state is uniquely exposed and faces a broad macro-fiscal challenge. Public finances face growing strain from both acute events and through multi-layered transmission channels with potentially severe impacts on public budgets and the economy (effects on fiscal balance, public debt, GDP, etc.) by mid-century although future impacts remain challenging to estimate precisely as they depend on climate scenario and present choices.

Overall, there is a clear trend of negative economic impacts caused by climate change. As public finances are impacted, both on the revenue and the expenditure sides, delayed action could translate to a deteriorated adaptative capacity for the state, leaving public authorities little time to act under high level warming scenarios.

A dual vulnerability
Being a small economy, open to the world, Belgium face a dual vulnerability:

- Internal, with exposure to acute domestic crises (floods overwhelming the insurance framework and affecting public finances) and with pressure on its water supply (both quantitative and qualitative) that threatens key industries and could affect economic activity;
- External, as it depends on international systems where disruptions are hard to anticipate or control (e.g. if an extreme-weather event hit the manufacturing sector in China, it will have a rippling effect on prices). For both cross-border risks (strategic imports, food markets) studied in this assessment, disruptions are already visible with potential impact on industry and households.

Food price risk for Belgium

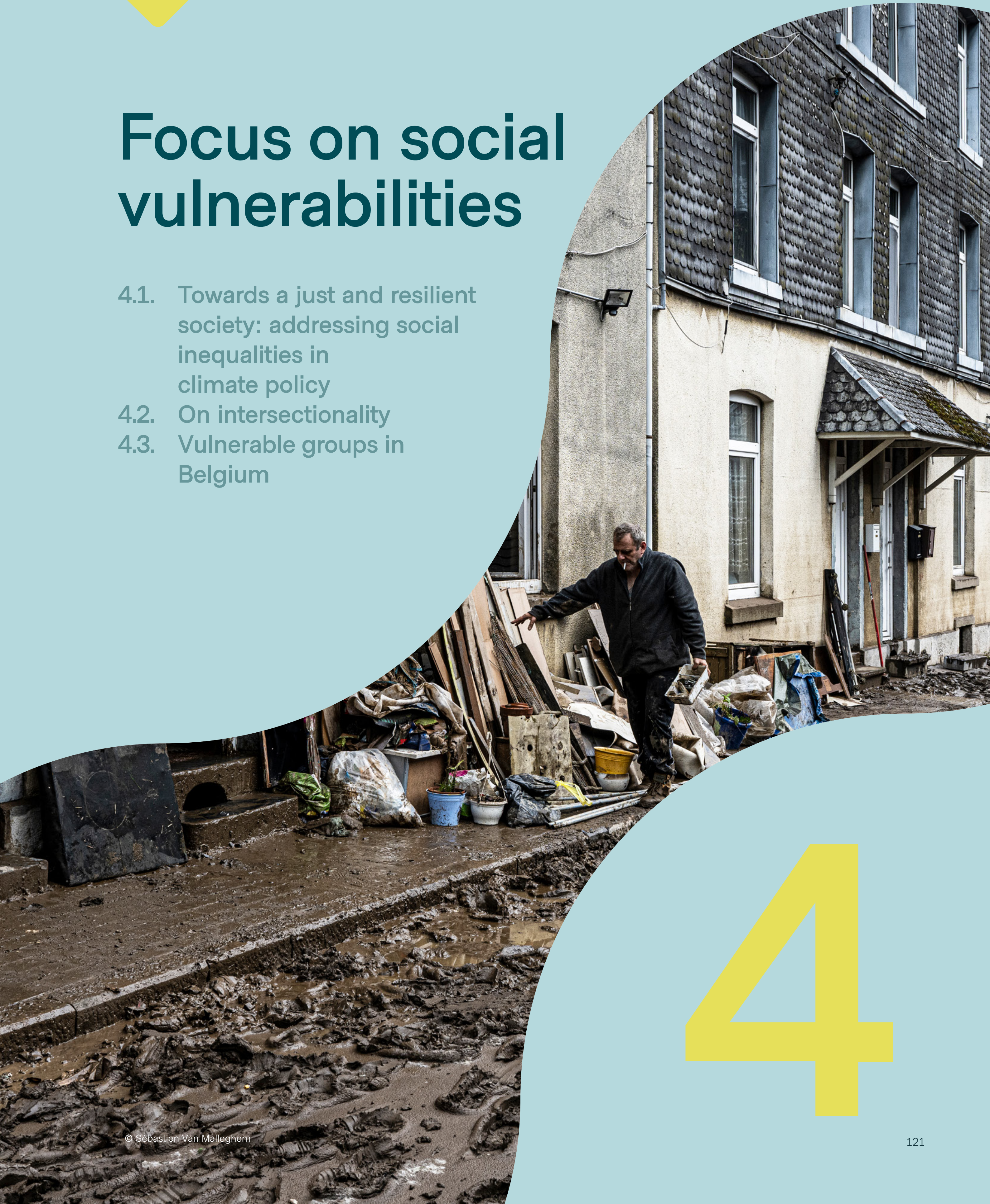
The severity of climate change impacts on Belgium's food system will largely depend on how its systemic vulnerabilities are addressed politically. Belgium inherits a highly industrialised food system that is deeply dependent on fossil energy for fertilisers, pesticides, processing, storage and transport.

As climate change increases pressure on energy systems, through speculation, infrastructure stress and the gradual internalisation of fossil fuel externalities, food production and prices become increasingly sensitive to energy volatility, as illustrated by the 2022 food price spike.

Likewise, the role of financial speculation in commodity markets has grown to the point where price volatility is often driven more by the dynamics of derivative trading than by physical production losses, especially in small, open economies such as Belgium where imports can buffer yield spikes. In parallel, the high concentration of market power among large commodity buyers and retailers means that farmers capture little of the value when prices rise, while consumers, especially low-income households, face higher costs.

This creates a situation where climate-related events are quickly translated into food inflation and food poverty, not so much because of reduced supply, but rather due to structural imbalances in the food value chain and financial market dynamics. The capacity of households to cope with these dynamics is further shaped by social protection systems – food insecurity is less the inevitable outcome of crop failures than the result of gaps in welfare systems. Even in the case of ecological risks such as pollinator decline, the consequences for farmers' incomes and consumer prices will be mediated by these systemic factors. Small-scale and organic farmers, for example, are more exposed to ecological variability due to lower capitalisation, yet they are also less dependent on fossil energy inputs and thus more resilient to energy price spikes. Overall, the extent to which climate change becomes a destabilising force for the Belgian food system will depend not only on biophysical hazards, but mostly on policy choices concerning energy transition, market regulation and social safety nets.

Focus on social vulnerabilities



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4

4 Focus on social vulnerabilities

4.1. Towards a just and resilient society: addressing social inequalities in climate policy

CLIMATE CHANGE AS A SOCIAL AND HUMAN RIGHTS CHALLENGE

Climate change has, now and in the future, significant impact on human health and wellbeing, the world economy, income distribution and labour markets – making it a social and economic challenge (Vleminckx, 2024). Environmental and social issues are intrinsically linked given that environmental risks are unevenly distributed – certain groups, communities and territories are more vulnerable because they are more exposed, suffer greater damage and have fewer opportunities to prepare and recover (Cantillon & Hudon, 2024). This phenomenon finds its origin in pre-existing social inequalities and further reinforces them (Fransolet and Vanhille, 2023; Service de lutte contre la pauvreté, 2019). Belgium is thus facing a dual challenge of ecological degradation and persisting social inequalities and poverty, which cannot be addressed independently.

Although the impacts of climate change affect everyone, some are more vulnerable than others, both to the consequences of climate change itself, as well as to the possible adverse effects of mitigation and adaptation policies (Service de lutte contre la pauvreté, 2019, 2023). Several types of vulnerability are identified in this report and define the structure of section 4.3 "**Vulnerable groups in Belgium**":

- Demographic;
- Socio-economic;
- Health-related;
- Cultural and linguistic;
- Occupational;
- Housing and geographic.

Many social groups that are particularly vulnerable to climate change often contribute the least to it and face multidimensional injustice, as they are:

- disproportionately affected by the risks and hazards associated with climate change;
- less able to adapt to and protect themselves from the effects of climate change;
- less resilient and less able to bounce back in the aftermath of a climate-related event;
- often less able to access protections, government aids, subsidies and warning systems that exist to protect and help them before, during and after climate hazards occur.

On top of this, vulnerable groups, because of their specific needs, risk not benefitting or might even undergo further harm from adaptation policies that do not take their vulnerabilities, needs and challenges explicitly into account (Breil et al., 2021; EEA, 2025; IPCC, 2022; Service de lutte contre la pauvreté, 2019, 2023). Inclusive and participatory decision-making processes are needed, which means including vulnerable groups in planning and implementing adaptation measures that address their unique needs and vulnerabilities (EEA, 2025; ILO, 2015; Service de lutte contre la pauvreté, 2019; Service de lutte contre la pauvreté et al., 2023; Soanes et al., 2021; Vielle et al., 2025).

The Belgian Federal Planning Bureau (2025) warns that a majority of the social objectives included in the United Nations Sustainable Development Goals – including those related to poverty, social exclusion and gender equality – will not be achieved in Belgium if current trends continue. Some social groups are much more affected by poverty and deprivation than others, including single-parent families (especially single mothers), youth with low or no education, immigrants from outside the EU and people with disabilities or chronic illness (Eurostat, 2025; Federal Planning Bureau, 2025; Statbel, 2022b). People in extreme insecurity, such as homeless or undocumented people, are largely invisible in statistics, meaning we are unable to fully monitor the evolution of the situation for these groups (Service de lutte contre la pauvreté, 2019), although initiatives exist to improve our ability to better measure the impact of crisis in contexts of (extreme) poverty (KU Leuven et al., 2025). Still, in 2023, wellbeing in Belgium fell to its lowest level for the last 20 years, mainly due to a decrease of population health, fewer social contacts and an increase in financial hardship (Federal Planning Bureau, 2025). Inequalities in Belgium are persistent and the effects of climate change and environmental degradation pose a severe risk of increasing them and further eroding population wellbeing.

THE IMPERATIVE OF JUSTICE IN ENVIRONMENTAL POLICY

"There is nothing more unequal than the equal treatment of unequal people" – this quote is typically attributed to either Thomas Jefferson, Kenneth Blanchard or Aristotle. Regardless of who said it first, the core message is clear – universal measures can worsen inequalities if they fail to account for the unequal starting positions of individuals and households (Service de lutte contre la pauvreté, 2019).

At the EU level, environmental justice is both a moral imperative and legal obligation (EEA, 2025). The Charter for Fundamental Rights (part of the Treaty on the Functioning of the EU), requires EU members states to ensure non-discrimination based on any ground (Article 21) and to guarantee social protection (Article 34), health care (Article 35) and equal access to services (Article 36). Member states must also comply with the Aarhus Convention, which ensures procedural justice in environment-related decision making.

Climate change will have impacts on our ability to ensure the continuity of several universal and constitutional human rights, with impacts mainly on the right to life (Art. 2 of the European Convention of Human Rights [ECHR]), the right to respect for private and family life (Art. 8 ECHR), the right to protection of property (First Protocol ECHR), economic and social rights, including the right to the protection of a healthy environment, the right to health and the right to housing (Art. 24 of the Belgian Constitution) (Born, 2018).

Floods in Wallonia (Belgium) in 2021

Social justice in adaptation and resilience policy need to take into account three dimensions (EEA, 2025):

- **Distributional justice** – the fair allocation of resources and burdens from climate impacts and adaptation measures;
- **Procedural justice** – fair, transparent and inclusive decision-making processes;
- **Recognitional justice** – recognising and respecting diverse values, cultures, perspectives and needs and addressing underlying causes of inequity.

REDUCING INEQUALITIES TO STRENGTHEN RESILIENCE

It has been shown that reducing social inequalities through strong social protection, labour and employment policies, provides protection against the socio-economic consequences of crises and increases the resilience of a population to climate crises (Service de lutte contre la pauvreté 2019; Vielle et al., 2025; Vleminckx, 2024). This means that the "leave no one behind" and "wellbeing for all" principles are not only crucial for achieving resilience for vulnerable groups but a precondition for resilience in society as a whole.

In order to achieve just resilience, adaptation policy at all levels needs to (EEA, 2025):

- address systemic and structural issues that perpetuate inequalities;
- reduce uneven impacts of climate change;
- leave no one behind, ensure that vulnerable groups benefit fairly from adaptation policies and are not additionally burdened by them.

By addressing the unique needs of vulnerable groups, policymakers can strengthen resilience and equity. This requires targeted interventions and a strong policy framework with dedicated funding and support mechanisms (EEA, 2025). Conversely, failure to mainstream justice risks maladaptation, exacerbating vulnerabilities and provoking resistance to change (Breil et al., 2021; EEA, 2024a; IPCC, 2022; Lager et al., 2023; Soanes et al., 2021). Modelling shows that if wellbeing declines and social tensions rise, this creates a negative feedback loop where the very conditions needed for transformational change become harder to achieve (Stoknes et al., 2025). It is therefore essential to stress the fact that consideration for justice, reducing inequality and increasing social cohesion make adaptation efforts more effective and strengthens resilience of society as a whole (Breil et al., 2021; EEA, 2024b; IPCC, 2022; Lager et al., 2023; Soanes et al., 2021; Stoknes et al., 2025). Social justice and explicit consideration for social vulnerabilities must therefore be mainstreamed as a core tenet in all adaptation policies (see EEA, 2025; Doughnut Economics Lab; Vielle et al., 2025; Vleminckx, 2024).

4.2. On intersectionality

It should be clear that vulnerable groups are not uniform. Within each social group, many variations influence the risks people face, depending on the hazard. Moreover, people never belong to only one group – it is our intersectional identities and circumstances (age, gender, health, disability, work, housing, income, culture, language, family situation, etc.) that shape our real risks.

Intersectional approaches address the complexity of social systems by recognising how overlapping and interdependent structures of inequity generate systemic injustice, social inequality and vulnerability (EEA, 2025; IISD, 2024). Intersectional analysis moves beyond one-dimensional views to show how overlapping identities amplify vulnerability. It shifts the focus from individual identities to structural inequities, providing the foundation for systemic approaches that address discrimination and injustice (IISD, 2024).

Although it is beyond the BCRA's scope to study in depth the interactions between intersectional vulnerabilities, it is essential to recognise their importance. Belonging to multiple vulnerable groups can compound risks and reduce adaptive capacity (Amorim Maia et al., 2022). Additionally, it should be recognised that vulnerability is dynamic and may change over time (van den Berg & Keenan, 2019).

Intersectional analysis is increasingly recognised as central for designing just and effective adaptation, resilience and climate justice strategies (EEA, 2025; IISD, 2024; IPCC, 2022). Yet, significant gaps remain in research and policy regarding the intersectional needs of vulnerable populations (Araos et al., 2021; EEA, 2025; Pham & Saner, 2021; Walker et al., 2024). Considering intersectionality within assessments will allow policymakers to better understand the diverse vulnerabilities in their areas (EEA, 2025).

Table 10 – Overview of vulnerable groups that were identified in the BCRA as particularly vulnerable to each of the selected environmental risks

	Vulnerable groups / Risks	Demographic vulnerabilities			Socio-economic vulnerabilities			Health-related vulnerabilities			Cultural and linguistic		Occupational vulnerabilities					Housing and geographic vulnerabilities				
		Children	Elderly	Women	Low-income populations	People in social isolation	Homeless people	People with physical disabilities	People with chronic illness	Mental health conditions	Language barrier	Migration background	Healthcare workers	Farmers and agricultural workers	Outdoor workers	Socially vulnerable workers	Small businesses	Renters	Private owners	Urban populations	People near vuln. ecosystems	Living in remote locations
Ecosystems	Risk to forest ecosystems due to gradual climate change																		●		●	
Ecosystems	Risk to forest ecosystems from wildfires	●	●	●		●		●			●	●							●		●	
Ecosystems	Risk to terrestrial coastal ecosystems due to sea level rise, coastal flooding and changes in soil salinity																					
Ecosystems	Risk to freshwater ecosystems due to droughts																					
Ecosystems	Risk to soil ecosystems due to droughts and erosion																					
Food	Risk to crops due to adverse weather conditions				●									●								
Food	Risk to food production due to soil ecosystems degradation				●									●								
Food	Risk to food production due to pollinator decline				●									●								
Food	Risk to livestock production from increased spread of diseases	●	●		●				●					●								
Food	Risk to food safety due to climate impacts on global agricultural production	●	●	●	●				●													
Infrastructure & buildings	Risk to buildings due to flooding	●	●	●	●	●		●			●							●	●		●	
Infrastructure & buildings	Risk to buildings due to changing moisture regime				●													●	●			
Infrastructure & buildings	Risk to infrastructure and buildings due to invasive alien plant species				●													●	●			
Infrastructure & buildings	Risk to energy & transport infrastructure due to extreme weather conditions	●	●	●	●			●	●			●					●					●
Infrastructure & buildings	Risk to civil and domestic water infrastructure due to droughts	●	●	●	●			●	●					●			●					●
Health & wellbeing	Risk to human health due to heat stress	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●		●		
Health & wellbeing	Risk to human health due to the increase of vector-borne diseases	●	●	●	●		●		●	●				●	●							
Health & wellbeing	Risk to human health due to the increase of non-communicable diseases	●	●	●	●		●		●					●	●					●		
Health & wellbeing	Risk to mental health due to climate change	●		●	●	●	●		●	●			●	●								
Health & wellbeing	Risk to human health due to the increase in pandemic zoonotic diseases	●	●	●	●		●		●	●			●	●		●				●	●	
Health & wellbeing	Risk to health systems and social care delivery due to climate change		●	●				●	●	●	●	●	●									●
Health & wellbeing	Risk of internal displacement of people in Belgium due to flooding	●	●	●	●	●	●	●			●							●	●		●	
Economy & Finance	Risk to property insurance due to flooding				●												●		●			
Economy & Finance	Risk to public finances due to climate change	●	●	●	●		●	●	●	●	●	●		●		●	●	●				
Economy & Finance	Risk to industry from water stress				●									●			●				●	
Economy & Finance	Risk to strategic imports due to climate change				●												●					
Economy & Finance	Risk to international food prices due to climate change				●																	

4.3. Vulnerable groups in Belgium

This chapter gives an overview of social groups that were identified in the BCRA as particularly vulnerable to the effects of climate change and ecosystems degradation. A synthesis of information that emerged from all 28 technical papers is provided below, with an overview in Table 10. It should be noted that many of these groups overlap and face similar risks, as social vulnerability is by definition intersectional.

4.3.1. Demographic vulnerabilities

4.3.1.1. Children

Children and youth are especially vulnerable to the effects of climate change, because they are still developing and because they will be confronted more with the consequences of climate change throughout their life than today's adults (Service de lutte contre la pauvreté et al., 2023).

CLIMATE DISASTER

First, they are at risk of specific climate hazards such as flooding and wildfires, as they generally rely on others (family members, care givers, rescue services, etc.) for protection and evacuation (Tradowsky et al., 2023). Especially young children have a reduced ability to self-evacuate and are generally less mobile.

HEALTH

Children, especially young ones, are particularly vulnerable to a number of health risks related to climate change and ecosystems degradation. They are particularly susceptible to heat, especially in their first years of life, as their thermoregulation is less effective and they have a higher body surface area to mass ratio (EEA, 2024a; Falk & Dotan, 2008; Nunes, 2025, p. 202; Slesinski et al., 2025). Academic achievement of school children has been shown to deteriorate with heat (Park et al., 2020; Wargocki et al., 2019) and European schools are more often located in areas hotter than the regional average (EEA, 2025). Children are also proportionately more vulnerable to diseases related to UV-radiation as their skin is very sensitive – with childhood sunburns representing an important risk factor in skin cancer development (Lergenmuller et al., 2022). Children are at higher risk of developing air-pollution related diseases (Thurston et al., 2017), with babies being especially vulnerable, as newborns (2-4 weeks old) in Western Europe were found to have a 74% higher chance of dying on days where fine particulate matter rates are high (Scheers et al., 2011). Foetuses exposed to air pollution in utero have an increased risk of developing asthma and allergies (Lu et al., 2020). Very young children are particularly vulnerable to a number of infectious diseases, including zoonoses and vector-borne pathogens and face worse outcomes when infected because their immune systems are still developing (CDC, 2025b).

Children and youth have been shown to be more susceptible to anxiety and mood disorders related to disasters (Cianconi et al., 2020). They are more susceptible to climate anxiety than adults due to their critical stage of physical and psychological development (Heeren et al., 2022; Wu et al., 2020), with around 10% of youth aged 9-20 in Brussels and Wallonia reporting frequent eco-anxiety and 71% expressing worry for future generations (Mouton et al., 2025).

FAILURE OF INFRASTRUCTURE

Minors are especially vulnerable to failures in public infrastructure, such as transport, because they depend on adults or public transport for longer trips and have a reduced ability to substitute one form of transport for another (EEA, 2025; Velghe, 2021). They are also more likely to suffer from water insecurity, making them vulnerable to decreased affordability and access to safe drinking water (Fondation Roi Baudoin, 2023). Children and infants are also particularly vulnerable to health risks associated with a lack of safe drinking water (Krishan et al., 2023) and with foodborne pathogens (CDC, 2025a) in the case of a failure of food safety mechanisms due to climate events.

4.3.1.2. Elderly

Currently, people over 65 years of age represent 20.3% of the Belgian population (Statbel, 2025b). Because of low fertility rates, higher life expectancy and stable migration, the share of the 67+ population is expected to rise to 28-30% of the total population by 2070 (Federal Planning Bureau, 2024).

HEALTH

First of all, the elderly are strongly affected by heat stress, especially those aged 80 and over. During the hot summer of 2022, for example, the mortality rate attributable to heat per million habitants in Belgium was about seven for the ages 0-64, 130 for ages 65-79 and 423 for people aged 80 or more (Ballester et al., 2023). This is partly because aging affects the body's thermoregulation and is associated with a higher probability of chronic cardiovascular and respiratory conditions (Ballester et al., 2023; EEA, 2024a; Lager et al., 2023; Slesinski et al., 2025).

The elderly are particularly vulnerable to several health impacts associated with climate change and ecosystems degradation. Infectious diseases, including zoonoses and vector-borne diseases, pose a particular threat because of age-related immune decline and the higher incidence of comorbidities (Mancinetti et al., 2024). The elderly are also more at risk of developing diseases related to air-pollution (Thurston et al., 2017). In the case of an interruption to the supply of drinking water due to drought or disaster, they are disproportionately vulnerable to health risks associated with a lack of safe drinking water (Krishan et al., 2023). If food safety mechanisms are interrupted due to climate events, foodborne pathogens may also have greater impact on them (CDC, 2025a).

CLIMATE DISASTER AND INFRASTRUCTURE FAILURES

Elderly residents are at increased risk of several climate-related disasters, such as wildfires and floods. They may not be able to self-evacuate in case of disaster and are often left to rely on family members or rescue services (Poussard et al., 2021; Tradowsky et al., 2023; Zacarias, 2025). They are particularly vulnerable to the failure of transport services, as they may have a reduced ability to substitute one form of transport for another (EEA, 2025; Velghe, 2021). This also reduces their ability to access healthcare if needed in the aftermath of extreme weather events.

They are also at higher risk of social isolation, reducing their access to early warning systems, informal communication and social networks. Furthermore, crisis communication may not always be adapted to their needs, as many such systems rely on digital and smart technologies.

4.3.1.3. Women

Gender equality is an important component of just resilience. A recent study from UN-Women & DESA (2024) warns that climate change could disproportionately push women and girls into extreme poverty worldwide. The IPCC (2022) concluded that inequities linked to gender can exacerbate vulnerability and could be worsened if adaptation measures do not address the gender dimension. The importance of addressing gender inequality in adaptation is recognised by the United Arab Emirates Framework for Global Climate Resilience adopted at COP 28, which encourages countries to adopt gender-responsive and participatory approaches (IISD, 2025).

CLIMATE DISASTER AND INFRASTRUCTURE FAILURES

Women are especially vulnerable to climate disasters because they more often carry the greater burden of family care-giving responsibilities (Cvetković et al., 2018). In particular, more often than men, they shoulder the responsibility for children and elderly family members, who are themselves particularly vulnerable to climate change risks and disasters. Additionally, women in Belgium tend to have lower access to resources and are, on average, more disadvantaged with regards to unemployment and lack of medical care due to financial hardship (Federal Planning Bureau, 2025). They are more at risk of water insecurity (Fondation Roi Baudoin, 2023) and transport poverty (EEA, 2025), increasing their vulnerability to the effects of infrastructure failure due to climate disaster.

HEALTH

Women are also more likely to suffer disability and worse mental health outcomes (Federal Planning Bureau, 2025), multiplying their vulnerabilities to climate risks. Women have been shown to be more susceptible to anxiety and mood disorders related to disasters and have an increased probability of developing mental health issues due to the effects of climate change (Cianconi et al., 2020). They also show notably higher levels of climate anxiety (Heeren et al., 2022) and are generally more worried about environmental issues than men in Belgium (FPS Public Health, 2022).

People who are pregnant are particularly vulnerable to health risks associated with climate change and ecosystems degradation. Women, in general, are already at risk from heat stress (EEA, 2023; Slesinski et al., 2025), with the 2022 heatwave leading to 56% more deaths in women throughout Europe (Ballester et al., 2023). Yet, pregnant people face additional risks, for themselves and for children in early life (prenatal and early postnatal period). Heatwaves have been shown to increase the risk of preterm birth by 26% and heat is associated with an increased risk of stillbirths, congenital anomalies and gestational diabetes mellitus (Lakhoo et al., 2025). In the case of an interruption to the supply of drinking water due to drought or disaster, they are particularly vulnerable to health risks associated with a lack of safe drinking water (Krishan et al., 2023). If food safety mechanisms fail due to climate events, they are more likely to get sick from foodborne pathogens (CDC, 2025a). They are also considered at particular risk of developing diseases related to air pollution (Thurston et al., 2017). Pregnancy is considered a risk factor for many infectious diseases, including zoonoses and vector-borne diseases. Additionally, they are at particular risk of disruptions to access to and functioning of health care infrastructure and services due to climate extremes or disaster, as they may not be able to access the healthcare that they need.

FINANCIAL

Women in Belgium are overrepresented in the numbers of single-parent families, with 82% of single-parent households being registered as single-mother (Statbel, 2024a). In 2019, 41.3% of single parents were found to be at risk of poverty in Belgium (Statbel, 2019). Single mothers thus face increased financial hardship, as they have to support their children financially and are at increased risk of poverty, including energy poverty (Fondation Roi Baudoin, 2024). This also puts them at increased risk from price inflation due to climate change and ecosystems degradation, for example through increased food prices, price of drinking water and the price of transport and energy due to infrastructure failure.

NEED FOR INCREASED KNOWLEDGE

Overall, however, gender inequality in facing climate risks is a topic that is currently understudied, especially as it intersects with other forms of vulnerability and inequality. Although this topic has been identified as a topic of concern, significant knowledge and data gaps exist regarding our understanding of social vulnerability in relation to gender, as well as in terms of gender-sensitive climate adaptation strategies (EEA, 2025).

The European Institute for Gender Equality (EIGE) has been working on addressing gender impacts specifically in climate policy, for example through gender mainstreaming in evaluation of a sustainable future for all (EIGE, 2024).

4.3.2. Socio-economic vulnerabilities

4.3.2.1. Low-income populations

In Belgium, 12.3% of the population had a disposable income below the poverty threshold in 2023 Statbel, 2025a). This figure conceals large regional disparities, however, as the level is 27.7% in Brussels, 15% in Wallonia and 8% in Flanders (Statbel, 2025a). Women, the elderly, people with a low degree of education, single-parent households and people without work have been identified as groups with a higher risk of poverty (Federal Planning Bureau, 2025). People with a disability or chronic illness are also at increased risk of poverty; with 22% at risk of monetary poverty and 17% suffering from severe material and social deprivation (Statbel, 2022b).

Low-income populations are disproportionately vulnerable to a large number of climate risks because (i) they are often more exposed to climate hazards, (ii) they are less able to adapt to and protect themselves from the effects of climate change and (iii) they are less able to bounce back in the aftermath of a climate-related event. Public policy choices can reinforce or mitigate exposure and adaptive capacity factors. For example, low-income households in Belgium often live in poorer quality housing and tend to benefit less from energy renovation policies, which further limits their adaptive capacity (Service de lutte contre la pauvreté, 2019).

HOUSING AND LOCATION

First, low-income populations face greater risks related to their housing, as they more often live in areas that are less desirable (flood-zone, high density, low access to green spaces and public infrastructure, etc.), as well as in homes with fewer adaptations (older, poor insulation, inadequate ventilation and drainage systems, etc.). This is the case for both low-income home owners, for whom the financial burden of necessary adaptations may be too high (see also "**Private owners**" below) and for low-income renters, who have less agency over the installation of adapted retrofitting (see also "**Renters**" below) (Service de lutte contre la pauvreté, 2024). Furthermore, any renovations undertaken by property owners could result in an increase in rent for tenants, thus excluding the most modest households.

Poorer households are often spatially concentrated in less desirable areas, reinforcing environmental injustice (Service de lutte contre la pauvreté, 2019). Low income populations in Belgium are more likely to live in lower valley and flood-prone areas, while disadvantaged neighbourhoods are often less protected by public infrastructure and recovery efforts are often slower (Coninx & Bachus, 2009; de Goër de Herve & Pot, 2024; Ozer, 2019; Poussard et al., 2021). People living permanently on campgrounds, because they are unable to afford more costly alternatives, are especially affected by flood risks (as became apparent during the catastrophic July 2021 Vesdre floods) as these campgrounds are often located along rivers and provide little to no flood protection (Service de lutte contre la pauvreté, 2021). This means that those in financial precariousness are both more at risk of flooding and less able to protect themselves and their property. Limited access to resources makes it more difficult to afford insurance, preventive measures or reconstruction after a disaster. Subsequently, those people that rely most on insurance mechanisms also tend to be the ones most at risk of being struck by natural disaster, which in turn puts them at risk of higher premiums or even the impossibility of arranging cover.

Lower-income households are also disproportionately affected by moisture-related damage to buildings, because they more frequently live in older, poorly insulated homes with inadequate drainage and ventilation systems, making them vulnerable to mould, wood decay and structural degradation (Vandemeulebroucke et al., 2024). They often lack the financial capacity to repair foundation cracks and structural damage caused by drought-related subsidence or slow-moving landslides and are less able to afford preventive reinforcements and insurance (Dewitte et al., 2018; Mateos et al., 2020; Naumann et al., 2021). The threat of invasive species such as Japanese knotweed to buildings disproportionately affects low-income homeowners, as financial constraints limit their capacity for eradication and damage repair, leading to possible property devaluation (Fennell et al., 2018; Hocking et al., 2023).

The increased risks low-income homeowners face to housing may also create vicious cycles and a lock-in phenomenon. As their housing is more at risk of the effects of climate change and ecosystems degradation, their property diminishes in resale value. This means that these vulnerable groups are less able to buy property elsewhere with better adaptations or lower risks, while they may become locked into worsening housing conditions and financial strain due to repairs and/or rising insurance premiums. As a result, this further exacerbates future vulnerability – reinforcing the vicious cycle (IPCC, 2022).

HEALTH

Low-income populations often also face a multiple health risk:

- they tend to be more exposed to health risks related to climate change;
- they often face limited access to healthcare;
- they have limited access to early detection;
- they are more likely to experience pre-existing health conditions such as respiratory diseases, obesity, heart disease or chronic illness (Statbel, 2018), which may exacerbate negative health outcomes.

Low-income populations are more vulnerable to heatwaves, as they more often live in old, poor-quality houses and are unable to afford cooling and insulation (De Muynck et al., 2025; EEA, 2024a, 2025; Lager et al., 2023). In Belgium, 24.1% of households that are at risk of poverty or social exclusion and 40% of households that experience serious material deprivation indicate that they are unable to keep their home cool (De Muynck et al., 2025; Statbel, 2024b). In urban environments, they are more likely to live in densely populated areas, with high degrees of soil sealing and low access to blue and green spaces, further exacerbating the urban heat island effect (Aerts et al., 2020; Burbidge et al., 2022).

They face a higher risk with regards to infectious diseases with zoonotic origin such as influenza and coronaviruses (Carlson et al., 2025; McGowan & Bambra, 2022; Ostfeld & Keesing, 2017). Indeed, people with lower incomes are often more exposed to infection because they are more likely to work in jobs that cannot be done remotely, live in more densely populated areas and have reduced capacity to self-isolate. Additionally, when they are exposed, they are more likely to face negative outcomes due to lower access to healthcare and early detection, as well as potential pre-existing health conditions (McGowan & Bambra, 2022). Addressing inequalities regarding infectious diseases is not only essential for reducing the disproportionate vulnerability of low-income groups but it would also protect society as a whole by limiting their spread in the wider population.

Regarding vector-borne diseases (VBD), the link with socio-economic status is well established even though systematic analyses for Europe are lacking (Moutinho et al., 2022). In particular, globally, low-income areas experience higher mosquito densities due to overcrowding, sub-optimal infrastructure, lack of effective vector control and environmental neglect such as stagnating water. These factors increase the risk of spread globally (Cofone et al., 2025) and this is likely valid for Belgium as well.

On average, low-income residents in Belgium live in areas with higher NO2 (Vandeninden et al., 2025) and particulate matter concentrations (Aerts et al., 2020), meaning they are more exposed to the health risks associated with air pollution. Inadequate insulation and ventilation of their homes may also contribute to a worse indoor environment, further increasing exposure to air pollution (De Muynck et al., 2025). Furthermore, they are also more likely to live in housing with poor indoor air quality due, for example, to elevated particulate matter, high humidity and mould contamination, increasing the risk of allergic and respiratory issues.

People living in poverty, deprivation and with low incomes are found to experience more mental health problems, both globally (McGowan & Bambra, 2022) and in Belgium (Sciensano, 2022). In Belgium, they are particularly affected by disasters caused by climate change or ecosystems degradation (Cianconi et al., 2020), leading to an increased probability of developing mental health issues (Morissens et al., 2025). An example of this was the COVID-19 health crisis, which had an immense impact on the mental health of people living in a situation of poverty in particular (Service de lutte contre la pauvreté, 2021a). Financial difficulties generated by climate hazards are a considerable vulnerability factor (De Maeyer et al., 2025).

In urban areas, low-income groups tend to have worse access to green spaces, meaning that they also have less access to their mental health benefits (WHO Regional Office for Europe, 2021). These worsened mental health conditions in turn make them more vulnerable to health risks such as infectious disease and heat (see **Health related vulnerabilities**). The psychological effects of poverty and insecurity (including stress, anxiety and loss of dignity) must be considered as part of vulnerability to climate crises (Service de lutte contre la pauvreté, 2019).

PUBLIC SERVICE AND INFRASTRUCTURE FAILURE

Low-income individuals are particularly vulnerable to the failure of public services on which they rely, as they may become less affordable or be interrupted due to climate change or environmental degradation. Unequal access to affordable and quality essential services – such as energy, water and mobility – exacerbates climate impacts (Service de lutte contre la pauvreté, 2019). This is the case for transport services, as low-income groups are particularly at risk of transport poverty, making them vulnerable to the failure of transport services due to infrastructure damage (EEA, 2025; Velghe, 2021).

Increased energy prices due to infrastructure failure may also particularly affect them, as 62.9% of households at risk of poverty also faced energy poverty in 2022 (Fondation Roi Baudoin, 2024). Lower income households are also vulnerable to diminished affordability and access to safe drinking water as water scarcity rises due to heat. This is because they are much more likely to struggle with rising water prices, the cost of water-saving measures during dry periods or the cost of installing pluvial water capturing systems (EEA, 2025; Mirra et al., 2024). In 2021, 58.5% of households at risk of poverty already face water insecurity in 2021, compared to 13.8% Belgian households in general (Fondation Roi Baudoin, 2023). These proportions will increase as water prices rise (Fondation Roi Baudoin, 2023b; Service de lutte contre la pauvreté, 2019).

AFFORDABILITY OF FOOD AND ESSENTIAL GOODS

Low-income groups are particularly vulnerable to rising market prices due to industrial operation disruptions and supply chain interruptions as extreme weather stresses infrastructure, causing shortages and inflation (Cevik & Gwon, 2024). Thus, some parts of the population may face greater financial burden or even become unable to afford essential goods. This is the case for food, as international trade and food production are affected by climate change and ecosystems degradation, leading to increases in food prices and impacting food accessibility for lower income groups (De Sloover & Jacobs, 2024; Murphy et al., 2022; Service de lutte contre la pauvreté, 2019). Furthermore, low-income households may not be able to afford home storage systems that are adapted to sustained hot conditions, increasing food scarcity, quality and safety issues due to food spoiling. This will affect the ability of low-income households to afford sufficient, safe, culturally appropriate and nutritious food (EEA, 2025). This may affect a large share of the population, as almost 13% of Belgians already currently experience some form of food insecurity (Berger et al., 2024) and some 209,000 people relied on food banks in 2024 (Fédération Belge des Banques Alimentaires, 2024).

FINANCIAL AND SOCIAL PROTECTION

Finally, those that are most reliant on redistributive mechanisms are the ones who will be the most and the first affected by climate change-induced fiscal disruptions which threaten Belgium's public finances. Indeed, pressure on national budgets threatens the sustainability of social security systems, such as social benefits, unemployment benefits, disability allowances, housing assistance, subsidies, pensions, aids for access to education and culture, etc. This is especially concerning for households already in or near poverty. Although the extent of the impact on these social policies will depend on political choices and prioritisation, a reduction of redistributive mechanisms will inevitably lead to a deepening of existing socio-economic inequalities, lower opportunities for economic mobility and an increased number of people living in or at risk of poverty and deprivation. Maintaining robust and accessible social protection systems is therefore essential for resilience (Service de lutte contre la pauvreté, 2019, 2021b; Vielle et al., 2025).

4.3.2.2. People in social isolation

While there is no single definition of social isolation, nor is it consistently monitored in Belgium, between 7% and 9% of the population indicated they felt always or usually lonely, which was especially prevalent in people living alone, single parents and low-income individuals (Statbel, 2024c). Loneliness is also more prominent in women, the elderly, unemployed and people with long-term and chronic illness (Statbel, 2022a). Language barriers, cultural differences and low digital literacy are also widely recognised as factors increasing social isolation (European Parliament, 2022; Whitehead et al., 2023).

CLIMATE DISASTER

People in social isolation may be more at risk of climate-related disasters such as flooding, wildfires, extreme weather events and health crises, given that they may not be reached by important information, early warning systems and informal communication channels (Kuran et al., 2020; Poussard et al., 2021; Van de Vel et al., 2021). This is particularly well-known for extreme heat, as their adaptive capacity and ability to find adequately cooled spaces may be compromised (Nunes, 2025) and they may not be reached by heat warnings and recommendations (Van de Vel et al., 2021). Furthermore, they cannot rely on a social network to help them protect themselves and their property. People in social isolation and marginalised people without a support network respond more slowly during and after crises, adding to the risk and limiting their ability to bounce back afterwards (Evans, 2010).

MENTAL HEALTH

People living in social isolation are also more vulnerable to mental health conditions and anxiety, meaning that climate change may have an increased impact on their mental health.

4.3.2.3. Homeless people

Homeless people are here defined as people who do not have access to their own permanent housing or residence. This includes people living in public spaces, people in (emergency) shelters, people living in a non-conventional space and people temporarily living with friends or family (Service de lutte contre la pauvreté, n.d.). These precarious living conditions and lack of structural support amplify health inequalities for homeless populations (Service de lutte contre la pauvreté, 2019). Although accurate and official counts of homeless people living in Belgium are by definition difficult to come by, it is estimated that nearly 50,000 people were homeless in 2024 in Belgium (Infirmiers de Rue, 2025). Nearly 25% are estimated to be children and there is an overrepresentation of people that have untreated mental disorders, that are suffering from addictions and that are undocumented (Infirmiers de Rue, 2025). The real impacts of climate and ecosystems degradation related risks on homeless people are difficult to track, however, due to a lack of data on homeless populations in Belgium.

HEALTH

Homeless people, because of their living conditions, sanitary conditions and lack of access to adequate medical care, face particularly high health risks. The risk of severe disease is further exacerbated by the higher proportions of comorbidities, such as arterial hypertension, diabetes and cardiovascular diseases, as well as a higher prevalence of risk factors such as smoking, illicit drug use, opioid substitution and alcohol abuse (Schrooyen et al., 2021).

Because of the higher probability of comorbidities, the lower access to healthcare and the reduced ability to self-isolate, they are more vulnerable to communicable diseases (Ogbonna et al., 2023; Schrooyen et al., 2021). Shelter overcrowding and limited access to hygienic supplies enhances the transmission of infectious disease (Schrooyen et al., 2021). For example, in Brussels, it was estimated that homeless people were three times more likely to be hospitalised due to COVID-19 (Schrooyen et al., 2021). Homeless individuals are also more exposed to vector-borne pathogens due to greater outdoor exposure and higher incidence of unprotected contact with vectors (ticks, mosquitoes, rodents, etc.) (Leibler et al., 2016).

Homeless people are particularly at risk from heat stress, because they are often unable to find adequately cooled shelter, may not have access to cold and clean drinking water and they are more likely to be affected by the urban heat island effect (Askew, 2023; De Muynck et al., 2025; EEA, 2025; Service de lutte contre la pauverté, 2019).

Their vulnerability is further increased due to the high incidence of risk factors such as mental health disorders, cardiovascular and pulmonary issues, social isolation and drug and alcohol use (De Muynck et al., 2025). Their reduced ability to shelter and protect themselves with sunscreen makes them also particularly vulnerable to UV-radiation (Askew, 2023; EEA, 2025). They are also typically more exposed to air pollution because of prolonged periods spent near road traffic (De Muynck et al., 2025). Vulnerability is again higher due to pre-existing comorbidities, including tuberculosis, their limited access to health care services and drug and alcohol use (De Muynck et al., 2025). The risk from these non-communicable diseases is further exacerbated by the fact that urban spaces that would reduce exposure to heat, UV-radiation and pollution, such as parks, are often inaccessible to them, especially at night due to closure or heightened security (De Muynck et al., 2025).

In the case of a breakdown of the drinking water supply due to drought or disaster, homeless people would be exposed to the health risks associated with a shortage of drinking water as they would be less able to afford or access safe drinking water (EEA, 2025). Inadequate sanitary conditions due to low access to safe water has an enormous impact on the health of homeless people (Service de lutte contre la pauvreté, 2019).

CLIMATE DISASTER

They are also disproportionately exposed to natural disasters such as floods (EEA, 2025). They face acute risks during extreme climate events, as they may not be able to find adequate shelter and have less access to information, early warning systems and institutional communications (De Muynck et al., 2025). Additionally, they have less access to a social network that may help them during or in the aftermath of a crisis and are more likely to lose all of their possessions due to a disaster or evacuation. There is a clear need for reliable data on homelessness in Belgium in order to design effective protective and preventive measures for this highly vulnerable group (Service de lutte contre la pauvreté, 2019).

4.3.3. Health-related vulnerabilities

4.3.3.1. People with physical disabilities

Disabilities cover a wide range of long-term and permanent health conditions, which each bring their own challenges and vulnerabilities. Generally, people living with disability share specific needs for accessibility in terms of basic needs, mobility, communication, health care, etc. Disadvantage arises from the interface between an individual who has one or more disabilities and an environment that is not adapted to that person's particular characteristics (Unia, n.d.).

In Belgium, 25.4% of the population aged 16 and over reported being more or less severely restricted in their usual activities due to disability in 2023 (Federal Planning Bureau, 2025). Women (27.8%) were more likely to report limitations than men (22.9%) and age is also a determining factor, reaching 42.1% of those aged over 64 (Federal

Planning Bureau, 2025). People with a lower income were also more likely to have a disability, affecting 38.7% of the lowest quintile by income (Federal Planning Bureau, 2025).

CLIMATE DISASTER AND INFRASTRUCTURE FAILURES

People with disabilities are disproportionately at risk in case of climate-related disasters, as they are often less able to self-evacuate in case of hazards such as floods and wildfire and are often left to rely on rescue services (Tradowsky et al., 2023; Zacarias, 2025). They may also not be able to access early warning systems, as communications are not always adapted to their needs, leaving them with a reduced ability and less time to protect themselves and their property.

People with physical disabilities are vulnerable to the failure of transport services due to infrastructure damage, since they are particularly at risk of transport poverty and may have a reduced ability to substitute one form of transport for another (EEA, 2025; Velghe, 2021). They are often reliant on either public transport services, the help of others or specially adapted private transport, limiting their access to adequate transportation in case of climate disaster (EEA, 2025). This also reduces their ability to access healthcare if needed in the aftermath of extreme weather events.

HEALTH

They are also more likely to suffer from water insecurity, making them vulnerable to decreased affordability and access to safe drinking water (Fondation Roi Baudoin, 2023). Additionally, people with physical impairments or functional limitations (especially people with mobility issues, people who are bed-ridden or people placed in care) are more vulnerable to the effects of heat (Nunes, 2025).

4.3.3.2. People with pre-existing health conditions or chronic illness

In Belgium, 26.8% of the population 16 and over declared having a long-standing illness or health problem in 2023 (Federal Planning Bureau, 2025). Women (28.4%) were more likely to suffer long-standing illness than men (25.1%), as are older people, affecting 42.3% of those aged over 64 (Federal Planning Bureau, 2025). People in a situation of severe material deprivation were found to be much more likely to suffer from pre-existing health conditions, with 43% indicating that they suffered from chronic illness in 2017, compared to 24% of the general population (Statbel, 2018). Additionally, 39.1% of the lowest income quintile indicate having a long-standing illness or health problem (Federal Planning Bureau, 2025).

HEALTH

Pre-existing health conditions increase vulnerability to health impacts given that the immune system may be compromised. Comorbidities may exacerbate the health impact of disease, including zoonoses and vector-borne diseases. In the case of an interruption to the supply of drinking water due to drought or disaster, they are particularly vulnerable to health risks associated with a lack of safe drinking water (Krishan et al., 2023). In the case of a failure of food safety mechanisms (especially cold chain failures) due to extreme heat or climate events affecting infrastructure and transport, they are vulnerable to issues of food safety and foodborne pathogens. They are at increased risk of developing diseases or facing worse health outcomes due to air pollution (Thurston et al., 2017). People with chronic conditions like allergies or asthma are more sensitive to pollen, which is a risk that will intensify as climate change increases pollen levels (Cruz et al., 2007).

People with chronic and non-communicable diseases such as diabetes, cardiovascular and respiratory disease and cancer, were found to be more susceptible to the effects of heat (Slesinski et al., 2025). People who are bed-ridden or placed in care are especially vulnerable to heat (Nunes, 2025).

People with chronic health issues in Belgium show notably higher levels of climate anxiety and are generally more worried about environmental issues and the effect of climate change (Morissens et al., 2025), further exacerbating their vulnerability to climate related health risks (see below).

FAILURE OF INFRASTRUCTURE

People with chronic illness in Belgium are considered particularly vulnerable to the failure of transport services due to infrastructure damage, as they are particularly at risk of transport poverty and may have a reduced ability to substitute one form of transport for another (EEA, 2025; Velghe, 2021). They are also more likely to suffer from water insecurity, making them vulnerable to decreased affordability and access to safe drinking water (Fondation Roi Baudoin, 2023).

Climate hazards and disasters which disrupt health systems and infrastructures form a particular risk to people with pre-existing health conditions, since they may not be able to access the regular or urgent healthcare that they need.

4.3.3.3. People with mental health conditions

In Belgium, 17.7% of the population aged over 15 was affected by a mental health disorder in 2023 (Federal Planning Bureau, 2025). Women (21.1%) were more likely to suffer from mental health disorders than men (14%) (Federal Planning Bureau, 2025). People with a lower income were also more likely to have a mental disorder, with 26.3% of the lowest quintile by income being affected (Federal Planning Bureau, 2025).

HEALTH

People with pre-existing mental health conditions are more vulnerable to the mental effects of extreme heat, as they may experience more psychological distress, worsened mental health, increased psychiatric hospitalisations, heightened suicide rates and even all-cause mortality rates (Charlson et al., 2021). Additionally, people with mental health conditions have been shown to be at higher risk from the health effects associated with heat because of reduced adaptive capacity (Nunes, 2025). People with psychoses have been shown to be more at risk of mortality due to heat exposure, possibly due to inadequate medication doses and impaired thermoregulation (Demoury et al., 2022).

Mental health disorders and adverse psychosocial circumstances have also been shown to increase immunosuppression, worsening the onset, course and outcome of infectious disease (McGowan & Bambra, 2022).

CLIMATE DISASTER

Climate hazards and disasters which disrupt health systems and infrastructures pose a particular risk to people with mental health conditions, as a lack of access to mental health care which could assist and mitigate the psychological outcome for victims becomes inaccessible (Cianconi et al., 2020).

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4.3.4. Cultural and linguistic vulnerabilities

4.3.4.1. People facing a language barrier

CLIMATE DISASTER

People who do not speak the local language fluently are more vulnerable to climate-related disasters, climate events, temperature extremes or health crises because accurate information, prevention communication, guidelines and early warning systems may not be accessible to them as multilingual sources are lacking (Kuran et al., 2020; Landeg et al., 2019; Van de Vel et al., 2021). This may apply to migrants but also to Belgian citizens who are fluent in one or more of the national languages but travel or live in an area where a different national language is official.

4.3.4.2. People with a migration background

In 2021, 17.7% of the population living in Belgium was foreign-born, with 9.8% being born outside of the EU (Statbel, 2021). Across the EU, migrants born outside of the EU have a higher risk of poverty (Eurostat, 2025). In Belgium, first-generation migrants suffer from lower employment rates, higher unemployment, wage discrimination and greater likelihood of poverty compared to natives (Centre for Social Policy et al., 2022). About 45% of non-EU migrants were found to be at risk of poverty or social exclusion (Centre for Social Policy et al., 2022). This means that people with a migration background in Belgium also have a higher chance of being vulnerable to the risks faced by low-income groups.

For migrants, or ethnic and cultural minorities, the lack of cultural inclusion and recognition can intensify social exclusion and lead to increased psychological distress (Graeme, 2005). Discrimination also acts as a powerful barrier, restricting access to housing, education and labour markets. Cultural and language barriers, along with persistent xenophobia and racism create additional obstacles to inclusion. Access to cultural rights and the ability to maintain cultural practices, identities and heritage – particularly for migrants and minorities – can also influence resilience and psychological recovery (Miola & Neher, 2016).

CLIMATE DISASTER AND INFRASTRUCTURE FAILURE

People with a migration background have been identified as particularly vulnerable to the failure of transport services, as they face increased transport poverty and may have a reduced ability to substitute one form of transport for another (EEA, 2025).

Experts surveyed by Cerac also warn that cultural barriers may mean that migrant populations may not be reached by warning systems, accurate information, prevention communication, recommendations and guidelines in the case of crisis or disaster related to climate events, temperature extremes or health crises.

4.3.5. Occupational vulnerabilities

4.3.5.1. Healthcare workers

HEALTH

Healthcare workers face increasing pressure, particularly during health crises, with staff often overwhelmed by high workloads, difficult working conditions and at increased risk of burnout. Climate extremes and climate-related disasters in particular may put additional stress on healthcare workers, due to the increased healthcare needs of victims and because access and functioning of parts of the healthcare system and infrastructure may become disrupted.

They are also at increased risk of exposure to infectious disease outbreaks, such as COVID-19, because of their work with infected patients. Additionally, expected rising temperatures contribute to fatigue among healthcare workers by increasing physical strain and reducing sleep quality, ultimately impacting their efficiency and exacerbating exhaustion.

4.3.5.2. Farmers and agricultural workers

FINANCIAL

The EEA (2025) identifies the agriculture and food system as highly vulnerable to climate-related hazards with significant implications for the livelihoods of farmers and agricultural workers. A loss of food productivity due to climate change and ecosystems degradation affects farmers directly, through the loss of profit in case of reduced production due to hazards in Belgium, through crop failures elsewhere of imported food for human or livestock consumption and through price fluctuations due to disruptions in global food supply chains (Murphy et al., 2022).

In particular, small-scale farmers and agricultural workers and particularly migrant labourers, are disproportionately affected by extreme weather events such as droughts, floods and heatwaves, as adaptive measures may be prohibitively expensive (EEA, 2025). These climate impacts threaten their income and increase their workloads. These pressures often lead to stress, social isolation and family conflict, increasing their risk of mental health impacts due to climate events.

Farmers face a particular risk related to water scarcity. Indeed, as drought affects water infrastructure and water scarcity increases due to climate change, the water they need for irrigation may become scarce. Competing demands for water (farmers, industries, citizens) may lead to restrictions in water use, increasing the risk of crop failure or reduced production. Fruit farmers are also specifically vulnerable to pollinator decline, as this may affect their produce yields.

Adaptation measures, because they are often costly, tend to favour larger and more affluent agricultural enterprises, leading to an unequal distribution of these measures and resilience to climate crises (EEA, 2025).

HEALTH

Agricultural workers face specific health risks. Climate change and ecosystems degradation have been linked to the increased spread of disease in cattle and farm workers are particularly at risk of contracting zoonotic diseases through close contact with livestock. They were also found to be at higher risk of vector-borne diseases, in particular from ticks (De Keukeleire et al., 2016, 2017, 2018; Sciensano, n.d.-b). Outdoor farm workers are at increased risk of diseases related to UV-radiation (Foundation Against Cancer, 2024) and to the effects of extreme heat (EEA, 2022, 2025).

4.3.5.3. Outdoor workers

HEALTH

Outdoor workers are especially exposed to the effects of heat, as they may not have access to adequate shelter during the working day (EEA, 2022, 2025; Nunes, 2025). Outdoor workers are also particularly vulnerable to diseases related to UV-radiation (such as skin cancer). Indeed, the risk of sunburn is 15% higher compared to the overall Belgian population, according to a recent survey (Stichting tegen kanker, 2024).

Outdoor workers in Belgium, in particular forestry workers, farmers, veterinarians and landscape workers were found to have a higher risk of exposure to tick-borne diseases such as Lyme disease, Tularemia and Anaplasmosis (De Keukeleire et al., 2016, 2017, 2018; Sciensano, n.d.-b).

4.3.5.4. Socially vulnerable workers

Socially vulnerable workers are individuals who, due to personal circumstances (such as socio-economic status, demographic characteristics, migration and documentation status, disability, etc.) and/or precarious employment conditions (such as informal, temporary, low-paid work, etc.), face heightened risk of exploitation, poor working conditions, inadequate social protection and diminished ability to claim rights or representation.

HEALTH

They see their vulnerability exacerbated by inadequate working conditions (Narocki, 2021). These workers often face higher exposure and a lack of adaptive measures, but hesitate to report health risks due to job insecurity and may be unwilling or unable to quit due to financial constraints, thereby exacerbating occupational health inequalities. Working locations may not provide the necessary adaptations to weather, exacerbating the impact of extreme weather events. This is the case in heatwaves, for example, when these workers often face prolonged exposure and a lack of access to cooling measures (Narocki, 2021). They may also be more vulnerable to infectious diseases, such as zoonoses, as adequate distancing measures may not always be respected and protective materials may not be provided, especially in crowded working conditions.

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4.3.5.5. Small businesses

FINANCIAL

Small businesses may be less aware of the risks related to climate change and have lower capacity to tackle them because they often lack in-house expertise, they do not have the resources to hire external consultants and they face issues accessing insurance (CCRA3, 2021).

They may also be less able to afford costly adaptation measures compared to larger and more affluent enterprises, making them more vulnerable to climate shocks. Additionally, they may be more affected by rising market prices due to industrial operation disruptions and supply chain interruptions as extreme weather stresses infrastructure, causing shortages, leading to reduced access to goods or raw materials. Thus, the increased costs of climate change may affect small business in particular, further increasing their vulnerability.

They may also be more vulnerable than their larger counterparts to financial disruptions due to climate change and ecosystems degradation. Indeed, they may be less able to absorb price increases of products and materials due to disruptions to strategic imports and supply chains.

4.3.6. Housing and geographic vulnerabilities

4.3.6.1. Renters

In Belgium, it is estimated that 28.1% of households live in rented housing (Eurostat, 2024). About 6.5% of properties are defined as public housing (Tomorrow. Building World Congress, 2025).

HOUSING

Renters may face particular vulnerability because of their reduced agency in obtaining necessary adaptations to their home to reduce climate risks (Service de lutte contre la pauvreté, 2024). Landlords may not be incentivised to install costly adaptations such as isolation, ventilation, temperature control, etc. to protect renters. Low-income renters and renters in social housing especially may not be able to afford to move out of low-quality housing and thus face increased risks from climate related hazards such as extreme heat and worsened air quality.

4.3.6.2. Private owners

In 2021, 64.5% of dwellings in Belgium were occupied by their owner (Statbel, 2024d). Although private land and house owners are generally considered as a relatively advantaged social group, they do face some risks that are specific to their private property. Especially low-income households, who may only be able to afford buying housing in very bad condition and do not have the budget for necessary repairs and adaptation, face increased risks.

FINANCIAL AND CLIMATE DISASTER

Compared to renters, homeowners are more often forced to leave their home temporarily due to floods (probably related to housing types, as they more often live in individual houses vs. apartments), but they are also less likely to move after a disaster such as flooding (Poussard et al., 2021), because they are emotionally attached to their homes or because they become financially trapped.

The management of private forests in the face of gradual climate change is the responsibility of the owner and a lack of knowledge, skills or interest in forestry, as well as elevated costs of investment and time constraints, may put their forests at risk of ecosystems degradation. In turn, the degradation of ecosystems may put these owners at higher risk of hazards such as wildfire, drought, zoonotic and vector-borne diseases, etc.

Low-income homeowners are particularly at risk of different hazards, devaluation of their home and increased insurance premiums or non-insurability. Those people that most strongly rely on insurance mechanisms due to stronger financial constraints, also tend to be the ones most at risk of being struck by such natural disasters. Financial strain also means that they are less able to either move to lower risk areas or to repair or adapt their homes, further exacerbating their vulnerability.

4.3.6.3. Urban populations

HEALTH

Urban populations face increased vulnerabilities to a number of health outcomes related to climate change and ecosystems degradation. They are particularly vulnerable to the heat island effect and urban areas experience several times more heatwave days than their rural surroundings in Belgium (Wouters et al., 2017). This is especially true for those living in neighbourhoods with high levels of soil sealing and little green or blue space (Nunes, 2025).

People living in urban areas, rapidly urbanising regions in particular, are more likely to experience increased exposure to zoonotic pathogens, such as COVID-19, because of high population densities (Gibb et al., 2025; Ostfeld & Keesing, 2017).

Urban populations are also more likely to be exposed to air pollution, as both concentrations of fine particulate matter and NO_x are typically higher in urban environments, especially high-density ones (IRCELINE, 2024). They are also more likely to be exposed to increased pollen concentrations of allergenic species (Schramm et al., 2021).

4.3.6.4. People living near vulnerable ecosystems

HEALTH AND FINANCIAL

Communities near forests may rely on them for both income from visitors and for the ecosystem services it provides, such as recreation, access to green spaces, cooling, etc. These communities would therefore suffer both in health and financial terms from the degradation of their living environment and landscape if forest degradation due to climate change continues.

People located near degraded ecosystems are more likely to experience increased exposure to zoonotic pathogens (Gibb et al., 2025; Ostfeld & Keesing, 2017). People living within 200 metres of moderately high to high wildfire probability zones are at increasing risk of wildfire as global temperatures rise (Depicker et al., 2020). People living in lower valley areas are most at risk of flooding (de Goër de Herve & Pot, 2024).

4.3.6.5. People living in isolation or remote locations

FAILURE OF INFRASTRUCTURE

People living in remote or isolated locations are at particular risk of infrastructure breakdown due to climate change or disaster. This is the case for transport, as people living in remote locations are particularly vulnerable to transport poverty and therefore may not be able to find suitable and affordable transport alternatives in the case of interrupted services and infrastructure damage (EEA, 2025; Velghe, 2021). People in remote locations are also more at risk of water poverty and are therefore more vulnerable to rising prices of drinking water and to an interruption in access to safe drinking water due to drought and infrastructure failure (EEA, 2025; Fondation Roi Baudoin, 2023). They are also among the households most at risk of energy poverty (Fondation Roi Baudoin, 2024), worsening the impact of energy price inflation due to failure of infrastructure. In the case of climate disaster, emergency services may not be able to reach them and healthcare services may more readily become inaccessible.

The bigger picture: urgency and interlinkages across system

5

5 The bigger picture: urgency and interlinkages across systems

5.1. Overview of the risk urgency across systems

The following table and figure list all the risks according to their urgency score. Based on future projections and the current state of policy readiness, the major risks for which Belgian institutions should consider taking urgent actions are:

1. Risk to **human health** due to **heat stress**;
2. Risk to **buildings** due to **flooding**, as well as the cascading risks to **property insurance**;
3. Risk to **crops** due to **adverse weather conditions** and **soil ecosystems degradation**;
4. Risk to **human health** due to the increase of pandemic **zoonotic diseases**.

Table 11. The 28 risks analysed in the BCRA, ordered by urgency score

Risk	System	Urgency score 3°
Risk to human health due to heat stress	Health and population wellbeing	Urgent action needed
Risk to buildings due to flooding	Infrastructure	Urgent action needed
Risk to human health due to the increase of pandemic zoonotic diseases	Health and population wellbeing	Urgent action needed
Risk to crops due to adverse weather conditions	Food	Urgent action needed
Risk to property insurance due to flooding	Economy & finance	Urgent action needed
Risk to food production due to soil ecosystems degradation	Food	Urgent action needed
Risk to international food prices due to climate change	Economy & finance	More action needed
Risk to human health due to the increase in non-communicable diseases	Health and population wellbeing	More action needed
Risk to energy & transport infrastructure due to extreme weather conditions	Infrastructure	More action needed
Risk to public finances due to climate change	Economy & finance	More action needed
Risk to social cohesion and inequalities due to climate change	Health and population wellbeing	More action needed
Risk to livestock production from increased spread of diseases	Food	More action needed
Risk to civil and domestic water infrastructure due to droughts	Infrastructure	More action needed
Risk to strategic imports due to climate change	Economy & finance	More action needed
Risk to soil ecosystems due to droughts and erosion	Ecosystems	More action needed
Risk to infrastructure and buildings due to invasive alien plant species (ecosystems degradation)	Infrastructure	More action needed
Risk to freshwater ecosystems due to droughts	Ecosystems	More action needed
Risk to food safety due to climate impacts on global agricultural production	Food	Precautionary action needed
Risk to health systems and social care delivery due to climate change	Health and population wellbeing	Precautionary action needed
Risk to buildings due to changing moisture regime	Infrastructure	Precautionary action needed
Risk to mental health due to climate change	Health and population wellbeing	Precautionary action needed
Risk of internal displacement of people in Belgium due to flooding	Health and population wellbeing	Precautionary action needed
Risk to forest ecosystems from wildfire	Ecosystems	Precautionary action needed
Risk to food production due to pollinator decline (ecosystems degradation)	Food	Precautionary action needed
Risk to industry from water stress (ecosystems degradation)	Economy & finance	Precautionary action needed
Risk to human health due to the increase of vector-borne diseases	Health and population wellbeing	Precautionary action needed
Risk to forest ecosystems due to gradual climate change	Ecosystems	Precautionary action needed
Risk to terrestrial coastal ecosystems due to sea level rise, coastal flooding and changes in soil salinity	Ecosystems	Operationalise existing policies

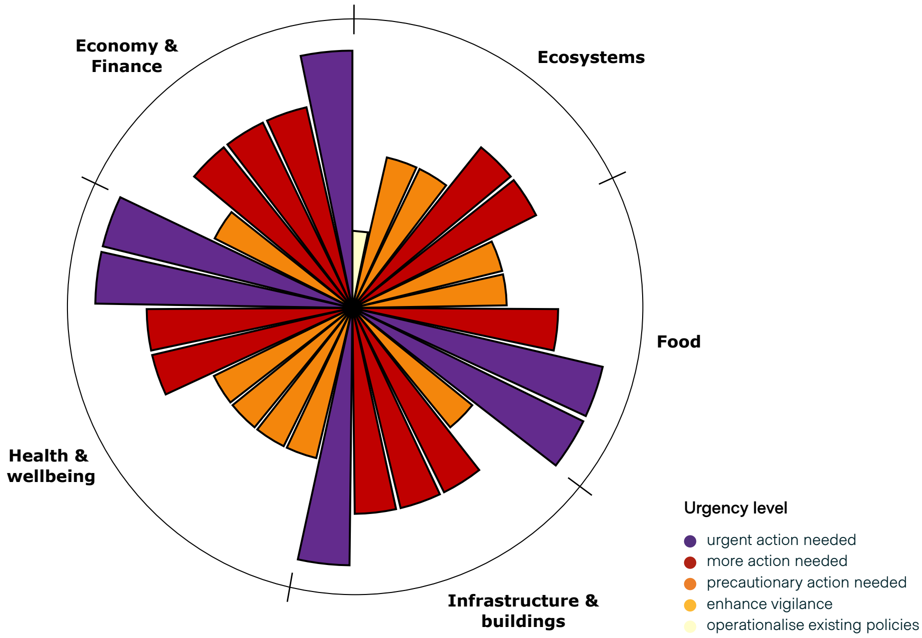


Figure 40. Number of risks analysed in the BCRA for each urgency score and per cluster

5.2. Complex risks

Climate change and ecosystems degradation are generating increasingly complex risks that extend far beyond conventional sector-based approaches. Complex risks are risks that emerge from the interaction of multiple, often individually insignificant, factors within complex systems, making them difficult to predict, detect and manage using traditional risk assessment methods.

The Belgian Climate Risk Assessment provides a risk-by-risk assessment, which should imperatively be seen in the context of these **systemic** (disruption of entire systems and interconnected sectors), **cascading** (domino effect initiating a chain of indirect impacts), **compounding** (interactions between hazards leading to amplification of risks) and **cross-cutting effects** (hazards affecting several sectors and generating several risks at once). These effects can accumulate and amplify the individual risks we have analysed, through feedback loops. Table 12 below lists some examples of such complex effects that could amplify risks analysed in the BCRA. These effects have also been identified in other national risk assessments (NZ-NCCRA 2020, UK-CCRA3 2021, DKRA 2023, PBL 2024).

Table 12. Examples of complex risks

Risk Example	Systemic aspect	Cascading effect	Cross-cutting aspect	Concerned risk factsheet
Prolonged drought affecting agriculture and freshwater supplies	Collapse of regional food systems and water supply	Lower crop yields > food prices rise > social unrest, malnutrition	Simultaneous stress on agriculture, water, health, economy	Risk to crops due to adverse weather conditions (Chapter 3.2.2)
Pest and disease outbreaks in forestry or agriculture	Regional economic collapse in primary sectors	Crop/forest loss > job loss > community decline Livestock contaminations > zoonoses	Affects biodiversity, economy, health, land use	Risk to forest ecosystems due to climate change (Chapter3.1.2), and Risk to livestock production from diseases (Chapter 3.2.2)
Climate-driven migration	Pressure on housing, labour markets, services	Sudden population influx > resource strain > social tension	Housing, planning, health, education, cohesion	Risk of internal displacement of people in Belgium due to flooding (Chapter 3.4.2)
Degradation of wetlands	Loss of flood protection and water filtration services	Wetland loss > increased flood damage > higher repair costs > fiscal strain	Biodiversity, climate adaptation, water, economy	Risk to terrestrial coastal ecosystems due to sea level rise, coastal flooding and changes in soil salinity (Chapter 3.1.2) Risk to freshwater ecosystems due to droughts (Chapter 3.1.2)

5.3. Comparison and interlinkage with other risk assessments

The following table provides a comparison between the BCRA, the EUCRA, the Belgian Regional assessments and the Belgian National Risk Assessment (BNRA) carried out by the National Crisis Centre. This comparison is intended to compare their respective risk selections and identify potential knowledge gaps. While the scope and methodologies of the BCRA, the regional assessments and the BNRA diverge, the BCRA has followed the same methodology as the EUCRA. These differences make the various risk assessments complementary and broaden our understanding of the risks facing Belgium.

However, these differences also make comparisons between the assessments challenging. Therefore, the comparison between the BCRA, the regional risk assessments and the BNRA is limited to whether a given risk is identified in the respective assessment.

The comparison between the BCRA and EUCRA goes further and also considers the scores attributed to the risks (see Table 13 and 5.3.1). Note however that three of the five urgency scores of the BCRA do not match EUCRA's scoring. Their wording and definition were adapted to better reflect the status of the risk in Belgium. In the BCRA, the first three urgency levels are "operationalise existing policies", followed by "enhance vigilance" and "precautionary action needed". In the EUCRA, this corresponds to, respectively, "sustain current action", "watching brief" and "further investigation needed". The two highest urgency levels, 'more action needed' and 'urgent action needed', are common to both the BCRA and the EUCRA. More information on the meaning of the urgency scores can be found in Chapter 2.

Table 13. Comparison of risks consideration and scores in various assessments

Ecosystems

BCRA Risk	Urgency score for 3°C GWL	EUCRA	Regions/Federal	BNRA
Risk to **forest** ecosystems due to **gradual climate change**	Precautionary action needed	More action needed.	Mentioned in all regional and federal adaptation plans, indicators and maps.	Not considered
Risk to **forest** ecosystems from **wildfire**	Precautionary action needed	Wildfires included in the analysis of risk to forests from gradual climate change. More action needed (but mainly due to hotspots in southern Europe)	Considered in the Flemish adaptation plan and in the new indicators and maps for the Walloon Region. Not at federal level nor for Brussels.	Wildfires are considered
Risk to **terrestrial coastal** ecosystems due to **sea level rise, coastal flooding** and changes in **soil salinity**	Operationalise existing policies	Urgent action needed	Risk considered in Flemish and Federal adaptation plans. Not relevant for Brussels and Wallonia.	Coastal flood and coastal erosion and shoreline change are considered but not for salinity aspects.
Risk to **freshwater** ecosystems due to **droughts**	More action needed	More action needed	Considered in all regional plans and indicators, but not at federal level.	Droughts are considered.
Risk to **soil** ecosystems due to **droughts** and **erosion**	More action needed	More action needed	Considered only for Walloon Region, through the new indicators and maps.	Subsidence and uplift risk due to soil degradation and droughts are considered.

Food

BCRA Risk	Urgency score for 3°C GWL	EUCRA	Regions/Federal	BNRA
Risk to **crops** due to **adverse weather conditions**	Urgent action needed	More action needed	Mentioned in the Flemish adaptation plan. Indicators and maps regarding crop yields and stability available for Walloon Region.	Agricultural plant diseases & pests are considered.
Risk to **livestock** production from increased spread of **diseases**	More action needed	Watching brief	New diseases mentioned in all regional and federal adaptation plans but not considered. Heat stress indicators and maps available for Walloon Region.	Animal disease is considered
Risk to **food safety** due to climate impacts on **global** agricultural production	Precautionary action needed	Further investigation	Not mentioned in the regions. Risk to food chain safety included in Federal adaptation plan.	Failure of food supply is considered.
Risk to **food production** due to **soil ecosystems degradation** (ecosystems degradation)	Urgent action needed	Not applicable (No ecosystems degradation risk assessment)	Not applicable (no ecosystems degradation risk assessment)	Failure of food supply includes production, shipping and delivery but does not discuss issues related to soil quality.
Risk to **food production** due to **pollinator** decline (ecosystems degradation)	Precautionary action needed	Not applicable (No ecosystems degradation risk assessment)	Not applicable (no ecosystems degradation risk assessment)	Not considered

Infrastructure & Buildings

BCRA Risk	Urgency score for 3°C GWL	EUCRA	Regions/Federal	BNRA
Risk to **buildings** due to **flooding**	Urgent action needed	Urgent action needed	Considered in all regionals and federal adaptation plans.	Considered as high probability but low impact risk.
Risk to **buildings** due to **changing moisture** regime	Precautionary action needed	Not considered	Not considered	Considered in the risk file "Subsidence and Uplift". Shrinking and swelling of expansive soils (e.g. clay), accentuated by alternating dry and wet periods causes subsidence and uplift.
Risk to **energy & transport infrastructure** due to **extreme weather conditions**	More action needed	Further investigation (more action needed in southern Europe for energy)	Considered in all regional and federal adaptation plans, mainly for electricity (production and distribution). Also gas in Walloon Region.	Failure of electricity supply is considered.
Risk to **civil and domestic water** infrastructure due to **droughts**	More action needed	Water scarcity for population and economy considered as "Further investigation" risk	Water scarcity risk due to climate change considered in all regional and federal plans.	Droughts and failure of drinking water supply are considered
Risk to **infrastructure and buildings** due to **invasive alien** plant species (ecosystems degradation)	More action needed	Not applicable (no ecosystems degradation risk assessment)	Not applicable (no ecosystems degradation risk assessment)	Invasive alien species is considered, including impact on infrastructures.

Health & population wellbeing

BCRA Risk	Urgency score for 3°C GWL	EUCRA	Regions/Federal	BNRA
Risk to **human health** due to **heat stress**	Urgent action needed	Urgent action needed	Considered by all regionals plans and indicators, but not at federal level (while data of over mortality comes from federal).	Heatwave is considered. The probability of a major heatwave is expected to increase significantly for the 2050 horizon due to climate change.
Risk to **human health** due to the increase of **vector-borne diseases**	Precautionary action needed	Considered as a major risk with more action needed	Mentioned in adaptation plans in Flanders and Brussels, as well as in the Walloon diagnosis of climate vulnerabilities.	Infectious disease is considered and climate change is expected to cause a slight increase of its probability by 2050
Risk to **human health** due to the increase in **non-communicable diseases**	More action needed	Not considered	Allergies considered under heatwaves collateral effects in Brussels Adaptation Plan.	Not considered
Risk to **mental health** due to **climate change**	Precautionary action needed	Not considered	Not considered	Considered in the 'Process of socio-psychological nature' risk file but was deemed difficult to assess.
Risk to **health systems** and **social care** delivery due to **climate change**	Precautionary action needed	Further investigation	Considered only in Walloon and Flemish regions.	Considered in the 'Failure of medical care supply' risk file with a slight increase in probability by 2050.
Risk to **social cohesion** and **inequalities due to climate change**	More action needed	Risk to viability of European solidarity mechanism considered as "urgent action needed".	Limited proxy indicators for inequalities regarding the vulnerability of the population to climate change (heat) existing in both Flemish and Walloon Region. Nothing at federal level.	Not considered
Risk of **internal displacement of people** in Belgium due to **flooding**	Precautionary action needed	Not considered as a specific risk. Mentioned as a possible consequence of large-scale flooding.		One of the indicators of flood risk (and all risk files) concerns people in need of assistance, including displaced persons.
Risk to **human health** from the increase of pandemic **zoonotic diseases** (ecosystems degradation)	Urgent action needed	Not applicable (no ecosystems degradation risk assessment)	Not applicable (no ecosystems degradation risk assessment)	Infectious disease is considered. The effects of climate change slightly increase the probability by 2050.

Economy & finance

BCRA Risk	Urgency score for 3°C GWL	EUCRA	Regions/Federal	BNRA
Risk to **property insurance** due to **flooding**	Urgent action needed	More action needed	Not considered, except for the current consideration of climate change in insurance policy framework	The economic impact is assessed by experts in the different 'flooding' risk files.
Risk to **public finances** due to **climate change**	More action needed	More action needed	Not considered	The 'government deficit' risk file exists but covers broader issues than just the effects of climate change.
Risk to international **food prices** due to **climate change**	More action needed	Further investigation	Not mentioned in the regions. Risk to food chain safety included in Federal adaptation plan.	Not considered
Risk to **industry** from **water stress** (ecosystems degradation)	Precautionary action needed	Water scarcity for population and economy considered as "Further investigation" risk	Water scarcity risk due to climate change considered in all regional and federal plans.	Droughts is considered.
Risk to strategic imports due to climate change	More action needed	Further investigation	Not considered	The 'commodities shortage' risk file exists but covers broader issues than just the effects of climate change.

5.3.1. Articulation with European and regional levels

The BCRA has taken a similar approach to assess the urgency of the risk as the European EUCRA methodology. The risks analysed are however not exactly the same.

15 risks considered in the EUCRA have not been assessed within this first BCRA (see Table 13) because they were considered of lesser priority at Belgian level but they could nevertheless be assessed in the future:

1. Risk to marine ecosystems from climate change in combination with other anthropogenic drivers;
2. Risk to food web dynamics and related ecosystem services due to phenological changes and species distribution shifts;
3. Risk to ecosystems and society from climate-induced species invasions;
4. Risk to fisheries and aquaculture in Europe and international waters from changed environmental conditions due to climate change and related ocean acidification;
5. Widespread disruption of marine transport;
6. Risk of electricity disruption due to the impacts of heat and drought impacts on energy production and peak demand;
7. Risk of energy disruption due to damage to energy transportation or storage infrastructure following coastal or inland flooding;
8. Widespread disruption of land-based transport;
9. Risk to population and built environment from wildfires facilitated by drought and heat;
10. Risk to human wellbeing from climate change impacts on residential and non-residential buildings;
11. Risk to human health from the emergence of harmful algal blooms and pathogens;
12. Climate risk to the viability of the European solidarity mechanisms;
13. Risk to winter tourism and countries or regions strongly depending on it;
14. Risk to population and economic sectors due to water scarcity;
15. Risk to European financial markets from climate impacts in Europe and beyond.

Conversely 9 risks were assessed within the BCRA that were not present in the EUCRA. This includes the six risks related to ecosystems degradation (since the EUCRA did not focus on this type of risk) and the following four climate related risks:

1. Risk to buildings due to changing moisture regime;
2. Risk to human health due to the increase in non-communicable diseases;
3. Risk to mental health due to climate change;
4. Risk of internal displacement of people in Belgium due to flooding.

Some important discrepancies to note from the BCRA and EUCRA assessments as well as the current concern at Belgian federal and regional levels are:

- A few risks are completely "off the radar" at regional and federal levels:
  - Risk arising from **ecosystems degradation** (soil quality, pollination, etc.) and invasive alien plant species,
  - Risk to buildings due to **changing moisture** regime,
  - Risk to **human health due to non-communicable diseases** (e.g. allergies) and **mental health issues**,
  - People **displacement,**
  - **Zoonotic diseases**,
  - Risk to **public finances** due to climate change, considered major in both BCRA and EUCRA,
  - Risk to **international food prices** due to climate change,
  - Risk to strategic imports (Belgian economy being particularly exposed to imports/exports),
  - Risk to property insurance due to flooding (globally considered but not sufficiently addressing the uncertainties in the legal framework identified after the 2021 Vesdre flooding);

- **Wildfires** are not sufficiently considered in regional and federal plans while suggested for precautionary actions in the BCRA and even more action needed in the EUCRA;

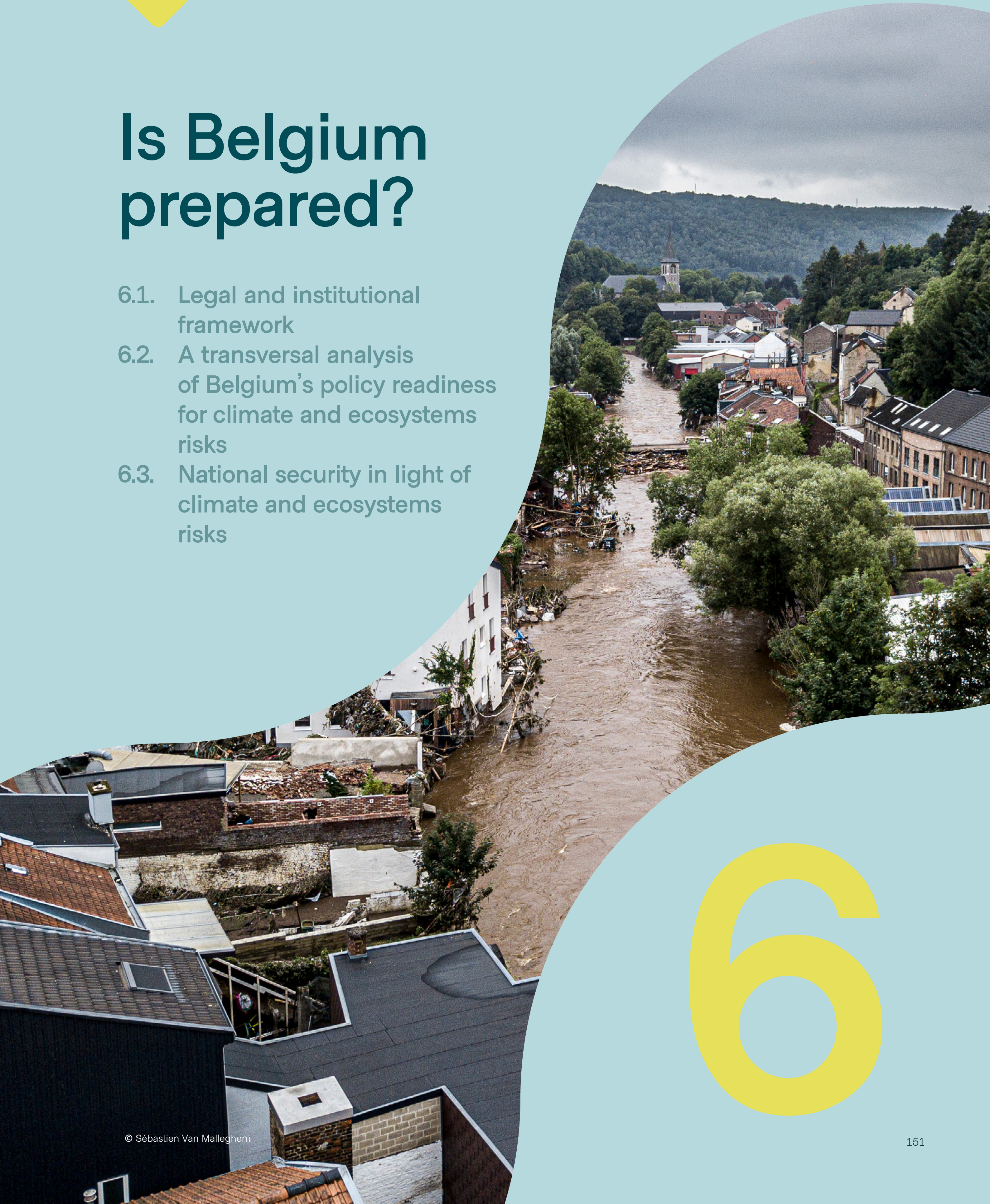
- Risk on **terrestrial coastal ecosystems** is considered to be sufficiently addressed by current policies at Belgian level (Flemish region) while Europe calls for urgent action;

- BCRA calls for urgent action regarding **crops and livestock** production which is higher than the urgency scored at European level (more action) and possibly the current concern at regional levels;

- Risk to human **health** due to **heat stress** (urgent action needed) and **vector-borne diseases** (precautionary action needed in BCRA and major risk in EUCRA) are mentioned at all levels, but probably not sufficiently addressed. Federal level probably has a crucial coordination role to play in addressing these risks and providing up-to-date monitoring data;

- Risk to health systems, social cohesion and inequalities is also raised in both BCRA and EUCRA, mentioned at regional level, but absent from federal documents while a national coordination and data collection is important.

Is Belgium prepared?



6

6 Is Belgium prepared?

This section does not aim to provide a comprehensive synthesis of all policy readiness measures expressed for each cluster or individual risk. Rather, its objective is to explore a set of cross-cutting considerations related to political preparedness for climate change and ecosystems-related stressors and to assess the capacity of governance systems to implement policies that match the scale and urgency of the risks identified. We begin by outlining the general contours of the international and national policy instruments that underpin climate and environmental preparedness. This will be followed by a more in-depth analysis of the challenges surrounding policy readiness in the context of climate change and ecosystems degradation.

6.1. Legal and institutional framework

To understand the current state of policy readiness for climate and ecosystems degradation risks, it is essential to first examine the existing legal and institutional frameworks. This section outlines the key international, European and national instruments that provide the foundation for climate adaptation and biodiversity-related policies, highlighting the multilevel architecture through which these policies are implemented. These frameworks should serve as the backbone for integrating resilience across all sectors, enabling coherent policy alignment, institutional coordination and the capacity to anticipate and manage future risks. Sector-specific policies will be detailed in the accompanying factsheets and technical papers, but this overview underscores the foundational role of legal and institutional systems in enabling a forward-looking and resilient governance model.

DEDICATED CLIMATE ADAPTATION AND RISK MANAGEMENT POLICIES

Managing climate risks is progressively emerging as a key dimension of climate governance, both internationally and domestically. At the international level, the 2015 Paris Agreement under the UNFCCC established a Global Goal on Adaptation (Article 7), aiming to enhance adaptive capacity, strengthen resilience and reduce vulnerability to climate change. This ambition is expected to be further operationalised through the UAE Framework for Global Climate Resilience, launched at COP28 in 2023. The framework is currently under negotiation and should be finalised at COP30 (November 2025).

Complementing this, the Sendai Framework for Disaster Risk Reduction (2015-2030), adopted by the UN in 2015, provides a global reference for integrating climate-related risks into broader disaster risk governance. It emphasises the importance of understanding risks, strengthening disaster risk governance, investing in resilience and enhancing preparedness for effective response and recovery. The Sendai Framework explicitly links climate adaptation to the full risk cycle – from prevention and preparedness to response and recovery – making it a key instrument for mainstreaming adaptation into national and local risk management strategies.

At the European level, Article 5 of the European Climate Law (2021) writes into law certain goals set under the European Green Deal. It notably mandates the EU and member states to make progress on adaptation, including specific provisions on mandatory adaptation strategies, assessments of progress, consistency and adaptation mainstreaming. Hence, the EU already adopted a European Adaptation Strategy (2021), which will be complemented by a forthcoming European climate resilience and risk management integrated framework (2026). The Communication on Managing Climate Risks (2024) further emphasises the need for integrated risk governance. The EU also devised five disaster resilience goals to better prepare European countries for natural hazards. The Union Civil Protection Mechanism (UCPM) is at the forefront of Europe's response to disasters and crises. More recently, the European Preparedness Union Strategy (2025) carries the ambition to better support member states and enhance Europe's capability to prevent and respond to emerging threats, as well as to develop a 'preparedness by design culture' across EU sectoral policies.

In Belgium, adaptation policy is structured across multiple levels of government. A National Adaptation Strategy was adopted in 2010, followed by a National Adaptation Plan (2017-2020). At the federal level, adaptation measures for 2023-2026 have been defined, while the federated entities have developed their own instruments (Table 14).

Under their competence over subordinate administrations, the regions encourage, support and sometimes require municipalities and provinces to adopt adaptive plans and measures (e.g. the Flemish municipalities rainwater plans (hemelwaterplannen) or Brussels' municipalities climate action plans). Local authorities themselves have also initiated a series of measures to cope with climate-driven risks, such as heatwaves in urban areas (e.g., Hittevlikker service in Antwerp).

Table 14. Non-exhaustive list of climate adaptation and risk management policies

List of measures
International level • **UNFCCC Paris Agreement** (2015): Global Adaptation Goals (Article 7) & UAE Framework for Global Climate Resilience (under discussion – possible agreement during COP30) • **Sendai Framework for Disaster Risk Reduction** (2015-2030)
European level • **European Adaptation Strategy** (2021) and upcoming **European climate resilience and risk management integrated framework** (to be adopted in 2026); Communication on managing climate risks (2024) • **European Climate Law** (2021, Article 5) • **European Disaster Resilience Goals** (2023) and the UCPM (2013, under revision) • **European Preparedness Union Strategy** (2025)
Belgium • **National Adaptation Strategy** (2010) (to be updated) • **National Adaptation Plan** (2017-2020) (to be updated) • **Federal Adaptation measures** (2023-2026)
Federated entities: • **Flanders** has adopted a Climate Adaptation Plan (2022), complemented by related measures such as the **Blue Deal** and the **Climate Health Plan** • **Wallonia** has integrated adaptation into its Air-Climate-Energy Plan (PACE 2030), though concrete adaptation initiatives remain limited. A Walloon Adaptation Strategy (SWA) and regional action plan are under development, based on the vulnerability assessment *"Diagnostic de vulnérabilités. Augmenter la résilience wallonne par l'adaptation au changement climatique"*. • **Brussels** has also included adaptation in its PACE 2030, with a focus on urban resilience

ECOSYSTEMS DEGRADATION AND BIODIVERSITY-LOSS POLICIES UNDER THE LOOP

The existing policy framework addressing biodiversity loss and ecosystems degradation is designed not only to conserve nature but also to safeguard the ecosystem services that underpin human health and livelihoods. At the global level, Belgium is a party to the United Nations Convention on Biological Diversity (CBD, 1993) and its protocols, including the Kunming-Montreal Global Biodiversity Framework (GBF, 2022), which sets ambitious targets for ecosystems restoration and protection by 2030. At the European level, the Birds (2009) and Habitats (1992) Directives aim to ensure the long-term protection, conservation and survival of Europe's most valuable and threatened species and habitats as well as the ecosystems of which they are a part. Natura 2000, which was established in 1992 and is the largest coordinated network of protected areas in the world, is the key instrument for implementing the objectives of those two Directives. More recently, the EU Biodiversity Strategy for 2030 (2020), a cornerstone of the European Green Deal, outlined the enlargement of Natura 2000 areas and introduced the Nature Restoration Law (2024) setting binding ecosystems restoration targets in the short and longer term.

In Belgium, the regions hold the primary responsibility for biodiversity policy, managing terrestrial ecosystems and implementing conservation measures within their territories. The federal level complements this by overseeing animal and plant health. The updated National Biodiversity Strategy 2030 (2025) provides a shared framework to align these multilevel efforts, ensuring coherence and coordination in protecting the ecosystems that sustain human and environmental health.

6.2. A transversal analysis of Belgium's policy readiness for climate and ecosystems risks

Building on the institutional overview, this section provides a transversal analytical framework to assess Belgium's readiness to address the risks posed by climate change and ecosystems degradation. In doing so, it highlights the difficulty of driving the necessary structural transformation to address increasingly complex and interconnected environmental challenges. The urgency of climate impacts and biodiversity loss calls for a shift from fragmented, short-term responses to systemic, long-term preparedness, anchored in robust climate adaptation and biodiversity strategies. Going beyond the analysis of specific measures, this section examines how these overarching policies interact with existing institutional structures, the extent to which they are integrated into risk management systems and the structural barriers that limit their effectiveness – particularly in a complex federal context.

This chapter proposes a transversal reading of policy readiness, structured around five interrelated dimensions:

- **Fragmented governance and institutional rigidity (6.2.1)**, which limits the capacity to coordinate adaptation across levels and sectors;
- **Mainstreaming climate and environment adaptation (6.2.2)**, which remains partial despite growing recognition of their cross-cutting nature;
- **Temporal misalignments (6.2.3)** which hinder investment in long-term resilience due to short-term political and budgetary cycles;
- **Financial constraints (6.2.4)**, which prevent the scaling-up of adaptation measures in the absence of sustained and coherent funding.

6.2.1. Fragmented governance and institutional rigidity

As highlighted by Head & Alford (2015) and Hendriks & Grin (2007), traditional institutions are poorly equipped to accommodate new strategies for complex policy problems. This is particularly true for the climate domain (Gupta et al., 2010), but the same applies to the conservation of ecosystems and biodiversity.

Climate change adaptation has emerged relatively recently as a public policy domain, with the first national strategies appearing in the early 2000s (Biesbroek et al., 2010). This novelty offers policymakers some flexibility to define strategic orientations but these choices must be made within pre-existing institutional and legal frameworks that are often rigid, sectoral and ill-suited to transversal challenges.

In Belgium, this difficulty is compounded by the fact that climate policies, and adaptation in particular, are not explicitly assigned to any single level of government. Instead, they are treated as shared competences, without a clear framework or efficient coordination mechanism, resulting in fragmented governance and uneven implementation. As Romainville et al. (2024) point out, the Belgian federal system – like many others – was not designed to address existential environmental threats. It was built to safeguard the autonomy of federated entities, not to manage cross-cutting issues like climate change or ecosystems degradation.

The concept of "Complex Intergovernmental Problems" (CIPs), developed by Paquet & Schertzer (2020), helps to characterise these challenges. CIPs are defined by three key features: (1) their root causes lie beyond the jurisdictional reach of individual governments, which can only manage localised consequences; (2) they require high levels of coordination across multiple levels of government; and (3) they tend to disrupt existing norms and mechanisms of intergovernmental collaboration, often demanding cooperation between institutions that have not traditionally worked together.

Building on this framework, Romainville et al. (2024) apply the CIP lens to the Belgian context, noting that climate governance presents significant coordination challenges across institutional boundaries. While she highlights structural tensions linked to the Belgian federal system – such as the distribution of exclusive competences and the absence of hierarchical coordination mechanisms – these challenges are not unique to Belgium. They reflect broader governance difficulties faced by many multi-level systems when addressing crosscutting, long-term risks like climate change.

Climate adaptation underscores the need to strengthen coordination mechanisms, clarify shared responsibilities and foster collaboration between institutions that may not traditionally interact. On the contrary, the policy readiness assessments conducted across the five risk clusters revealed persistent fragmentation and a lack of cross-sectoral coherence, which continue to impede effective adaptation planning and implementation.

For instance, regarding heatwave risks, the Federal Ozone and Heat Plan provides a structured framework for managing heat-related health impacts, with clearly defined phases and responsibilities. However, preventive and adaptive measures – such as greening, building standards and long-term urban planning – are not yet systematically embedded across all levels of governance.

The water system offers another illustrative example. During droughts, the prioritisation of water use becomes a critical issue that requires coordination across multiple sectors such as agriculture, industry and households. However, existing governance frameworks do not provide a coherent mechanism to arbitrate between competing demands. Regional drought cells operate independently and while some tools exist (e.g., the Priority Water Use Assessment Framework in Flanders), they are not systematically embedded in broader planning or investment strategies. The absence of a unified approach to water allocation under water stress conditions highlights the need for transversal coordination.

In the field of agriculture, the risk to crop production from adverse weather conditions is considered critical, yet policy readiness is rated as low due to fragmented and under-resourced responses. At the same time, soil monitoring remains uneven with significant variations between regions, while existing instruments under CAP such as eco-schemes remain voluntary and insufficiently integrated. More broadly, systemic contradictions between environmental, agricultural and food policy frameworks continue to hinder progress toward ecological sustainability and resilience.

Risks related to ecosystem degradation are often not addressed through a coherent and coordinated approach. For instance, wildfire risks to forest ecosystems are increasingly recognised, yet Belgium lacks a cohesive national strategy. Regional efforts exist but implementation remains inconsistent and under-resourced, illustrating the challenges of coordinating across jurisdictions and sectors.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6.2.2. Mainstreaming climate and environment adaptation: a necessary but challenging endeavour

Mainstreaming climate adaptation into existing policy domains is increasingly recognised as a necessary condition for effective and sustained action. Adaptation is a cross-cutting issue that touches all sectors – health, water, infrastructure, agriculture, spatial planning, etc. – and therefore cannot be confined to a single policy silo. Mainstreaming biodiversity in economic sectors is also one of the major challenges in halting biodiversity loss and ecosystems degradation (Karlsson-Vinkhuyzen et al., 2017).

Termeer et al. (2013) highlight that mainstreaming can be effective during implementation phases but may require a distinct policy identity to mobilise attention and resources. In many governance contexts, this tension is particularly acute: while adaptation is often framed as a shared responsibility, the absence of a clear mandate and the fragmentation of policy instruments hinder its operationalisation. The result is a paradox: adaptation demands integrated, cross-sectoral governance, but institutional architectures - whether shaped by federal structures, sectoral silos, or multi-level competences - tend to resist such integration.

This paradox is reflected in agriculture where the risk to soil ecosystems degradation is often hindered by inefficient governance and conflicting interests, which favour short-term gains of agro-industrial models over long-term ecological resilience. This misalignment between productivity-driven incentives and ecological sustainability makes it difficult to implement and sustain policies that support soil regeneration despite their long-term benefits for food security and ecosystems health.

Similarly, the emergence of zoonotic diseases has highlighted insufficient coordination between environmental, animal and human health authorities. Fragmented responses can hinder early detection and effective management of such risks. Strengthening intersectoral collaboration through a One Health approach is essential to ensure integrated surveillance, preventive action and response measures across these domains.

Ecosystem protection is not sufficiently considered in other sectoral policies, despite its foundational role in climate resilience and biodiversity. Risks related to ecosystem degradation – such as soil erosion or water quality loss – are addressed in isolation, leading to fragmented and inconsistent responses across sectors.

Social cohesion is also affected by the lack of mainstreaming. Climate risks disproportionately impact vulnerable populations, yet social protection policies rarely integrate environmental dimensions and environmental policies often overlook social inequalities. One of the strongest recommendations emerging from recent stakeholder consultations is to break down these silos: climate adaptation must be embedded in social policy and social equity considerations must inform environmental planning. Without such integration, adaptation measures risk reinforcing existing inequalities and undermining societal resilience.

These examples underscore that mainstreaming biodiversity and climate adaptation is a governance challenge. It requires deliberate efforts to align objectives, instruments and responsibilities across sectors and levels of government and to ensure that climate resilience is treated as a shared and structuring priority.

6.2.3. Temporal misalignments in climate and ecosystems degradation-related risk governance

The temporal misalignment between climate and ecosystems degradation risks and political cycles remains a structural barrier to adaptation. As Head (2022) notes, the deferred nature of benefits from preventive policies makes them less attractive to decision-makers navigating short-term electoral pressures. This is compounded by cognitive biases such as temporal discounting (Kahneman, 2011), which favour immediate gains over long-term resilience.

In Belgium, adaptation is often reactive and long-term projections are not systematically embedded into infrastructure, health or spatial planning policies. While flooding is addressed through regional risk management plans, slow-onset risks such as subsidence, soil degradation and ecosystem decline are rarely considered in renovation strategies or investment frameworks. Moisture-related damage to buildings, for instance, is increasing, yet remains absent from regional renovation plans despite its long-term financial implications. Health system responses to climate stressors – such as heat-related morbidity, mental health deterioration and increased demand for care – are managed through emergency protocols but lack sustained investment in infrastructure adaptation, workforce training or real-time surveillance. The psychosocial impacts of extreme events, including long-term trauma after floods, are not systematically monitored or integrated into recovery planning.


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In agriculture, the degradation of soil ecosystems and pollinators decline unfolds over decades, yet policy instruments remain focused on short-term productivity and annual compensation mechanisms. Sustainable agroecological farming practices, although recognised as necessary, are not supported by adequate multi-year planning or financing structures. Existing surveillance systems also lack flexibility for monitoring climate-driven emerging risks to food safety such as the proliferation of new pathogens and contamination.

Water governance also reflects this temporal disconnect. Drought coordination units are activated during dry periods but long-term measures – such as aquifer recharge, reuse systems or demand reduction – are not sufficiently embedded in infrastructure or land-use planning. Seasonal imbalances in water availability are projected to intensify, yet adaptation remains focused on crisis management.

Ecosystems restoration requires decades to deliver results but planning and funding cycles are typically limited to three to five years. Forest resilience, for example, depends on anticipatory silvicultural choices, yet legal and budgetary frameworks lack the flexibility to support long-term ecological adaptation. One of the challenges will be to align policies and measures between stakeholders to ensure consistent implementation across regions and forest types. For instance, regions are starting to introduce more mixed species composition and support active interventions in the Brussels Sonian Forest to reduce the vulnerability of the beech forest to climate change. Yet, there remain many uncertainties about the silvicultural directions to be taken, leading to several challenges such as long-term monitoring and sustained financial resources in the face of ecological and climate uncertainty.

To address these misalignments, scholars such as Haasnoot et al. (2013) and Pahl-Wostl (2009) advocate for robust and flexible strategies – measures that perform under a range of future scenarios and can be adjusted over time. This implies embedding climate projections into planning instruments, aligning investment horizons with ecological timescales and establishing long-term monitoring and evaluation mechanisms. Without such reforms, adaptation will remain fragmented, reactive and insufficient to meet the scale and pace of climate risks.

6.2.4. Financial constraints and the underfunding of environmental policies

Financial constraints are a recurring theme in environmental governance. As Head, cited by Romainville et al. (2024), argues, difficult problems such as climate change or ecosystems degradation are often met with coping strategies rather than long-term transformative action, due to limited institutional capacity and fragmented funding. The lack of dedicated, long-term financing mechanisms undermines the ability to implement robust transition plans, especially when benefits are uncertain or politically contested. Adaptation funding can also be dispersed across multiple entities with no overarching framework to ensure coherence or sufficiency. This fragmentation complicates resource allocation and limits the scalability of resilience measures. Driessen & Van Rijswick (2011) highlight the normative dilemmas surrounding the distribution of public and private responsibilities, noting that unclear mandates and constrained budgets can lead to implementation gaps.

Concrete examples across systems illustrate this structural issue. In the healthcare system, hospitals are required to have emergency plans but many lack resources to implement climate-specific measures. Psychiatric and residential care facilities do not have emergency power supply and are often excluded from priority energy supply schemes, despite their vulnerability during heatwaves or floods. Regarding agriculture, compensation mechanisms for climate-related crop losses are regularly activated but structural transformation, such as soil restoration or crop diversification, lacks sustained financial support.

Considering infrastructure, renovation strategies do not account for changing moisture-related risks and adaptation of older buildings remains unfunded despite growing damage from subsidence and infiltration. More importantly, the 2021 floods revealed systemic weakness in the natural catastrophe ("cat nat") insurance regime. The fact that regional solidarity mechanisms were, and still are, underfunded resulted in insurers absorbing losses far beyond statutory limits, undermining the trust of reinsurance companies in the Belgian legal framework. This lack of legal certainty threatens the viability of the insurance system as reinsurance companies could decide to leave the Belgian market. The erosion of insurability is a critical concern as it could result in cascading effects, potentially leading to systemic failures in mortgages, real estate development and long-term investments under higher warming scenarios.

Municipalities, which are central actors in spatial planning and local service delivery, often lack the financial autonomy and technical capacity to implement adaptation measures effectively. Despite being responsible for key levers such as land-use regulation, public space management and social support, they operate without clear mandates or dedicated funding streams for climate resilience. This limits their ability to anticipate and respond to localised risks, particularly in vulnerable urban areas.

Biodiversity-related adaptation is also underfunded. Invasive plant species cause increasing damage to infrastructure, yet coordinated management across sectors is not backed by dedicated budgets. Municipalities are often left to manage infestations without sufficient resources and, while some sectors have begun to address the issue, responses remain fragmented and reactive.

International comparative studies confirm this trend. Even in high-income countries, adaptation efforts are often poorly resourced and lack institutional anchorage. In Canada, Paquet & Schertzer (2020) observed that the absence of dedicated intergovernmental venues and financing mechanisms led to uneven responses to the COVID-19 zoonotic pandemic, a CIP with clear parallels to climate adaptation.

Adaptation also presents significant economic benefits with positive effects on GDP, employment and social welfare. In Austria, measures showed positive effects concentrated mainly in agriculture, forestry and, most importantly, disaster management (Bachner et al., 2019). Several studies underline that investing in preventive measures, such as flood protection, heat mitigation or soil restoration, can reduce long-term public expenditure, avoid disruption of essential services and protect vulnerable populations. However, these benefits are often difficult to quantify. Strengthening the economic case for adaptation, including through cost-benefit analyses and avoided damage estimates, is essential to mobilise sustained financing and shift the investment logic toward resilience.

As highlighted by Gupta et al., (2010), building adaptive capacity requires financial resilience: the ability of institutions to allocate, coordinate and sustain resources over time, in alignment with the systemic and long-term nature of climate risks. Without such reform, adaptation will remain reactive, fragmented and structurally underfunded.

6.2.5. Conclusion

The transversal analysis of policy readiness confirms that Belgium's preparedness is constrained by a combination of institutional fragmentation, limited integration, short-term planning horizons and underinvestment. These barriers are not isolated. They interact and reinforce one another, creating a governance landscape where climate risks are often managed reactively and where long-term resilience remains difficult to operationalise.

Moving from reactive responses to proactive preparedness will require institutional innovation, better coordination across levels and sectors and the development of financing and planning instruments aligned with the temporal and systemic nature of climate and ecosystems risks. Without such reforms, adaptation efforts risk remaining fragmented, insufficient and misaligned with the scale and urgency of the challenges ahead.

Given the pervasive, long-term and potentially disruptive impacts of climate change and ecosystems degradation on critical systems, including infrastructure, public health and social cohesion, preparedness for these risks should also be recognised as a matter of national security. This implies the need for sustained political attention, strategic foresight and cross-sectoral mobilisation.

6.3. National security in light of climate and ecosystems risks

Disruptions caused by climate change and biodiversity loss are identified among the primary threats in Belgium's National Security Strategy (2022). While climate change and ecosystems disruptions are often approached as technical or environmental issues, their implications for public safety, social stability and territorial resilience indeed call for a broader framing within security risk management.

As this BCRA shows, these issues will lead to risks such as wildfires, disruptions to energy and transport infrastructures, water scarcity and stress on public finances all reaching critical or catastrophic severity levels under +3°C WL scenarios. These disruptions can rapidly escalate into security risks, particularly when they affect critical services such as emergency response, communication systems or access to essential goods and care. Moreover, the likely rise in inequality and deterioration of mental wellbeing may fuel societal tensions, undermining the legitimacy of the state and further straining our collective capacity for action and adaptation.

Climate change and ecosystems degradation can accelerate the emergence and spread of new infectious diseases, including zoonotic and vector-borne illnesses, by altering habitats and expanding the range of disease-carrying species. They also contribute to a rise in non-communicable diseases. These shifts place growing pressure on healthcare systems, posing serious risks to public safety.

Climate change also poses a significant threat to the global economy by disrupting trade and supply chains, especially in climate-sensitive sectors like agriculture. As a highly open and globally integrated economy, Belgium is particularly vulnerable to these disruptions, which can lead to price volatility and reduced access to safe food.

Belgium must become more resilient to ensure that, even under the pressures of climate change, it can continue to guarantee vital services and protection to its citizens. The EUCRA advocates for a systems approach to adaptation and resilience, so as to better account for cascading and compounding risks (EEA, 2024b).

Currently, risk management in Belgium remains largely siloed – both in practice and in formal structures. This fragmentation hampers the alignment of prevention activities and emergency preparedness and complicates the mapping, anticipation and management of intersectoral risks and cascading effects.

Climate change risks demand long-term planning but investment in adaptation is far more cost-effective than disaster response. Nonetheless, decision-making, planning and financial frameworks are still predominantly short-term oriented.

Social cohesion, trust and mental wellbeing are essential foundations for a resilient security architecture, especially under growing climate pressures. However, a broad-based risk culture – one that encourages active public participation in risk management and disaster response, while accounting for the specific needs of vulnerable groups – is not yet fully developed in Belgium.

During the process of the BCRA, these concerns have been voiced on several occasions by public servants engaged in security management.

The reality of climate change calls for a new approach to climate adaptation, not as a series of incremental or project-based responses, but as a strategic imperative for national security that should be addressed with the same urgency and resource mobilisation as other major security threats. From early vulnerability mapping to long-term resilience planning, adaptation must be mainstreamed into the risk management architecture.

To safeguard the resilience of our society, Belgium must transition towards a whole-of-government and whole-of-society security architecture – one that is integrated, adaptive and future-proof. This will require a fundamental rethinking of our security architecture, spanning all phases of the risk cycle.

Recommen-dations

7

7 Recommendations

This chapter synthesises recommendations emerging from multiple rounds and types of expert elicitation that were conducted under the BCRA. They should be seen as the initial step in a longer process – they are meant to guide reflection, stimulate dialogue and provide strategic direction for strengthening Belgium's adaptation to climate change and ecosystem degradation. In line with its mandate, Cerac will help ensure that these recommendations are translated into concrete and actionable measures by further discussing, refining and tailoring them to specific target stakeholders. This follow-up process will be essential to ensure that adaptation policies are coherent, realistic and effective, supported by the necessary political decisions, financial frameworks and monitoring tools.

7.1. Integrating climate and environmental risks into national security and public governance

7.1.1. A Whole-of-Society security architecture

Decisive and sustained reductions in greenhouse gas emissions remain a top priority for all countries to achieve the objectives of the Paris Agreement – namely to limit global temperature rise to well below 2°C and to pursue efforts to restrict it to 1.5°C. Mitigation is the first and most effective response for reducing the scale and severity of climate-related risks. Yet, despite global mitigation efforts, the increasing plausibility of high-impact scenarios, including warming beyond 3°C or 4°C, underscores the urgent need to scale up adaptation efforts to ensure adequate preparedness.

Scientific evidence and widespread expert consensus underscore that extreme weather events are no longer hypothetical – they are occurring with increasing frequency and intensity. This was demonstrated in 2025 with, among others, record-breaking wildfires, heatwaves and droughts in Belgium and western Europe, as well as severe storms, tornadoes, hail and flash floods in other parts of Europe. The question is no longer if climate-disasters will happen, but when and how we will respond. This demands a shift in mindset in which climate change is considered a fundamental and society-wide threat for national security.

The inherently cross-sectoral and systemic nature of the risks makes the current, often siloed, risk management frameworks, structures and processes insufficiently apt for the future. Instead, integrated governance frameworks and long-term planning horizons are required.

Belgium must reinforce and broaden its security architecture to adapt and prepare for the climate change reality. Such a new architecture should be driven by clear mid- and long-term Belgian cross-sectoral risk management objectives, grounded in robust risk assessments and, periodically, they should be updated. Climate and biodiversity-related risks must form an integral part of these national risk assessments and risk management objectives, as exemplified by the Belgian Climate Risk Assessment (BCRA) and its alignment with the National Risk Assessment (BNRA). The risk management objectives need to be supported by clear deadlines, targeted financing and recurring political reporting periods.

Prevention actors, emergency management services (across all levels of government) and the private sector, with support from the scientific community, should be institutionally and formally brought closer together to jointly implement these risk management goals. A clear coordination and collaboration framework and clear division of tasks and mandates are essential.

As new collaboration models, procedures and actions will have to be developed, policy should actively support the development and dissemination of innovative ideas and concepts.

Financing mechanisms should be adapted to enable long-term planning and investment. Short-term visions on impacts and resulting priorities do not facilitate climate risk management.

In order to better anticipate and react to cascading effects, information and communication channels, monitoring tools and early warning systems and procedures among all stakeholders must be further reinforced.
Given the scale and severity of climate-related risks, resilience will not be achievable without the active engagement of citizens. To ensure no one is left behind – and to foster trust and social participation – citizen involvement should begin during the policy development phase through formal participation mechanisms. Differences in exposure, sensitivity and adaptive capacity must be acknowledged in preventive efforts and accounted for in preparedness strategies. Cultivating an active safety culture among the population is essential. This will allow emergency services to focus on those most in need during a disaster, while also leveraging the knowledge, solidarity and capacities of our society as a whole. Such efforts contribute to a more efficient and more manageable crisis response and recovery.

An evolution of Belgium's security architecture toward a more integrated, whole-of-government and whole-of-society system would align with similar developments at EU level. The report by Special Adviser Niinistö on strengthening Europe's civil and military preparedness and readiness (2025), along with the European Commission's EU Preparedness Union Strategy (2025), both advocate for a comprehensive approach to resilience in the face of climate change and geopolitical challenges.

The conclusions of this BCRA also support recommendations outlined by the regional crisis centre CORTEX, including:

- Define, in coordination with the federal level, clear regional recovery strategies post-crisis;
- Contribute to the national risk assessment (BNRA) and resilience planning (BNRP) efforts;
- Further develop and disseminate a risk culture, both among public authorities and the general population, as required by Article 4 of the Decree of 13 July 2023.

In summary, to effectively address the growing risks of climate change, **Belgium must build a coordinated security framework that enables joint action across government levels, sectors and society** – supported by clear mandates, early warning systems, citizen participation and targeted investments in resilience.

Although the direction is becoming clearer, Belgium is only at the beginning of understanding how – and in what format – such a new security framework could and should be implemented. Legal, institutional, financial and political questions must now be further analysed and translated into concrete proposals, in close collaboration with emergency management actors.


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7.1.2. Economic imperatives and strategic returns of adaptation

Acting now is not only more effective but also more cost-efficient. **Investing in adaptation** now will, in the mid- to long-term, be more affordable than the cost of massive damages to infrastructure, housing, ecosystems, etc. that will occur due to climate extremes. The World Resources Institute (WRI) underscores that effective adaptation measures not only prevent climate-related damages but that they also spur economic development and create social and environmental benefits. Indeed, the WRI (Brandon et al., 2025) estimates that, overall, every $1 invested in adaptation worldwide is expected to yield over $10.50 in benefits over a 10-year period. These benefits can include positive effects on GDP, unemployment and social welfare, particularly in the agricultural, forestry and catastrophe management sectors (Bachner et al., 2019).

In Belgium, it is estimated that the Sigma plan has a cost-benefit ratio between 1.87 and 5.52, for example, meaning that every euro invested had a clear positive return (World Bank Group, 2024). National and regional energy-climate plans already outline the mitigation path; adaptation must now be equally integrated, implemented and adequately funded.

In Belgium, this includes ensuring the effective deployment and financing of adaptation plans of all federated entities.

7.1.3. Vertical and horizontal mainstreaming of climate adaptation and preparedness

To effectively prepare for both acute and chronic climate hazards, a whole-of-government approach is essential. In other words, this means aligning actions across all levels of government – from national to regional and local – while ensuring intersectoral collaboration between domains such as health, agriculture, environment and infrastructure. Such an approach demands political will, the use of impact assessment tools, shared and accessible data and active community engagement. Across Europe, a growing number of countries are embedding vertical coordination mechanisms into their adaptation policies, with national adaptation strategies increasingly providing the overarching frameworks to support and guide local-level planning and action. In turn, these local actions feed further national adaptation strategies.

Mainstreaming adaptation and preparedness into sectoral, social and spatial planning is equally critical – not as a separate exercise, but as a core component of all decision-making processes. In light of its direct implications for national preparedness and security, climate resilience must be treated as a strategic component of all decision-making processes, vertically and horizontally. For this, it is essential to fund and encourage local and sectoral climate risk assessments that inform the design of tailored and meaningful adaptation measures at their level. Concrete examples already exist – the EU's Critical Entities Resilience (CER) Directive requires critical infrastructure operators to conduct climate risk assessments and implement appropriate measures to manage those risks. This sets a precedent for broader integration of climate adaptation across policy areas.

Proactive adaptation reduces damage, protects communities and preserves economic stability. Climate adaptation is not a linear process but an iterative, action-learning cycle. Even amid uncertainty or in the absence of perfect information, Belgium must act now **with precautionary, no-regret measures grounded in justice and equity,** ensuring a resilient society while knowledge continues to grow.

The recommendations made above are aligned with the European Climate Risk Assessment (EUCRA), which identifies three overarching priorities across all sectors and risk clusters. First, the need to promote **systems-based thinking to address the interconnections** between sectors and avoid siloed responses to climate risks. Second, the importance of **improving climate risk assessments to support a more precautionary** and forward-looking policy approach. Third, the necessity of **enabling transformational adaptation** to address deep-rooted vulnerabilities and build long-term resilience. Beyond risk reduction, many adaptation measures are designed to deliver **multiple co-benefits**, such as improving biodiversity, supporting public health and protecting vulnerable populations.

7.1.4. Ensuring just resilience

Climate risks are inherently complex and interconnected, with cascading effects across sectors. They can exacerbate existing crises and have far-reaching socio-economic consequences. To address these vulnerabilities effectively and increase resilience, adaptation must be inclusive and socially just. Embedding just resilience as a guiding principle across all levels of governance is essential to ensure that adaptation policies do not reinforce existing inequalities but instead contribute to a fair and inclusive transition. Policymaking must be rooted in solidarity, long-term vision and a recognition of our shared responsibility to protect both people and planet.

As emphasised by the European Environment Agency (EEA, 2025), just resilience must be a core principle of adaptation policy:

- At the EU level – ensure adaptation plans promote fairness, are adequately funded and monitored with equity in mind;
- At the national level – embed social justice in adaptation strategies, ensure inclusive access and monitor impacts across populations;
- At the local level – actively involve vulnerable groups early in the planning process and tailor measures to their needs.

Building resilience means leaving no one behind.
It is necessary to systematically consider vulnerable groups and integrate the "leave no one behind" principle into climate resilience and adaptation policies at all levels. Social justice must be mainstreamed in adaptation and environmental policies and climate change impacts must be systematically considered in social policies (see also technical paper "Risk to social cohesion and inequalities due to climate change" for more specific recommendations on this topic).

Increased inequalities and a lack of social cohesion make a society vulnerable. By addressing the unique needs and vulnerabilities of different social groups, policymakers can create more resilient and equitable communities that are better prepared to cope with climate-related hazards (EEA, 2025). The "leave no one behind" concept is not only crucial for achieving resilience for vulnerable groups, but justice and equity in adaptation are a precondition to achieve a resilient society. Thus, attention for social vulnerabilities and social cohesion need to be considered as a condition of national security.

Decision-making processes need to be inclusive, transparent and participative. Vulnerable groups need to be included in planning and implementing adaptation measures that address their unique needs and vulnerabilities. The design and implementation of socio-ecological protections should be democratised, including meaningful, ongoing participation by stakeholders and 'experience experts' at all levels of governance, especially locally, with particular attention to including policy-makers, researchers, unions, associations representing vulnerable groups and vulnerable groups themselves (EEA, 2025; ILO, 2015; Service de lutte contre la pauvreté, 2019; Service de lutte contre la pauvreté et al., 2023; Vielle et al., 2025). Existing structures and instruments implementing participative processes, such as those put in place by the Belgian Service to Combat Poverty (Service de lutte contre la pauvreté, la précarité et l'exclusion sociale), should be reinforced and utilised as much as possible. Ex-ante impact analysis is needed to ensure that vulnerable groups are effectively reached by policies designed to support them (Service de lutte contre la pauvreté, 2024b). Above all, adaptation strategies must not worsen the situation for people already at risk or put new people at risk

Strengthening resilience also requires attention to social capital and communication. For people and communities in precarious situations, climate impacts often erode not only material security but also vital social connections and social cohesion, which are essential for coping and recovery (Service de lutte contre la pauvreté 2019). Policies must therefore support community-level initiatives and local schemes that foster trust, solidarity and mutual aid, while urban planning should actively facilitate neighbourhood interactions by creating safe, inclusive public spaces (EEA, 2025). At the same time, communication strategies in times of crisis need to be designed to reach vulnerable groups effectively – information must be accessible, culturally sensitive and disseminated through trusted local intermediaries, using diverse formats and channels that do not exclude those with limited digital access or language barriers (EEA, 2025; Service de lutte contre la pauvreté 2024b). Integrating social capital and inclusive communication into adaptation strategies is crucial to strengthen cohesion, reduce isolation and ensure that no one is left behind when crises occur.

Mechanisms are needed to integrate future generation perspectives into decision-making. The long-term consequences of global climate change will disproportionately affect future generations. Beyond short-term solutions, it is necessary to ensure and preserve the wellbeing and prosperity of future generations as well as to achieve long-term sustainability. To do this, policies require anticipation of long-term impacts, balancing today's needs with those far ahead in time (OECD, 2020).

In order to implement effective policy, it is necessary to continue building our knowledge of vulnerable groups and the mechanisms through which they face vulnerabilities to climate change and ecosystems degradation in Belgium. In this report, a first overview was made of social vulnerabilities that were identified in the scientific literature relating to the different risks. However, it also became clear that for many vulnerabilities, the exact situation in Belgium is not always fully known. For example, there are many aspects for which no fully reliable Belgian numbers are known (e.g., number of homeless people, undocumented people, people living in poor housing, people with pre-existing health conditions, numbers of requests for social assistance, demographic profiles of people needing hospitalisation during crisis, etc.). Furthermore, the spatial overlap between vulnerable communities and increased risks for climate and ecosystems degradation hazards has not always been fully mapped. It is therefore necessary to further build our knowledge on the specific ways and places the identified vulnerable groups face specific risks through the elaboration of reliable, up-to-date indicators and maps. Further exploration of intersectional vulnerabilities and the ways in which risks may accumulate, both socially and spatially, is needed. Collaboration, data collection and shared knowledge building across disciplines is crucial to achieve a better understanding of the social challenges of the environmental degradation we face.

However, the need for further knowledge must not be used to justify delaying action. Even with uncertainty, precautionary and no-regret measures should be implemented now through an intersectional, justice-centred approach, while being continuously refined as new knowledge emerges. Acting proactively while building knowledge ensures that Belgium moves toward a just and resilient society without postponing responsibility.

7.1.5. Enhancing climate resilience through strengthened regulatory impact analysis

In Belgium, the regulatory impact assessment (RIA) framework has evolved over the past two decades yet remains fragmented and inconsistently applied across governance levels and policy domains. As highlighted in recent evaluations, including the comprehensive study by (Lanssens, 2024), the integration of RIA into decision-making processes has often lacked coherence, legal enforceability and strategic alignment with long-term resilience goals. While various thematic tests have emerged – including those on administrative burden, gender equality, poverty and SMEs – their implementation has been uneven and their influence on policy design limited.

To effectively anticipate and manage climate-related risks, Belgium must strengthen its ex-ante impact assessment mechanisms by embedding climate resilience criteria into all relevant legislative and regulatory processes. This includes systematically evaluating the potential impacts of proposed measures on ecological thresholds, vulnerable populations and long-term adaptation needs.

The importance of moving from reactive to anticipatory governance requires not only better data and foresight tools but also institutional mechanisms that ensure climate risks are considered upstream in the policy cycle. As the Service de lutte contre la pauvreté (2024b) recommends for social impact assessments, such mechanisms must be transversal, inter-federal and supported by trained civil servants, adequate timelines and quality control procedures.

A climate-focused RIA should be made mandatory for all major public decisions with potential systemic or territorial impacts. This would align Belgium with the OECD's best practices. To achieve this, Belgium should establish a legally binding framework for RIA that explicitly includes climate and environmental dimensions as core evaluation criteria. This framework must ensure that RIAs are conducted early in the policy development process, not retroactively and that they are systematically applied to all strategic decisions, including those related to infrastructure, land use, energy, agriculture and public health.

The OECD recommends that RIAs be supported by clear procedural guidelines, transparent methodologies and publicly accessible documentation. Belgium should therefore develop a national RIA protocol for climate resilience, including standardised templates, scenario-based modelling tools and indicators for systemic risk, equity and ecological integrity.

Furthermore, the effectiveness of RIAs depends on institutional capacity. Belgium should invest in targeted training for civil servants across all levels of government, focusing on systematic thinking, climate risk quantification and intersectoral coordination.

Finally, to ensure accountability and learning, RIA results should be published and integrated into parliamentary and public debate. This would reinforce the democratic legitimacy of climate-related decisions and foster a culture of precaution and transparency.

7.2. Address knowledge gaps and strengthen scientific understanding and institutional capacities

Increased research investment remains key, particularly in order to better understand changes in frequency and severity of hazards and in order to produce more granular geospatial data to help protect (vulnerable) people and (critical) infrastructure. While a wealth of data already exists, it must be transformed into accessible, user-friendly formats, particularly for non-specialist stakeholders and decision-makers. In addition to known hazards, emerging risks must be anticipated through more flexible and forward-looking approaches. These risks often fall outside traditional planning frameworks and require adaptive methodologies that can evolve with new evidence and shifting conditions.

In order to adequately address the complex and interdependent risks posed by climate change and ecosystems degradation in Belgium, it is imperative to strengthen scientific understanding and institutional capacities to deal with cascading systemic risks. These risks, where failures or disruptions in one part of an ecological or socio-economic system can propagate and amplify throughout others, require cross-sectoral and interdisciplinary approaches to risk assessment and policy design.

Strategies and knowledge are needed to be able to deal with "black swan" events – rare, high-impact occurrences such as simultaneous crop failures or pandemic zoonotic disease outbreaks. In order to increase preparedness and adaptation for such events, it is necessary to invest in scenario-based foresight methodologies that explicitly incorporate such wildcards (OECD, 2020). These scenarios necessitate inter-level cooperation across municipal, regional, federal and European governance levels. Belgium's federal structure adds complexity but also opportunity – coordination mechanisms should be empowered to develop joint contingency plans and stress-test them regularly using foresight tools such as horizon scanning and backcasting.

Moreover, to address "known unknowns", such as the uncertain rates of species decline and ecosystem tipping points, Belgium should expand its environmental monitoring systems. Linking data from Flemish, Walloon and Brussels biodiversity databases can improve the resolution and predictive accuracy of ecological models. Establishing an integrated, open-access platform for climate and biodiversity data would also facilitate rapid response and adaptive policymaking, particularly in regions vulnerable to compounding stressors.

In particular, further investigation is needed into those risks for which significant knowledge gaps have been identified and for which an evaluation of their true impact in the short and long term is still tentative. This includes all risks in the current analysis for which confidence about the severity level has been evaluated as low:

- Risk to forest ecosystems from wildfire;
- Risk to livestock production from increased spread of diseases;
- Risk to food safety due to climate impacts on global agricultural production;
- Risk to human health due to the increase of vector-borne diseases;
- Risk to mental health due to climate change;
- Risk to social cohesion and inequalities due to climate change;
- Risk of internal displacement of people in Belgium due to flooding;
- Risk to public finances due to climate change;
- Risk to industry from water stress due to ecosystems degradation.

In these cases, additional evidence and monitoring is needed both to fully understand the impact of certain hazards in Belgium and to identify the most effective and efficient measures needed to mitigate their risk. Evaluation processes need to be implemented to evaluate policy effectiveness, with a view to continuous improvement.

Finally, dealing with "unknown unknowns" demands cultivating resilience and flexibility in policy and infrastructure. This can be achieved through nature-based solutions (e.g., restoring wetlands, green urban infrastructure, etc.), participatory governance and adaptive regulatory frameworks that allow for dynamic revision based on new knowledge. Embedding precautionary principles into land use, agricultural and economic development policies is essential, especially where irreversible ecological and socio-economic damage may occur. Policymakers must be encouraged to adopt a mindset of systemic thinking, acknowledging the limits of current knowledge and the non-linear behaviour of ecological and social systems under stress.

Belgium must move from reactive to anticipatory governance by closing data gaps, simulating cascading effects, preparing for high-impact surprises and embedding systemic resilience into decision-making processes. These recommendations are not only scientifically justified but essential for safeguarding the ecological foundation upon which Belgium's economy and population wellbeing depend.

7.3. Key recommendations for each cluster

7.3.1. Ecosystems

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The EUCRA (EEA, 2024b) urges prioritising marine/coastal pressures; closing key knowledge gaps on interacting stressors and cascading impacts; tackling drought, warming, altered rainfall and wildfire risks through adaptive ecosystem management; strengthening policy coherence with concrete, operational targets and better guidance to member states; and urgently cutting agricultural and industrial pollution. Those are the broad recommendations made by EUCRA that were echoed by our assessment.

In the text below, numbers refer to respective risk technical papers the recommendations were sourced from, as follows: 1 = Forests due to gradual climate change, 2 = Forests from wildfires, 3 = Terrestrial Coastal Ecosystems due to sea level rise, coastal flooding and changes in soil salinity, 4 = Freshwater Ecosystems due to droughts, 5 = Soil due to droughts and erosion.

Governance & Policy

Build one coordinated adaptation architecture. Create a national coordination backbone with clear roles across federal-regional-local levels, so strategies align while respecting regional autonomy. This should include a national wildfire coordination body and medium/long-term strategy and formal mechanisms to link local specificities to overarching plans in forests, freshwater and soils. Cross-border cooperation should be embedded where relevant. (Risks: 1,2,4,5)

Mainstream ecosystem-based solutions into all relevant policies and budgets. Scale up nature-based and close-to-nature approaches, not just grey works, by integrating biodiversity and ecosystem resilience into coastal safety plans, forest policy and freshwater management. Use ecosystem-services valuation in planning and cost-benefit analyses to ensure ecological goals sit alongside infrastructure and economic concerns. (Risks: 1,3,4)

Stress-test and harmonise legal frameworks. Systematically review regional and federal rules against rising wildfire and drought risks; clarify mandates for prevention, response, vegetation management (e.g., dead wood) and the ability to mobilise private and defence assets. Where gaps or contradictions appear, propose updates and, where useful for safety, greater harmonisation. (Risks: 1,2)

Move from plans to enforcement and delivery. Accelerate the implementation of approved strategies (e.g., Blue Deal, Integrated Drought Strategy) with timelines, funding and enforcement; adopt pending tools (e.g., prioritisation of water use) and establish unified monitoring to track compliance and effectiveness. (Risk: 4)

Link water governance with ecosystem resilience. Adopt interregional water-management plans for storage, reuse and recharge, including drought "shutdown" procedures and measures that improve infiltration to replenish groundwater reserves – critical for forests, wildfire prevention and freshwater ecosystems. (Risks: 2,4,5)

Support nature-based solutions and prohibit any practices that degrade soil ecosystems. This implies supporting the implementation of very specific practices such as limiting the extension of artificialised areas, proscribing excessive drainage, limiting soil compaction, reducing the use of chemical inputs as much as possible, promoting permanent vegetation cover, increasing organic matter in soils, etc. (Risks: 1,2,5)

Addressing Information Gaps

Create unified, cross-regional monitoring frameworks. Build coherent systems with ecosystem-specific indicators that connect long-term climate projections to on-the-ground trend data. Leverage existing portals (e.g., Klimaatportaal, Kustportaal), strengthen forest inventories and ecosystem health observatories and standardise data collection for decision-use. (Risks: 1,2,3,4,5)

Close the coastal salinisation knowledge gap. Fund targeted research on groundwater salinisation, soil dynamics, ecosystem functioning and biodiversity responses and translate findings into salinity-specific regulatory targets (e.g., within River Basin Management Plans) and biodiversity policies for terrestrial-coastal interfaces. (Risk: 3)

Expand and standardise aquatic bio-ecological monitoring. Upgrade monitoring to include water quality, macroinvertebrates and broader ecological indicators, with real-time capabilities linked to action plans for drought and other stressors; standardisation enables better synthesis across regions. (Risk: 4)

Invest in predictive risk modelling. Strengthen spatial and temporal models for wildfire risk assessment (including climate projections and human drivers) and use climate-scenario modelling for drought and flood impacts to refine adaptation planning and prioritisation. (Risks: 2,4)

Map population and infrastructure exposure. Use the above models to explicitly assess direct risks to urban areas and key infrastructure and identify socio-ecological vulnerabilities to guide protective measures with the greatest public-health value. (Risks: 2,4)

Systematically assess climate-induced soil degradation. Develop a harmonised, cross-regional framework to track drought-driven soil changes and cascading effects on water and biodiversity – always considering the hosted aboveground ecosystem. More specifically, promote research, for example on the impact of persistent pollutants on soil ecosystems' functioning, dynamics of useful water reserves and their (over)exploitation, the behaviour of clays following drought, etc., closing today's science-policy gap on soil climate resilience. (Risk: 5)

Raising Awareness

Institutionalise targeted risk communication. Run sustained national campaigns on wildfire ignition risks and, where appropriate, support regional/local seasonal restrictions, paired with timely public alerts; in forests, support Regions in proactively briefing managers and owners about rapid climate shifts and the need to adapt before damage becomes irreversible. (Risks: 1,2)

Support private owners and practitioners. Offer tailored advisory services and shared learning networks for private forest owners; improve coordination and dissemination of scientific findings to translate research into day-to-day practice. (Risk: 1)

Surveillance and Early Warning Systems

Standardise wildfire protection, reporting and alerts. Establish a national system with common definitions, barometers and alert thresholds, separating public alerts from higher-precision operational thresholds that trigger precautionary measures and automatic notifications for emergency zones. Include early detection and a trained fire-forensics network. (Risk: 2)

Deploy real-time hydrological and ecological early warning. Advance real-time drought and water-quality monitoring for rivers, streams and reservoirs, tied to pre-agreed action plans (e.g., abstraction bans, wastewater permit adjustments, ecological flow safeguards). (Risk: 4)

Strengthen forest health surveillance. Expand forest inventories and health observatories to detect drought stress and biotic outbreaks (e.g., bark beetle, Phytophthora) early and link them to adaptive responses. (Risk: 1)

Track coastal salinity thresholds. Build monitoring networks for coastal aquifers and soils to anticipate salinity tipping points affecting ecosystems and dependent services, informing timely protective measures. (Risk: 3)
Forest Management Practices

Forest Management Practices

Diversify forests and manage for resilience. Shift to species and structural diversity, enhance ecological connectivity and adopt close-to-nature silviculture (e.g., selective harvesting, multi-age stands). Prioritise native, climate-adapted and, where suitable, more drought-tolerant species; implement hydrotechnical measures (for example the installation of retention ponds, basins, and infiltration channels, optimized rainwater collection, etc.) to manage water availability. (Risk: 1)

Reduce landscape-scale fire susceptibility. Limit new, even-aged, species-poor conifer plantations – especially on nutrient-poor, drought-sensitive soils – while designing robust post-disturbance reforestation. Balance biodiversity objectives (e.g., dead wood) with fuel-load safety in high-risk zones. (Risks: 1,2)

Design forests for emergency access and drought readiness. Align road widths and load capacities to emergency needs; manage soils to avoid excessive compaction and improve infiltration; coordinate water-reserve management to maintain availability through prolonged droughts. (Risks: 1,

Back forest management practices with stable finance and tools. Increase targeted subsidies, establish or strengthen existing selective programmes and nurseries for the most adapted tree species and fund equipment, staffing and applied research (e.g., predictive models, early-warning systems) that directly support field actors. (Risks: 1,2)

Embed adaptation in long-term planning. Align forest strategies with climate model projections, evolve conservation from static protection toward maintaining processes, connectivity and resilience and periodically review regulatory frameworks to keep pace with gradual, cumulative change. (Risk: 1)

7.3.2. Food

In the text below, numbers refer to respective risk technical papers the recommendations were sourced from, as follow : 1. Crops, 2. Food and Soil Ecosystems, 3. Pollinator Decline, 4. Livestock Diseases, 5. Food Safety.

Governance & policy

Support a **transition towards agroecological farming systems** that integrate crops, livestock and nature, reduce dependence on synthetic inputs and fossil fuels and enhance resilience to climate shocks. Integrate food system resilience into national climate, biodiversity and energy strategies, recognising the links between soil, water, biodiversity, nutrition and social equity. (Risks: 1,2,3,4,5)

Make climate adaptation a co-priority with mitigation across the whole food system – shift from farm-only policies to end-to-end food-system governance (producers, processors, retailers, consumers), with mandates to translate existing knowledge into action and remove administrative bottlenecks. Prioritise funded, multi-annual adaptation strategies and coordinated implementation between regions and public-private actors. (Risks: 1,2,4,5)

Reinforce environmental conditionality and limit exemptions to avoid backsliding – ensure the alignment of CAP instruments such as income support with existing environmental and animal welfare criteria under the conditionality principle, including the nine good agricultural and environmental conditions (GAECs). (Risks: 1,2,3,4)

Revise the allocation of CAP funds so that they are no longer primarily determined by farm size (surface area or number of livestock) but increasingly linked to performance-based objectives – introduce a generalised conditionality mechanism, requiring compliance with a set of environmental, climate and social performance indicators. These criteria should not only focus on environmentally friendly practices (e.g., pollinators diversity, emissions reduction) but also measures that strengthen farm resilience in the face of climate change and other environmental stressors (crops resilience, soil health). Such an approach would ensure that CAP support rewards long-term viability and adaptive capacity, rather than scale alone. (Risks : 1,2,3,4)

Prevent unfair competition for Belgian farmers – ensure that imported agricultural products meet equivalent environmental, climate and social standards as those applied within the EU. Trade agreements and market access should systematically integrate reciprocity clauses to avoid undercutting EU farmers who comply with stricter sustainability requirements. (Risks : 1,2,3,4)

Align agricultural and biodiversity policies – ensure consistency between the Common Agricultural Policy (CAP) and the Nature Restoration Law targets. (Risks : 1,2,3,4)

Scale up the use of eco-schemes, as well as sustainable development measures such as agri-environment-climate measures (AECM) or biological agriculture financing measures to remunerate farmers for climate and environmentally friendly farming. (Risks : 1,2,3,4)

Reinforce food security by promoting shorter supply chains and climate-compatible farming systems – set shared objectives with the food industry that are aligned with realistic, health-oriented and climate-compatible diets. Prioritise waste reduction, sustainable consumption patterns and farming resilience over yield maximisation alone. Use integrated foresight scenarios (e.g., TYFA) to inform decisions. Supporting small-scale, diversified farming and regional value chains will strengthen resilience, reduce dependence on volatile global markets and lower reliance on imported fertilisers. (Risks : 1,2,4,5)

Back the agroecological transition with stable finance and rules – create concrete, funded roadmaps for crop diversification, longer rotations, reduced chemical inputs and farm-level redesign (smaller plots, mixed systems). (Risks: 1,2,3,4)

Enable collective water governance – modernise legal frameworks to allow shared water infrastructure and watershed-scale planning; pair permitting reform with incentives for proactive buffering (retention basins, controlled drainage) and soil-based water retention to protect yields and reduce contamination risks downstream. (Risks: 1,2,4,5)

Anchor a One Health approach in agricultural policies and farming practices – ensure that plant, animal and human health are addressed in an integrated manner, avoiding trade-offs where farming production efforts (e.g. nitrogen use) cause biodiversity or public health risks. (Risks: 1, 2, 4, 5)

Maintain effective protection and fair compensation measures against disasters, but complement them with stronger upfront investments in resilience – next to existing regional disaster funds and insurance schemes that ensure risks mutualisation and ex-post compensation in case of a natural disasters, investments should be made in risk reduction measures to support farmers in building lasting resilience and ensure long-term investment returns. (Risks : 1,2,4)

Fix land-tenure incentives for soil stewardship – use fiscal and financial tools to reward long-term leases and regenerative contracts so tenants are incentivised to invest in soil health and erosion control, improving nutrition and safety co-benefits. (Risks: 1, 2)

Ensure coherence with EU-level priorities – as highlighted in the EUCRA, the CAP currently fail to sufficiently address climate risks. Belgium should use EU levers to promote policy alignment and avoid maladaptation measures.

Introduce targeted social measures to safeguard food security – ensure that vulnerable households can access healthy, sustainable diets even in times of price volatility or crisis. Tools may include income support, food vouchers or reduced VAT on essential nutritious foods.

Addressing Information Gaps

Harmonise soil data and make it decision-ready – leverage the EU Soil Monitoring Law to build a national soil information system with consistent indicators (erosion, compaction, SOC/SOM, pollution), interoperable across regions and usable in CAP targeting, impact assessment and planning. (Risks: 1,2,4,5)

Quantify health links from soil degradation to nutrition quality – study how biodiversity-depleted soils (maintained by synthetic inputs) affect crop nutrient profiles and human health; integrate results into food-based dietary guidelines and farm support. (Risks: 1,2)

Develop climate-crop models that integrate not only temperature and precipitation shifts but also biotic risks such as pests, diseases and toxin-producing fungi, alongside soil fertility and ecosystem service decline, to avoid overestimating yields and underestimating food safety hazards under warming. (Risks: 1,5)

Develop toxicity and cumulative exposure maps – produce national maps of soil health and chemical stress hotspots (incl. intensive pesticide areas) to target mitigation with co-benefits for water quality and food safety. (Risks: 2,5)

Close evidence gaps on pollinator decline and remedies – improve distribution/abundance data for wild pollinators (beyond Apis/Bombus); assess pesticide regulation effectiveness and the benefits of diversified landscapes for pollination and micronutrient-rich food availability. (Risks: 1,2,3)

Map climate-sensitive trade and internal flows – analyse Belgian intra-national and cross-border trade for climate-impacted products to anticipate regional shortages, price spikes and substitution risks along the value chain. (Risk: 5)

Advance erosion and hydrology modelling – move beyond empirical averages to represent non-linear extremes on degraded soils; link land-use patterns, rotation length and tenancy duration to soil loss and watershed risk. (Risks: 1,2)
Conduct socio-economic vulnerability analyses - of the food system, assessing risks by farm type, region and household income group, to design more targeted support measures.

Quantify and communicate the economic case for prevention – ecosystem restoration is less costly than long-term soil degradation and food system collapse.

Broaden research programmes to support innovation in agroecological practices, bio-based and low-climate-impact materials for farming and food storage and circular approaches reducing waste and fossil fuel dependency.

Raising awareness

Make diets and seasonality part of adaptation – engage citizens on healthier, lower-impact diets and the realities of seasonal availability and climate-related shortfalls; align consumer demand with resilient Belgian production. (Risks: 1,2,5)

Build system-wide soil and water literacy – target farmers, planners, architects and developers with training on soil-water functions; improve accessibility of datasets and tools so everyday decisions reinforce resilience. (Risks: 1,2)

Support farmer-led transition knowledge, without blaming farmers – value existing expertise, prioritise plot-level advice/coaching and reduce financial risk during transitions (including insurance design) while amplifying young farmers' leadership (Risks: 1,2,4). This implies also strengthening public and farmer awareness of the systemic risks that climate change poses to food production – crop losses from heat, drought, floods and frost; livestock diseases linked to vector spread; and food safety risks from pathogens and toxins.

Communicate true environmental costs – explain why prices should reflect externalities from conventional systems to help drive demand for sustainably-produced, safer food. (Risks: 1,2,5)

Promote **understanding of the critical role of soils and pollinators for food security.** Healthy soils and diverse pollinators underpin long-term productivity but are increasingly degraded by intensive land use and climate extremes. (Risks: 1,2,3)

Highlight that short-term productivity fixes (e.g. monocultures, heavy irrigation) can backfire, undermining soils and biodiversity and that **resilience requires long-term, collective investment**.

Surveillance and Early Warning Systems

Monitor vectors and integrate One-Health alerts – strengthen surveillance of vectors relevant to livestock (and zoonotic) diseases; link animal-health, public-health and environmental data streams for rapid risk communication. (Risks: 4,5)

Establish a national soil and biodiversity monitoring framework, aligned with EU directives, tracking soil organic matter, erosion, compaction and pollinator populations. (Risks: 2,3)

Harmonise pollinator monitoring and plan evaluation – implement a monitoring system aligned with EU PoMS; periodically evaluate the National Pollinator Strategy with indicators and transparent reporting; create interoperable data platforms. (Risk: 3)

Boost rapid response capacity for food safety – invest in rapid containment and coordination via EFSA/ECDC/WGS, RASFF and FASFC controls rather than over-relying on long-range prediction of inherently unpredictable hazards. (Risk: 5)

Further invest in robust early warning systems for agriculture – monitoring extreme weather, crop and livestock disease outbreaks, soil degradation and pollinator decline. Expand monitoring for northward-moving pests and pathogens and for irrigation/processing water quality (toxins, pathogens, algal blooms) after floods and droughts. (Risks: 1,5)

Strengthen veterinary and phytosanitary surveillance to prevent and rapidly contain emerging animal and plant diseases (e.g. bluetongue, avian flu). (Risk: 4)

Improve coordination across regions and levels of government, ensuring timely, accessible communication to farmers and consumers with particular attention to vulnerable groups. (Risk: 1,2,3,4,5)

Enhance international monitoring of food trade and supply disruptions to anticipate price spikes and food security risks, especially for low-income households. (Risk: 5)

7.3.3. Infrastructure & buildings

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In the text below, numbers refer to respective risk technical papers the recommendations were sourced from, as follow: Risks: 1 = Buildings and floods; 2 = Changing moisture regime; 3 = Invasive alien plant species; 4 = Energy and transport; 5 = Water scarcity

Governance & policy

Create integrated, multi-level adaptation governance with clear mandates. Integrated and cross-sectoral governance is key to addressing both invasive species and climate risks that threaten infrastructure. This requires the establishment of permanent cross-sector platforms and integrated governance frameworks that bring together regional governments, infrastructure operators, insurers and communities so decisions on floods, subsidence, invasive species, energy and water are coordinated. (Risks: 1,2,3,4,5)

Mainstream climate-proofed spatial planning and building standards. Strategic planning and regulation must embed climate resilience into spatial planning, building codes, and infrastructure design and renovation strategies. Adaptation should not be reactive or short-term, but instead long-term and risk-based, with particular emphasis on sectors that are especially exposed, such as energy, transport, water, and housing. (Risks: 1,2,3,4,5)

Translate flood hazard maps and soil moisture risk assessments into enforceable zoning, building codes and permit conditions. Relevant measures include mandatory rainwater management, flood-proof new constructions and flood-resistant existing buildings, subsidence-resilient foundations, so that exposure and vulnerability of households and other key infrastructure are reduced. (Risks: 1,2,4)

A clear prioritisation of risks and protection measures based on likelihood, impacts and lifecycle cost-effectiveness is essential. Different strategies should be applied depending on the severity of hazards and the feasibility of responses – ranging from prevention and early eradication to containment, mitigation, or even passive management where necessary. For infrastructure, this means focusing investments on the most critical and exposed infrastructure nodes, such as tunnels, ports, bridges, and energy grids, where disruption would have the greatest societal impact. (Risks: 1,2,3,4,5)

Strong legal frameworks are essential to ensure clarity and enforceability. This requires both leveraging existing regulations and developing new ones, while avoiding unnecessary administrative burdens and duplication. Streamlining reporting obligations, clearly defining responsibilities, and strengthening enforcement are key steps to ensure that actors comply with climate-resilient standards. Robust governance should also guarantee transparency and adherence to high standards for climate adaptation, water management, invasive species control, and infrastructure resilience. (Risks: 1,2,3,4,5)

In parallel, effective financial frameworks are necessary to ensure the sustainability of these efforts. Adaptation costs must be embedded into public investment and development plans, while promoting fair, risk-based insurance coverage. A risk-based, cost-benefit approach should be applied when full protection is not feasible – focusing investments where they yield the highest resilience value. In addition, long-term operational costs of climate extremes (e.g., heating/cooling of infrastructure, energy price surges) must be anticipated and included in investment budgets and return calculations. (Risks: 1,2,3,4,5)

Scale up nature-based solutions for buffering, shading and infiltration. Use riparian buffers, urban trees, hedgerows, sponge-zones and upstream retention to reduce flood peaks, improve groundwater recharge, lower heat exposure for infrastructure, and reduce contamination risks to soil and water. Nature-based solutions (e.g., green zones for soil permeability) should complement traditional technical infrastructure like drainage networks and retention basins. These hybrid strategies provide both climate resilience and valuable ecosystem co-benefits. (Risks: 1,2,4,5)

Addressing Information Gaps

Research and capacity building should play a central role in enabling adaptation. Research centres and specialised agencies must be mobilised to develop standards, monitor evolving risks, co-design solutions with stakeholders and provide technical support.

Significantly improve mapping and monitoring of soil subsidence, flood-prone areas, and infrastructure vulnerabilities, drawing on professional systems, citizen science, and satellite imagery to build a robust and wide-ranging risk picture that supports preparedness during disruptions. (Risk 1,2,3,4,5)

- Establish a baseline data inventory of key infrastructure conditions to better assess current vulnerabilities;
- Develop updated and precise geospatial risk maps integrating multiple hazards;
- Create operational modelling tools combining hydrological, climate, spatial, and socio-economic data to support proactive adaptation, prioritise maintenance and protect populations most at risk.

Standardise invasive species mapping, requiring mandatory reporting for infrastructure projects, and funding professional surveillance (not only citizen science) to quantify structural damage from species such as Japanese knotweed. This requires **recording species distributions and their impacts on both infrastructure and ecosystems, and integrating these data into planning processes.** Such integration ensures that ecological and infrastructural dimensions of risk are considered together, rather than in isolation. (Risk 3)

Integrate sectoral climate studies into comprehensive assessments to guide effective adaptation strategies. (Risks 1,2,3,4,5)

- Move beyond isolated sectoral resilience studies to aggregate findings into an **integrated national climate risk assessment** to take into account interdependencies, cascading effects.
- Incorporate **local specificities and microclimates** rather than relying solely on broad global climate scenarios.
- Integrate the **full range of climate hazards** - such as floods, droughts, and heatwaves - together with biodiversity impacts and socio-economic vulnerabilities.

Technical studies and innovation will play a central role in building resilience. Research should be promoted on climate-resilient materials, innovative construction techniques, water management, and nature-based solutions. This should be complemented by field studies to better understand how infrastructure degrades under climate stress or biological threats and inform their maintenance. Equally important is the sharing of knowledge across sectors and regions. (Risk 1,2,3,4,5)

Improve hydrological, soil-moisture and subsidence modelling rather than relying on outdated historical baselines. Invest in basin-scale hydrological models and soil-moisture/subsidence projections (including drought-driven shrink-swell dynamics) to improve forecasting, and evidence-based planning. This will enable to anticipate and prevent potential damages and improve water management systems (Risks: 1,2,5)

Data sharing and harmonisation are critical to ensure that adaptation efforts are coherent and effective. This requires the use of consistent methodologies and the provision of accessible information across regions and sectors. Such harmonised data systems are indispensable for planning, crisis management, and the design of long-term adaptation strategies. Among others, this implies an exhaustive inventory of existing surface and groundwater abstractions, available through shared data systems and stronger oversight by public authorities. (Risks: 1,2,3,5)

Sustainable, soil- and moisture-sensitive construction practices should be integrated across all layers of the built and natural environment. Adaptation measures must account for the links between construction, soil health, and moisture management – preventing groundwater overuse, promoting breathable bio-based materials for buildings, restoring vegetation to regulate humidity and biodiversity and stabilise soils, and protecting soil ecosystems to improve infiltration, reduce erosion and enhance drought resilience. These cross-scale interactions should inform construction standards and spatial planning to create climate-resilient environments. (Risk 2)

Raising awareness

Education and awareness-raising are essential to ensure that all actors are prepared for climate-related risks and capable of adopting resilient practices. This means engaging a wide range of stakeholders - including construction professionals, infrastructure operators, urban planners, and water managers - so that they are familiar with climate-resilient practices, invasive species management, and drought mitigation measures.

- **Create targeted campaigns for specific groups, such as gardeners, landscapers, developers, and infrastructure contractors, can help prevent the spread of invasive species** and promote the uptake of resilience measures and invasive-plant protocols. For instance, incorporating technical guidelines into call for tenders can support the choice for native, non-invasive species in public planting programmes (e.g. ornamental trees). This could serve as a cost-effective strategy, reducing structural damage, supporting biodiversity and lowering the cost linked to invasive species management. (Risk 3)

- **Train and certify built-environment professionals on climate risks.** Provide accredited training (architects, engineers, surveyors, planners, contractors) on moisture-sensitive construction, flood-proofing, and resilient materials so technical choices reduce mould, subsidence and infrastructure failure risks. (Risks: 1,2,4)
- **Promote alternative water sources, water efficiency and reuse** such as rainwater harvesting or circular water management in industrial processes (Risk 5).
- Finally, the **capacity of infrastructure managers** must not be overlooked. They need to be equipped with sufficient human and financial resources to regularly inspect, maintain, and rehabilitate assets that are essential for economic continuity and public safety, especially considering the increasing risks posed by droughts, floods, and other climate extremes. (Risks: 1, 3, 4, 5)

Provide targeted public communication at decision points to ensure public engagement. Transparent communication should ensure citizens – especially vulnerable groups – are fully informed. Beyond knowledge, the objective is to foster cultural shifts toward more sustainable behaviours, especially in urban environments and private spaces, where individual choices can significantly influence resilience.

- **Inform buyers, renters and renovators about flood and subsidence risk** during property transactions and at building fairs (Risks: 1, 2)
- Citizens and businesses need to be **informed about responsible water use**. The rational consumption of drinking water by both citizens and businesses should be emphasised year-round to cultivate a lasting cultural shift and greater consciousness around water use and waste. (Risk 5)
- **Raise awareness about invasive species** to enable citizens to contribute to limiting their spread. (Risk 3)

Finally, **crisis communication** must be strengthened. **Major public events, fairs, and digital platforms** offer opportunities to **raise awareness of risks and promote preventive measures** against floods, droughts, and other climate hazards. Such communication strategies should also pay special attention to **vulnerable groups**, ensuring that no one is left behind in the face of increasing climate risks.

Surveillance and Early Warning Systems

Flood and drought forecasting must be continuously improved by maintaining and updating hazard maps that are informed by climate data. Effective forecasting requires the integration of hydrological, meteorological, and socio-economic information into real-time monitoring systems and predictive models, allowing authorities to anticipate and respond more effectively to extreme events. (Risk: 1)

Develop integrated multi-hazard alerting for essential public services. Create interoperable early-warning links between meteorological and hydrological services, and transport, energy and water operators so that cascading risks (e.g. heatwaves leading to blackout; drought leading to reduced water availability and quality for treatment as well as higher operational and costs constraints) trigger coordinated actions (Risks: 4,5)

Professionalise invasive species early detection & response. Fund targeted monitoring (satellite imagery, professional field surveys) especially along infrastructure where infestations are still poorly documented. Mapping and reporting of invasive alien species should be made mandatory for infrastructure projects and rapid-response capacity based on well-defined IAS management protocols should be available to reduce long-term repair costs. (Risk: 3)

Key infrastructure monitoring is equally important. Energy grids, transport networks and water supply systems should be systematically tracked for climate-related risks. This monitoring needs to be paired with adaptive maintenance strategies and early detection of damage, ensuring that disruptions can be minimised before they escalate. (Risks: 4, 5)

Early warning and emergency response capacities must be strengthened. This includes robust alert systems, regular crisis preparedness exercises, and effective coordination between local, regional, and national authorities. Special attention should be given to vulnerable populations, ensuring they receive timely and accessible warnings, and to cascading risk scenarios, where one event (e.g., flooding) can trigger additional hazards (e.g., infrastructure failures). (Risks 1, 2, 4, 5)

7.3.4. Human health & population wellbeing

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The EEA (2024) emphasises the importance of addressing climate-health risks at different governance levels, the importance of looking beyond strictly health-related policies and the need for providing additional resources to operationalise climate resilience in healthcare. They also recommend particular attention to vulnerable groups and to paying particular attention to integrating justice in climate policy in order to leave no-one behind. This echoes some of the BCRA's key recommendations.

In the text below, numbers refer to respective risk technical papers the recommendations were sourced from, as follow : 1 = Heat stress, 2 = Vector-borne diseases, 3 = Non-communicable diseases, 4 = Mental health, 5 = Zoonotic diseases, 6 = Health infrastructure, 7 = Social cohesion, 8 = Internal people displacement.

Governance & policy

Make One-Health, inter-agency governance the default. Establish a permanent, well-resourced coordination mechanism spanning public health, veterinary/animal health, environment, urban planning and social care; designate a single coordination point (build on NEHAP and strengthen its mandate and resources). Prioritise proactive, scenario-based planning and regular stress-tests over reactive crisis management. (Risks: 2, 5, 6)

Strengthen multilevel coordination and clarify roles. Overcome institutional silos by creating unified frameworks, mandate cross-level coordination and mobilise funding for municipalities to strengthen resilience. Use a COVID-style consultation committee model to align federal, regional and local actions; map decision chains; reduce institutional fragmentation; and secure cross-border coordination. Vectors, pathogens, pollution and floodwaters ignore administrative boundaries. (Risks: 1, 2, 5, 6, 7, 8)

Adopt or upgrade national action plans where gaps exist. Develop a national vector-borne disease (VBD) plan aligned with regional strategies and EU/WHO guidance; systematically integrate UV/skin-cancer prevention into ozone/heat plans and pursue a national strategy for UV risk reduction. (Risks: 2, 3)

Integrate health in spatial planning and adaptation policy. Embed health objectives into climate adaptation, land-use and urban design (e.g., heat-resilient design standards; nature-based solutions; UV provisions in heat/ozone plans; floodplain restoration; "make space for water"). (Risks: 1, 3, 8)

Create stable financing and incentives. Shift from short-term project funding to multi-year budgets for preparedness, surveillance and local interventions; align hospital financing reforms with resilience targets; provide administrative/technical support for facility managers. (Risks: 2, 6, 1)

Protect workers and high-risk groups by design. Formally recognise heat as an occupational hazard with workplace-specific action plans (scheduling, rest, cooling access), heat stress monitoring and sector-specific guidance on personal protective equipment (PPE); ensure all climate-health plans include tailored actions for perinatal health, elderly in poorly insulated housing, outdoor workers, homeless people, pregnant women, people with substance use disorders, people with pre-existing conditions and socially isolated groups. (Risks: 1, 6, 7)

Prioritise community and primary care within resilience. Reduce hospital-centrism by strengthening community and primary care capacity for climate crises (continuity of care, mental health support, home care, outreach to vulnerable groups). (Risks: 6, 4, 7)

Institutionalise just resilience. Mainstream "leave no one behind" across adaptation policies; embed distributional, procedural and recognitional justice in design, funding and evaluation; require inclusive, participatory processes and integrate social actors into crisis governance. Consider social cohesion as a condition of national security. (Risks: 7, 8, 6)

Improve disaster governance and risk ownership. Clarify lead authorities and operational responsibilities before, during and after events (floods, heatwaves, outbreaks), including recovery, relocation and long-term psychosocial support; apply "build back better." (Risks: 8, 4, 6, 1)

Addressing Information Gaps

Close spatial health-outcome gaps. Ensure spatially explicit morbidity data for all regions and mortality data for Wallonia and Brussels; facilitate timely access to mortality data for forecasting and evaluation. (Risks: 1)

Refine health-relevant thresholds and compounding-risk science. Determine Belgian-specific heat thresholds from observed health impacts; study temperature variability and short extreme peaks; quantify interactions of heat with air pollution for cardiometabolic and respiratory outcomes; systematise evidence on UV exposure, aeroallergens and mental-health sensitivity to heat/medications. (Risks: 1, 3, 4)

Assess health-system vulnerabilities systematically. Mandate hospital-level climate risk assessments covering infrastructure (cooling/energy continuity), organisation (contingency plans) and staff capacity; develop national maps of climate risks to health infrastructure and supply chains (flood zones and UHIs). (Risks: 6, 1)

Measure social vulnerability comprehensively. Develop/expand a Belgian (or harmonised regional) social-vulnerability index for climate hazards; consolidate data on homeless/undocumented people, poor housing, pre-existing conditions and service use to target resources effectively; study how climate change policies may impact social cohesion and intersectional vulnerabilities; monitor outcomes and long-term consequences of climate hazards. (Risks: 7, 8, 6)

Evaluate what works. Learn systematically from international practices (e.g., France's ANAP tools, IMDC Global Repository of Good Practices); perform ex-ante impact analysis to ensure that vulnerable groups are effectively reached by policies designed to support them; expand randomised controlled trials and robust evaluations of adaptation measures and heat plans. (Risks: 1, 6, 7, 8)

Raising awareness

Targeted risk communication for vulnerable groups. Provide accessible guidance and information on different hazards so that it reaches the most vulnerable in accessible formats that bridge the digital divide and language barriers; provide practical heat protection guidance (hydration, shading, ventilation) and institutionalised counselling to groups like neonates/parents, elderly, people with pre-existing conditions, socially isolated and homeless people. (Risks: 1, 3, 7)

Sustained campaigns on UV, air pollution and allergens. Intensify UV-risk communication and protective behaviours; expand air-pollution health messaging; link seasonal pollen with pollution; ensure affordability and reach for low-SES groups. (Risk: 3)

Mainstream VBD and zoonotic literacy. Long-term public awareness on ticks/mosquitoes (including schools/youth movements); communicate biodiversity loss and zoonotic spillover drivers and interactions with wildlife/domestic animals and travel practices. (Risks: 2, 5)

Address climate-related mental health openly. Build resilience via age-appropriate education (schools), clear guidance on preventive actions and continuity of psychosocial support after disasters; train frontline workers in trauma-informed approaches. (Risk: 4)

Train the workforce beyond health. Include thermal stress, flood risk and climate-health basics in curricula for urban planners, architects, builders, social workers and care staff; integrate flood-resilient design into professional training (architects, urban development). (Risks: 1, 8)

Normalise a culture of preparedness. Pair top-down crisis management with bottom-up household/individual preparedness to increase societal robustness. Educate residents, particularly in flood zones and heat-islands, on protective actions before, during and after extreme weather events. (Risks: 7, 6, 1)

Surveillance and Early Warning Systems

Upgrade heat-health surveillance and triggers. Move from mortality-only monitoring to include hospitalisations, visits to GPs, recovery and mental-health outcomes; provide real-time and weekly indicators; refine activation criteria (e.g., minimum temperatures, local forecasts, UHI effects) using retrospective health analyses; enable active surveillance (phone calls/home visits) for registered vulnerable people during heatwaves. (Risks: 1, 4, 6)

Implement integrated One-Health surveillance. Enhance active surveillance for native and exotic vectors (density, seasonality, vulnerability) and include VBDs that are currently ignored such as West Nile Virus; strengthen points-of-entry surveillance; build interoperable platforms to map threats and vulnerabilities across human, animal and environmental domains. (Risks: 2, 5)

Maintain environmental monitoring tied to health advice. Sustain UV-index forecasting, air-pollution monitoring and aeroallergen surveillance; link alerts to concrete behavioural guidance and occupational protections. (Risk: 3)
Health-system readiness dashboards. Track facility-level resilience status (e.g., reference temperatures, cooling redundancy, emergency energy, staff training completion) and enable rapid mobilisation (e.g., temporary accreditation flexibility to host displaced residents). (Risks: 6, 8)

Implement early warnings that reach everyone. Enhance warning coverage and precision; tailor communication and last-mile delivery to vulnerable groups, both digital and non-digital, in local native and other languages (including non-official languages when necessary); integrate social services and community networks into warning activation and welfare checks. (Risks: 1, 7, 8)

Infrastructure & built environment

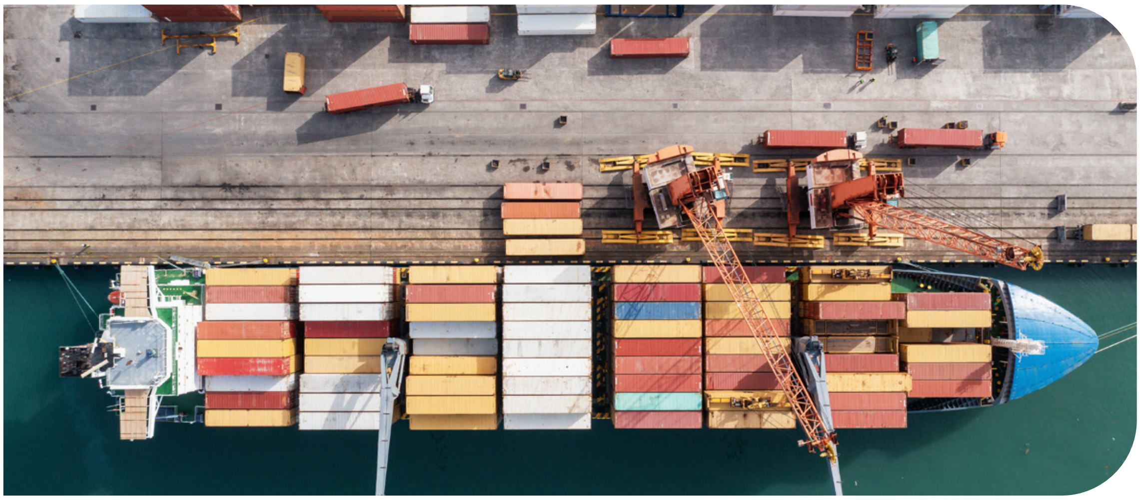
Cooler, healthier neighbourhoods at scale. Reduce soil sealing; expand green/blue infrastructure (green roofs/walls, shaded streets, tree canopies) and passive cooling; aim for neighbourhood-level canopy targets (e.g., 30%) and apply the "3+30+300" rule as a practical planning heuristic for greenspaces to leverage public health benefits (e.g., thermal comfort, mental wellbeing and air quality) in an equitable way. (Risks: 1, 3, 4, 7)

Resilient health and care facilities. Prioritise renovation funding for insulation, shading, ventilation and green surroundings before cosmetic works (e.g., repainting); set enforceable indoor temperature standards in facilities housing vulnerable populations, with particular attention to neonates; provide technical assistance to implement measures. (Risks: 1, 6)

Water-sensitive, risk-aware planning. Scale river-space restoration and nature-based flood protection (extend Sigma-style approaches to all basins); stop building/rebuilding in high-risk areas; coordinate with insurers and social services to protect vulnerable households; plan strategic retreat/relocation where justified. (Risk: 8, 6)

Avoid maladaptation. Perform ex-ante evaluations to ensure that policies and adaptations have the desired effects, reach targeted groups and don't unintentionally harm vulnerable groups; curb indiscriminate air-conditioning roll-out that increases outdoor heat and energy grid stress; prefer passive design, dynamic indoor thermal environments and behaviour-change approaches that also improve cardiometabolic health and reduce energy demand. (Risks: 1, 3, 7)

7.3.5. Economy & finance



In the text below, numbers refer to respective risk technical papers the recommendations were sourced from, as follow : 1 = Flooding & insurance; 2 = Public finances; 3 = Water stress & industry; 4 = Food prices; 5 = strategic imports.

Financing & Investment

Maintain and expand Belgium's multi-layer insurance "ladder" with adequate public backstops. (Risks: 1, 2)

Fund the regional solidarity mechanisms appropriately. In order to restore trust in the Belgian "cat nat" (natural catastrophes) regime and avoid reinsurers withdrawal, proper funding of regional solidarity mechanisms and strong commitment from public authorities to the "cat nat" framework is essential (Risks: 1, 2)

Leverage EU risk-pooling – public-private reinsurance + EU disaster fund. Back national reforms with European solutions that pool catastrophe risks and reinforce public disaster financing. A multilayered approach is the most effective, in addition to appropriately funded regional and federal policies, a combined EU reinsurance scheme and EU fund can reduce volatility, preserve affordability, help with liquidity, accelerate recovery and help provide essential services after a large-scale disaster (European Central Bank and EIOPA, 2024). (Risks: 1, 2)

Create a fund for adaptation akin to the French "fonds Barnier". The Major Natural Risk Prevention Fund (most commonly known as fonds Barnier) is a compensation fund for expropriations carried out in the context of natural risk prevention. It also helps finance part of the French government's preventive and adaptative activities, including at the communal level. It is funded by a levy on "cat nat" insurance policies for house and vehicles and is considered a key feature for financing adaptation policies. (Risks: 1, 2, 3

Front-load adaptation to lower long-run fiscal and health costs. Prioritise resilient infrastructure and timely adaptation that reduce the welfare costs of climate change. Though substantial, these investments lessen future damage, service outages and health burdens, easing long-term pressure on public finances and healthcare. (Risks: 1, 2, 3)

Keep investing in functioning adaptation solutions as the Sigma plan, which has a positive estimated cost-benefit return of 1.87 – 5.52 (World Bank, 2024), and help alleviate floods and heat by regulating water flows. (Risks: 1, 2, 3)

Invest in circular water systems and efficiency technologies. Support reclaimed-water use, greywater systems, rainwater harvesting and industrial process optimisation. Reducing withdrawals and boosting reuse increases resiliency during droughts. (Risks: 1, 3)

Guide spatial planning with climate safeguards. Use zoning, permitting and standards to steer development away from flood-prone areas and require water-sensitive urban design. These choices reduce exposure to floods. (Risks: 1, 3)
Calibrate fiscal envelopes for transition and adaptation. Plan multi-year budgets that reflect the manageable scale of the transition and the larger, but cost-saving, needs for long-term adaptation and resilience. (Risks: 2)

Governance & policy

Restore trust in the "cat nat" legal framework. Reaffirm or reestablish a clear legal framework that allocates natural-disaster costs and sustains Belgium's "ladder" (multi-layer) model involving private insurers, reinsurers and public backstops. This helps avoid coverage withdrawals, protects households from catastrophic health and financial spikes after floods and stabilises fiscal exposure. (Risks: 1, 2)

Strengthen water resilience regulation and land-use controls. Adopt and enforce comprehensive water legislation that prioritises resilience, limits new construction in floodplains and tackles urban soil sealing (notably in Flanders) to increase infiltration.

Embed climate-risk criteria in public procurement. Integrate physical-risk requirements, metrics and targets into procurement at EU and Member State levels to climate-proof key infrastructures and supply chains for food and medicines. This reduces service disruptions that amplify health risks during climate shocks.

Adopt coordinated food stockpiling and calibrated price-stabilisation tools. (Risks: 2, 4)

- Support and complement the European Preparedness Union Strategy, key action 9, that proposes an EU-wide stockpiling strategy that will integrate all sectoral stockpiling efforts with the goal of strengthening access to critical resources across the EU. Including emergency and disaster response, medical countermeasures, critical raw materials, energy equipment, shelter and potentially agri-food products and water.
- Develop and participate in EU-consistent stockpiling strategy and pre-defined, temporary price control mechanisms to prevent acute nutrition insecurity and protect low-income households' health when climate extremes disrupt supplies.

Strengthen international cooperation and trade diplomacy. Proactively secure relations with key supplier countries and use EU/multilateral fora to coordinate access to critical goods. (Risk: 5)

Adopt an integrated national resilience strategy. Combine diversification of suppliers, domestic production potential, strategic stockpiles and EU solidarity mechanisms into a single roadmap with roles, timelines and funding. (Risk: 5)

Update regulatory and financing instruments. Push for CSRD/CSDDD and related instruments to explicitly address under-investment in supply-chain adaptation and create incentives or funding streams for private-sector resilience measures. (Risk: 5)

Addressing Information Gaps

Support physical-risk assessments across businesses. Extend and align obligations for large companies to assess and disclose physical climate risks (via CSDDD/CSRD/ESRS) and provide practical data and scenario tools for SMEs. Better, comparable risk information enables targeted adaptation. (Risks: 1, 2, 3, 4)

Mainstream water-stress diagnostics in economic planning. Systematically integrate water-availability and stress analyses into industrial and regional development decisions. Making water constraints explicit early reduces maladaptation, curbs production curtailments and avoids cascading impacts from service interruptions during droughts or floods. (Risks: 1, 3)

Assess domestic potential for critical raw materials and trade-offs. Assess Belgium/Europe's geological and industrial potential for critical raw materials, in order to favour strategic independence but weight environmental and social trade off impacts as to not replace one risk with another. (Risk: 5)

Raising awareness

Promote citizen and business engagement on water conservation. Invest in campaigns and partnerships that promote industrial water efficiency, reuse (reclaimed/greywater) and rainwater harvesting, alongside community involvement. (Risk: 3)

Communicate insurance options and risk-reducing behaviours. Pair statutory reform with public guidance on coverage choices, property-level flood risk and avoiding new builds in high-risk zones. (Risks: 1, 2)

Promote soil de-sealing and cooling. Work with municipalities, industry and civil society to promote permeable surfaces, green infrastructure and heat-mitigating urban design. These measures reduce runoff, flood peaks and help with water management and heat exposure. (Risks: 1, 3)

Promote substitution and circular options. Promote materials substitution and recycling/circular options where available to expand medium- and long-term domestic resilience. (Risk: 5)

Surveillance and Early Warning Systems

Flood early warning systems can help citizens protect health, belongings and vehicles which may reduce damages and insurance claims.

Supply-Chain Resilience Practices

Diversify sourcing and build redundancy. Encourage firms, especially pharma, to broaden supplier bases where feasible, while recognising physical concentration limits for some minerals. (Risk: 5)

Scale strategic reserves and reverse logistics. Expand targeted stockpiles for critical components and pilot reverse-logistics and recycling chains to reclaim critical materials. (Risk: 5)

Reduce demand via sufficiency and substitution. Promote demand-side measures (efficiency, sufficiency, modal shifts e.g., public transport over individual EV growth where appropriate) and support alternative technologies to lower raw-material needs. (Risk: 5)

Support industry adaptation and innovation. Use Belgium's strong R&D base to finance alternatives to critical materials, resilient manufacturing and sectoral roadmaps (pharma included) that integrate physical and transition risks. (Risk: 5)

List of acronyms

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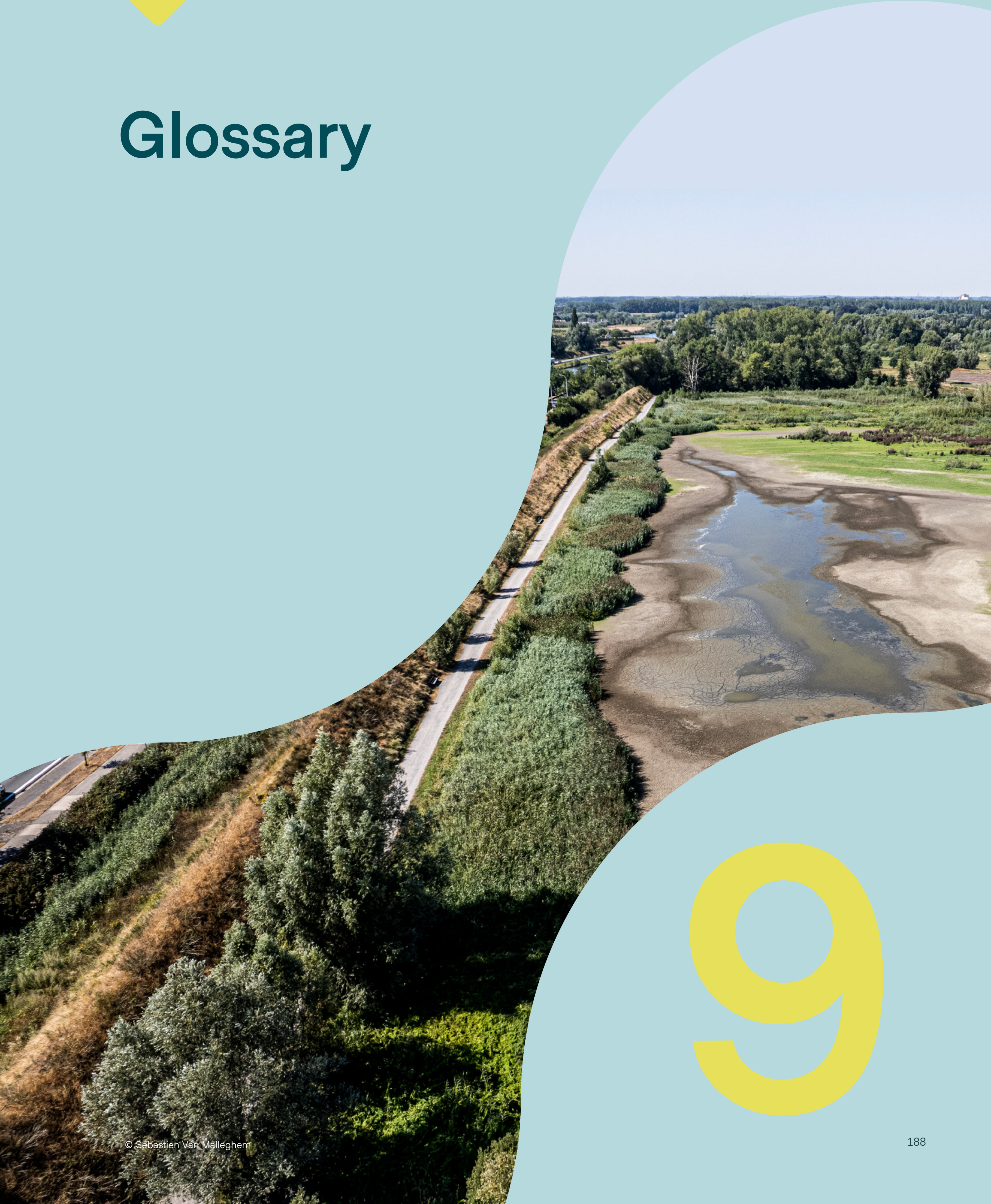
8 List of acronyms

ADIS:	Animal Disease Information System
AWAC:	Agence Wallonne de l'Air et du Climat
BCRA:	Belgian Climate Risk Assessment
BIMD:	Belgian Index of Multiple Deprivation
BNRA:	Belgian National Risk Assessment
CAP:	Common Agricultural Policy
CBD:	Convention on Biological Diversity
CCIP:	Climate Change Impact Programme
CER:	Critical Entities Resilience Directive
CLEFSA:	CLimate change and Emerging risks for Food SAfety
COP:	Conference of the Parties
CORTEX:	Centre de Coordination des Risques et de Transmission d'Expertise
CSDDD:	Corporate Sustainability Due Diligence Directive
CSRD:	Corporate Sustainability Reporting Directive
ECDC:	European Centre for Disease Prevention and Control
EEA:	European Environment Agency
EFSA:	European Food Safety Authority
EIOPA:	European Insurance and Occupational Pensions Authority
ESS:	Ecosystem services
EU:	European Union
EU PoMS:	EU Pollinator Monitoring Scheme
EUCRA:	European Climate Risk Assessment
FAO:	Food and Agriculture Organisation of the United Nations
FASFC:	Federal Agency for the Safety of the Food Chain
FPS:	Federal Public Service
FRMP:	Flood Risk Management Plan
GAECs:	Good agri-environmental conditions
GDP:	Gross Domestic Product
GHG:	Greenhouse gases
GWL:	Global warming level
HVAC:	Heating, Ventilation and Air Conditioning
IAPS:	Invasive alien plant species
ICT:	Information and Communication Technology
IPBES:	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IPCC:	Intergovernmental Panel on Climate Change
ISO:	International Organisation for Standardisation
IT services:	Information technology services
IUCN:	International Union for Conservation of Nature
NBS:	Nature based solutions
NCD:	Non communicable disease
NDC:	Nationally Determined Contributions
NEHAP:	National Environmental Health Action Plan
NGFS:	Network of Central Banks and Supervisors for Greening the Financial System
NGTs:	New genomic techniques
NO2:	Nitrogen Dioxide
OECD:	Organisation for Economic Co-operation and Development
PACE 2030:	Air-Climate-Energy Plan 2030
RASFF:	Rapid Alert System for Food and Feed

RCP: Representative Concentration Pathway
RMI: Royal Meteorological Institute of Belgium
SDGs: Sustainable Development Goals
SLR: Sea level rise
SMRs: Statutory management requirements
SOC: Soil organic carbon
SOM: Soil Organic Matter
SPW: Public Service of Wallonia
SSP: Shared Socio-economic Pathway
Statbel: Belgian Statistical Office
TBE: Tick-Borne Encephalitis
UNEP: United Nations Environment Programme
UNFCCC: United Nations Framework Convention on Climate Change
VBD: Vector-Borne Disease
VMM: Vlaamse Milieumaatschappij
WBGT: Wet-bulb globe temperature
WFD: Water Framework Directive
WHO: World Health Organisation
WMO: World Meteorological Organisation
WWF: World Wide Fund for Nature

Glossary



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9 Glossary

Adaptation: the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities (IPCC Glossary).

Adaptive capacity: the ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities or to respond to consequences (IPCC Glossary).

Agroecology: the science and practice of applying ecological concepts, principles and knowledge (i.e., the interactions of and explanations for, the diversity, abundance and activities of organisms) to the study, design and management of sustainable agroecosystems. It includes the roles of human beings as a central organism in agroecology by way of social and economic processes in farming systems. Agroecology examines the roles and interactions among all relevant biophysical, technical and socio-economic components off farming systems and their surrounding landscapes (IPBES, 2019)

Agroecosystem: an ecosystem, dominated by agriculture, containing assets and functions such as biodiversity, ecological succession and food webs. An agroecosystem is not restricted to the immediate site of agricultural activity (e.g. the farm), but rather includes the region that is impacted by this activity, usually by changes to the complexity of species assemblages and energy flows, as well as to the net nutrient balance (IPBES, 2019).

Aquifer: a stratum of permeable rock that bears water. An unconfined aquifer is recharged directly by local rainfall, rivers and lakes and the rate of recharge will be influenced by the permeability of the overlying rocks and soils. A confined aquifer is characterised by an overlying bed that is impermeable and the local rainfall does not influence the aquifer (IPCC Glossary).

Biodiversity: the variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part. This includes variation in genetic, phenotypic, phylogenetic and functional attributes, as well as changes in abundance and distribution over time and space within and among species, biological communities and ecosystems (IPBES, 2019)

Biomass (macrofaunal): macrofauna is defined as animals that range in size from 0.5 mm to 5 cm and inhabit the muddy and sandy seafloor, living on or just below the sediment surface. They serve as an important link in the marine food web, acting as prey for various species such as fish, birds and whales (ScienceDirect, n.d.-a).

Biomass (mesofaunal): small, invertebrate animals found in the soil, characteristically annelids (worms), arthropods (Arthropoda), nematodes and molluscs. These organisms are readily removed from a soil sample by using a Tullgren funnel or a similar device (Oxford Reference, n.d.).

Biomass (microbial): microfauna refers to single-celled soil fauna with a body width of less than 100μm, including major taxa such as nematodes and protozoa, which primarily inhabit water-filled pores and feed on other soil microbes. They are predominantly heterotrophic and are mostly found in the topsoil (ScienceDirect, n.d.-b).

Blue Deal: Belgian strategic frameworks and investments for securing water resources and resilience.
Cascading risk: domino effect initiating a chain of indirect impacts (Westra & Zscheischler, 2023).

"Cat nat" regime: the "cat nat" regime is the name given to the insurance policy that covers damages caused by natural catastrophes. In Belgium, this type of insurance is included with the home fire insurance. The natural disasters covered include: earthquakes, floods, overflowing or backflow of public sewers and landslides or subsidence (FPS Economie, n.d.).

Civil water: water as a natural resource, as well as the infrastructure and systems designed for the supply, distribution, treatment and disposal of wastewater.

Crisis: is considered a national crisis any event, including emergencies, resulting from human activities, natural causes or technological causes which, by its nature or consequences (NCCN, n.d.-a):

- threatens or is likely to threaten the general interest, the vital interests of the nation or the essential needs of the population or which undermines or is likely to undermine one or more of these interests or needs;
- and requires urgent decisions and strategic coordination at national level and, where appropriate, requires harmonised; and consistent information to be provided to the population.

Critical raw materials: critical raw materials (CRMs) are those raw materials which are economically and strategically important for the European economy but have a high-risk associated with their supply. Used in environmental technologies, consumer electronics, health, steelmaking, defence, space exploration and aviation, these materials are not only 'critical' for key industry sectors and future applications, but also for the sustainable functioning of the European economy (CRM Alliance, n.d.).

Co-benefits: a positive effect that a policy or measure aimed at one objective has on another objective, thereby increasing the total benefit to society or the environment (IPCC Glossary).

Comorbidities: the simultaneous presence of two or more diseases or medical conditions in a patient.
Compound event: multiple drivers and/or hazards that act together to produce an impact or that produce impacts that are more severe when combined than when acting separately (IPCC Glossary).

Delphi method: the Delphi method is defined as an expert group decision-making model that systematically gathers and organises the opinions of selected professionals to reach a consensus on a specific topic through iterative questionnaires. This method is widely used across various fields for exploring and predicting research topics (Hsueh, 2015).

Domestic water: water used for household activities that can be differentiated into four categories: i) consumption (drinking and cooking), ii) hygiene (bathing, washing and cleaning), iii) amenity use (watering lawns, car-washing and other non-essential tasks) and iv) productive use (watering livestock and kitchen gardens and beer-brewing) (Naoko & SHAIBU, 2025).

Drought: an exceptional period of water shortage for existing ecosystems and the human population (due to low rainfall, high temperature and/or wind) (IPCC Glossary).

Early Warning Systems (EWS): organised systems to detect, forecast and issue timely alerts of impending hazards to reduce risk and enable response.

Ecosystem: a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit (CBD, 1992).

Ecosystem degradation: the deterioration of the structure, function or composition of an ecosystem leading to loss of ecosystem services and biodiversity.

Ecosystem services: ecosystem services are the benefits provided by ecosystems to human living. These include provisioning services such as food and water resources; regulating services such as the regulation of climate, floods, disease and water quality; cultural services such as recreation and spiritual fulfilment; and supporting services such as soil formation, pollination and nutrient cycling (Reid et al., 2005).

Enhancing vigilance: the evidence in these areas should be kept under review, with continuous monitoring of risk levels, so that further action can be taken if necessary.

Exposure: presence of people, livelihoods, species or ecosystems, environmental functions, services, resources, infrastructure or economic, social or cultural assets in places and settings that could be affected (ISO, 2021).
Flood: the overflowing of the normal confines of a stream or other water body or the accumulation of water over areas that are not normally submerged (IPCC Glossary).

Flooding (coastal): flood in coastal areas driven by rising sea levels, tidal swings and storm surges (EEA, 2021).

Flooding (fluvial): fluvial flooding occurs when watercourses (rivers, streams, canals, etc.) overflow their banks, causing large areas to be flooded (NCCN, n.d.-b).

Flooding (pluvial): flood as a result of heavy rain, where the water is no longer able to drain away, flooding streets and possibly causing landslides (NCCN, n.d.-b).

Food safety: food safety is a science-based discipline, process or action that prevents food from containing substances that could harm a person's health. Food safety aims to have food that is safe to eat (FAO, n.d.).

Food security: a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. The four pillars of food security are: access; availability; stability; and utilisation. The nutritional dimension is integral to the concept of food security (FAO, 2009, 2018).

Global Warming Level (GWL): a metric expressing a specific level of global mean temperature increase (e.g., +1.5°C, +2°C, +3°C, +4°C) above pre-industrial levels, used to compare impacts (IPCC Glossary).

Gradual climate change: gradual climate change refers to slow, persistent, long-term shifts in average weather patterns and climate variables – such as temperature, precipitation and wind – that unfold over decades or longer, in contrast to sudden or abrupt climatic events.

Greenhouse gas (GHG): gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of radiation emitted by the Earth's surface, by the atmosphere itself and by clouds. This property causes the greenhouse effect. Water vapour (H2O), carbon dioxide (CO2), nitrous oxide (N2O), methane (CH4) and ozone (O3) are the primary GHGs in the Earth's atmosphere. Human-made GHGs include sulphur hexafluoride (SF6), hydrofluorocarbons (HFCs), chlorofluorocarbons (CFCs) and perfluorocarbons (PFCs); several of these are also O3-depleting (and are regulated under the Montreal Protocol) (IPCC Glossary).

Groundwater recharge: the process by which external water is added to the zone of saturation of an aquifer, either directly into a geologic formation that traps the water or indirectly by way of another formation (IPCC Glossary).
Hazard: potential source of harm (ISO, 2021).

Health infrastructures: health infrastructure relates to all the physical infrastructure, non-medical equipment, transport and technology infrastructure (including ICT [Information and Communication Technologies]) required for effective delivery of services (Masaba et al., 2020)

Heat stress: a range of conditions when the body absorbs excess heat during overexposure to high air or water temperatures or thermal radiation. Heat stress in mammals (including humans) is exacerbated by a detrimental combination of ambient heat, high humidity and low wind speeds, causing regulation of body temperature to fail (IPCC Glossary).

Heatwave: a period of abnormally hot weather, often defined with reference to a relative temperature threshold, lasting from two days to months (IPCC Glossary).

Intersectionality: intersectional approaches address the complexity of social systems by recognising the ways in which different structures of inequity are overlapping and interdependent (IISD, 2024). This approach recognises that risks are overlapping and compounding due to factors related to age, gender, health, disability, work, housing, income, culture, language, etc., which contribute to systemic injustice, social inequality and social vulnerability (EEA, 2025).

Invasive alien species: a species introduced outside its natural past or present distribution (i.e., an alien species) that becomes established in natural or semi-natural ecosystems or habitat, is an agent of change and threatens native biological diversity (IUCN, 2000).

Just resilience: resilience is the ability of a social, ecological or socio-ecological system to anticipate, reduce, accommodate or recover from the effects of a hazards in a timely and efficient manner (IPCC, 2022). Just resilience adds an equity dimension: adaptation should (1) distribute benefits and burdens fairly across social groups, (2) be based on transparent and inclusive processes, (3) avoid maladaptive outcomes and (4) address the root causes of pre-existing inequalities (EEA, 2025).

Just transition: a set of principles, processes and practices that aim to ensure that no people, workers, places, sectors, countries or regions are left behind in the transition from a high-carbon to a low-carbon economy. It stresses the need for targeted and proactive measures from governments, agencies and authorities to ensure that any negative social, environmental or economic impacts of economy-wide transitions are minimised, while benefits are maximised for those disproportionately affected. Key principles of just transitions include: respect and dignity for vulnerable groups; fairness in energy access and use, social dialogue and democratic consultation with relevant stakeholders; the creation of decent jobs; social protection; and rights at work. Just transitions may embody the redressing of past harms and perceived injustices (IPCC Glossary).

Maladaptation: actions that may lead to increased risk of adverse climate-related outcomes, including via increased greenhouse gas (GHG) emissions, increased or shifted vulnerability to climate change, more inequitable outcomes or diminished welfare, now or in the future. Most often, maladaptation is an unintended consequence (IPCC Glossary).

Mitigation (of climate change): human intervention to reduce emissions or enhance the sinks of greenhouse gases. In climate policy, mitigation measures are technologies, processes or practices that contribute to mitigation, for example, renewable energy technologies, waste minimisation processes and public transport commuting practices (IPCC Glossary).

Moisture regime: a change in moisture regime refers to climate-driven shifts in the patterns and balance of wet and dry conditions, characterised by more frequent or intense periods of drought on the one hand and excessive moisture or heavy rainfall on the other.

More action needed: the severity of risk and the limited level of policy readiness calls for more action to be implemented. It is crucial to initiate processes that strengthen adaptation action to avoid critical impacts of climate change.

Nationally Determined Contribution (NDC): a country's self-defined climate action commitments under the Paris Agreement outlining mitigation and adaptation plans (UNFCCC, n.d.).

Natural capital: the world's stocks of natural assets which include geology, soil, air, water and all living things. It is from this natural capital that humans derive a wide range of services, often called ecosystem services, which make human life possible (IPBES, 2022).

Natura2000: a network of nature areas across the EU established to provide support on the long-term survival of Europe's most valuable and threatened species and habitats (EEA, n.d.).

Nature based solutions: actions to protect, sustainably manage and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human wellbeing and biodiversity benefits (IPCC Glossary).

Network of Central Banks and Supervisors for Greening the Financial System (NGFS): the Network of Central Banks and Supervisors for Greening the Financial System (NGFS) is a group of Central Banks and Supervisors willing, on a voluntary basis, to share best practices and contribute to the development of environment and climate risk management in the financial sector and to mobilise mainstream finance to support the transition toward a sustainable economy (NGFS, n.d.).

Net-zero emissions: a state in which anthropogenic emissions of greenhouse gases to the atmosphere are balanced by removals over a specified period (UNFCCC, 2021).

Non-communicable diseases (NDC's): also known as chronic diseases, tend to be of long duration and are the result of a combination of genetic, physiological, environmental and behavioural factors. The main types of NCDs are cardiovascular diseases (such as heart attacks and stroke), cancers, chronic respiratory diseases (such as chronic obstructive pulmonary disease and asthma) and diabetes (WHO, n.d.).

No-regret measures: actions that generate net benefits under a wide range of future scenarios, even if risks against which this measure was taken do not materialise.

One Health: One Health is an integrated, unifying approach that aims to sustainably balance and optimise the health of people, animals and ecosystems. It recognises that the health of humans, domestic and wild animals, plants and the wider environment (including ecosystems) are closely linked and interdependent (WHO, n.d.-a).

Operationalise existing policies: current or planned actions are appropriate, but effective implementation of related policies and plans is needed to ensure that the risk is also managed in the future. A monitoring process should be in place to evaluate policy effectiveness, with a view to continuous improvement.

Particulate matter: atmospheric aerosols involved in air pollution issues. Of greatest concern for health are particles of aerodynamic diameter less than or equal to 10 micrometres, usually designated as PM10 and particles of diameter less than or equal to 2.5 micrometres, usually designated as PM2.5 (IPCC Glossary).

People affected: people who are affected, either directly or indirectly, by a hazardous event. Directly affected are those who have suffered injury, illness or other health effects; who were evacuated, displaced, relocated or have suffered direct damage to their livelihoods, economic, physical, social, cultural and environmental assets. Indirectly affected are people who have suffered consequences, other than or in addition to direct effects, over time, due to disruption or changes in economy, critical infrastructure, basic services, commerce or work or in social, health and psychological consequences.

N.B.: people can be affected directly or indirectly. Affected people may experience short-term or long-term consequences to their lives, livelihoods or health and to their economic, physical, social, cultural and environmental assets. In addition, people who are missing or dead may be considered as directly affected.

Policy readiness: policy readiness refers to the degree of preparedness of public policies to respond to an identified climate or environmental risk. It assesses the presence, quality and maturity of existing policy, regulatory and strategic frameworks, as well as their capacity to anticipate, manage or mitigate the impacts of the risk. This assessment takes several dimensions into account: the level of political awareness and surveillance of the risk, notably through monitoring and early warning mechanisms; the risk ownership; the existence of a relevant legal and policy framework; the degree of implementation of existing measures and their operational evaluation.

Pollinator: an agent that transports pollen. Such agents may be animals of many kinds or physical (wind or water) or both (IPBES, 2022).

Precautionary action needed: precautionary actions and no-regret measures are needed due to the potential severity of the risk, even when knowledge is scarce. Additional evidence must be gathered regarding the severity of the risk as well as policy readiness, e.g. through dedicated research, monitoring or policy evaluation.

Precautionary principle: a strategy to cope with possible risks where scientific understanding is yet incomplete: lack of full certainty should not be used as a reason to postpone cost-effective measures (EUR-Lex, n.d.).

Reinsurer (reinsurance): reinsurance serves as a crucial risk management tool for insurance companies by allowing them to transfer some of their policy risks to another company, the reinsurer. This relationship is established through a formal contract, in which the primary insurer (cedent) passes portions of its liability to the reinsurer. By doing so, the primary insurer can safeguard its financial stability while enhancing its ability to underwrite more policies. Reinsurance thus plays a significant role in maintaining equilibrium within the insurance market as it helps insurers manage large-scale natural disasters and major claims without overwhelming their financial resources (IPCC Glossary).

Resilience: the capacity of interconnected social, economic and ecological systems to cope with a hazardous event, trend or disturbance, responding or reorganising in ways that maintain their essential function, identity and structure. Resilience is a positive attribute when it maintains capacity for adaptation, learning and/or transformation (IPCC Glossary).

Reuse system: water reuse means to reclaim wastewater from a variety of sources and treated to a standard appropriate for a second purpose (Sonar et al., 2024).

Reverse logistics: in the context of the circular economy, reverse logistics denotes the systematic process of retrieving end-of-life products, components and materials to facilitate their reuse, recycling or return, thereby contributing to sustainable development.

Risk: the potential for adverse consequences for human or ecological systems, recognising the diversity of values and objectives associated with such systems. In the context of climate change impacts, risks result from dynamic interactions between climate-related hazards with the exposure and vulnerability of the affected human or ecological system to the hazards. Hazards, exposure and vulnerability may each be subject to uncertainty in terms of magnitude and likelihood of occurrence and each may change over time and space due to socio-economic changes and human decision-making (see also risk management, adaptation and mitigation) (EEA, 2024b).

Risk ownership: risk ownership refers to the assignment of primary responsibility for managing a climate or environmental risk to one or more levels of governance. It reflects the legal, institutional and operational capacity of policy actors to design, implement and finance adaptation or risk-reduction measures.

Salinisation: increase in water-soluble salts in soil which is responsible for increasing the osmotic pressure of the soil. In turn, this negatively affects plant growth because less water is made available to plants. Salinisation can be caused by natural processes. It can also come about through artificial processes such as irrigation (IPBES, 2022).

Sea-level rise: change to the height of sea level, both globally and locally (relative sea level change) (at seasonal, annual or longer time scales) due to (1) a change in ocean volume as a result of a change in the mass of water in the ocean (e.g. due to melt of glaciers and ice sheets), (2) changes in ocean volume as a result of changes in ocean water density (e.g. expansion under warmer conditions) (3) changes in the shape of the ocean basins and changes in the Earth's gravitational and rotational fields and (4) local subsidence or uplift of the land. Global mean sea level change resulting from change in the mass of the ocean is called barystatic. The amount of barystatic sea level change due to the addition or removal of a mass of water is called its sea level equivalent (SLE) (IPCC Glossary).

Shared Socio-economic Pathways (SSP): scenarios that describe plausible global socio-economic futures used in climate impact and mitigation modelling (IIASD, n.d.).

Short chains: the short chain includes strongly locally-anchored agricultural and food businesses that are not intensely interwoven in vertical and horizontal chains. There are different types of short-chain initiatives, such as farm sales, vending machine sales, food teams, pick-your-own farms and Community Supported Agriculture (CSA) (ILVO, n.d.).

Social cohesion: a cohesive society is characterised by resilient social relations, a positive emotional connectedness between its members and the community and a pronounced focus on the common good. Social relations, in this context, are the horizontal network that exists between individuals and groups within the society. Connectedness refers to the positive ties between individuals and their country and its institutions. A focus on the common good, finally, is reflected in the actions and attitudes of the members of society that demonstrate responsibility for others and for the community as a whole (Eurofound, 2014).

Social disruption: situations where the normal functioning of social systems is disturbed during and after a crisis. (Schrijvers et al., 2021).

Social vulnerability: vulnerability is determined by exposure, sensitivity and adaptive capacity. Social vulnerability refers to the uneven distribution and burdens within those vulnerability dimensions, exacerbating impacts for certain groups, especially those on the margin of society (EEA, 2025).

Soil erosion: the displacement of the soil by the action of water or wind. Soil erosion is a major process of land degradation (IPCC Glossary).

Soil health: the term soil health, though rather close to the concept of soil quality, can be characterised "as the continued capacity of soil to function as a vital living system, within ecosystem and land-use boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality and promote plant and animal health" (Doran & Zeiss, 2000). Soil health therefore refers to a broader concept that recognises the ecological functions of soil (and hence its attributes such as biodiversity, food web structure and soil biota activity) beyond its quality or capacity to support agricultural production or other human needs. It also relies on the functioning and balance between physical, chemical and biological soil properties and processes (Bünemann et al., 2018). For this study, soil health and soil quality can be considered as synonyms.

Supply chain: the series of processes involved in the production and supply of goods, from when they are first made, grown, etc. until they are bought or used (Oxford Dictionary, n.d.).

Systemic risk: a risk that can disrupt an entire system (economic, infrastructural, ecological) and threaten foundational societal functions. The notion of systemic risk refers to the risk or probability of breakdowns in an entire system, as opposed to the breakdown of individual parts or components (Florin & Nursimulu, 2018).

Systems approach: a system is a set of interrelated or interacting elements (ISO, 2021). A systems approach is a way to understanding the complex network of interactions that occur within and between interdependent components. It refers to methodologies that consider the interconnectedness and interdependencies of various components within environmental and societal contexts. This approach is particularly emphasised in addressing complex challenges such as climate change, resource management and sustainability transition.

Teleconnection (climate): climate-related linkages where anomalies in one region influence climate or impacts in another distant region (IPCC, 2021).

Tipping point: a threshold where small changes produce a qualitative change in a system, potentially leading to reinforcing feedbacks and/or irreversible impacts (IPCC, 2021).

Transition risks: risks related to the transition to a low-carbon economy (EEA, 2024b).

Urban greening: urban greening is the incorporation of green spaces and elements into urban environments and infrastructure, such as streets, cities, roofs and walls. Urban greening initiatives make up a part of green infrastructure (Serck, 2024).

Urban heat island: the relative warmth of a city compared with surrounding rural areas, associated with heat trapping due to land use, the configuration and design of the built environment, including street layout and building size, the heat-absorbing properties of urban building materials, reduced ventilation, reduced greenery and water features and domestic and industrial heat emissions generated directly from human activities (IPCC Glossary).

Urgent action needed: the combination of catastrophic risks and insufficient policy readiness calls for urgent new, stronger or different action in the coming years to reduce climate risks. Such actions include policymaking, implementation, capacity building or enabling the environment for adaptation, over and above those already planned.

Vector-borne diseases: vector-borne diseases are diseases caused by bacteria, parasites and viruses that are transmitted by the bite of infected arthropod vectors, such as mosquitos, ticks, sand flies and fleas. Vectors can transmit pathogens from animals to humans, between humans and between animals (Sciensano, n.d.-c).

Vulnerability: is the susceptibility of a system, social group or person to harm, influenced by sensitivity (the degree to which a system is affected positively or negatively by a hazard) and adaptive capacity (ability to adjust to the new situation when a hazard occurs, depending on technical, policy, financial, social and ecological factors) (ISO, 2021).

Water scarcity: refers to the volumetric abundance, or lack thereof, of freshwater resources. Water scarcity is a physical, objective reality that can be measured consistently across regions and over time. Water scarcity reflects the physical abundance of fresh water rather than whether that water is suitable for use (CEO Water Mandate, 2014).

Water stress: refers to the ability, or lack thereof, to meet human and ecological demand for fresh water. It considers several physical aspects related to water resources, including water availability, water quality and the accessibility of water (i.e., whether people are able to make use of physically-available water supplies), which is often a function of the sufficiency of infrastructure and the affordability of water, among other things. Water stress has subjective elements and can be assessed differently depending on societal values (CEO Water Mandate, 2014).

Wetland: land that is covered or saturated by water for all or part of the year (e.g., marsh, fen, peatland) (IPCC Glossary).

Wet-bulb globe temperature (WBGT): the wet-bulb globe temperature is an indicator for heat as perceived by the human body. It reflects air temperature, air humidity, radiant temperature and wind speed – the major factors for thermal perception. It is most often used to monitor heat stress in humans during physical exertion (Budd, 2008).

Wildfire: a wildfire is an uncontrolled fire in a natural area, such as forest, grassland, brushland, the verge of roads and water ways, savannah, prairie or agricultural areas. The terms forest fire, brush fire, etc., may be used to describe specific types of wildfires; their usage varies according to the characteristics of the fire and the region in which it occurs. In this report, the term "wildfire" is consistently used as an umbrella term encompassing all these specific types of wildfires (Kruk et al., 2025).

Zoonotic disease: zoonoses are defined as those diseases and infections naturally transmitted between people and vertebrate animals (WHO, n.d.-b).

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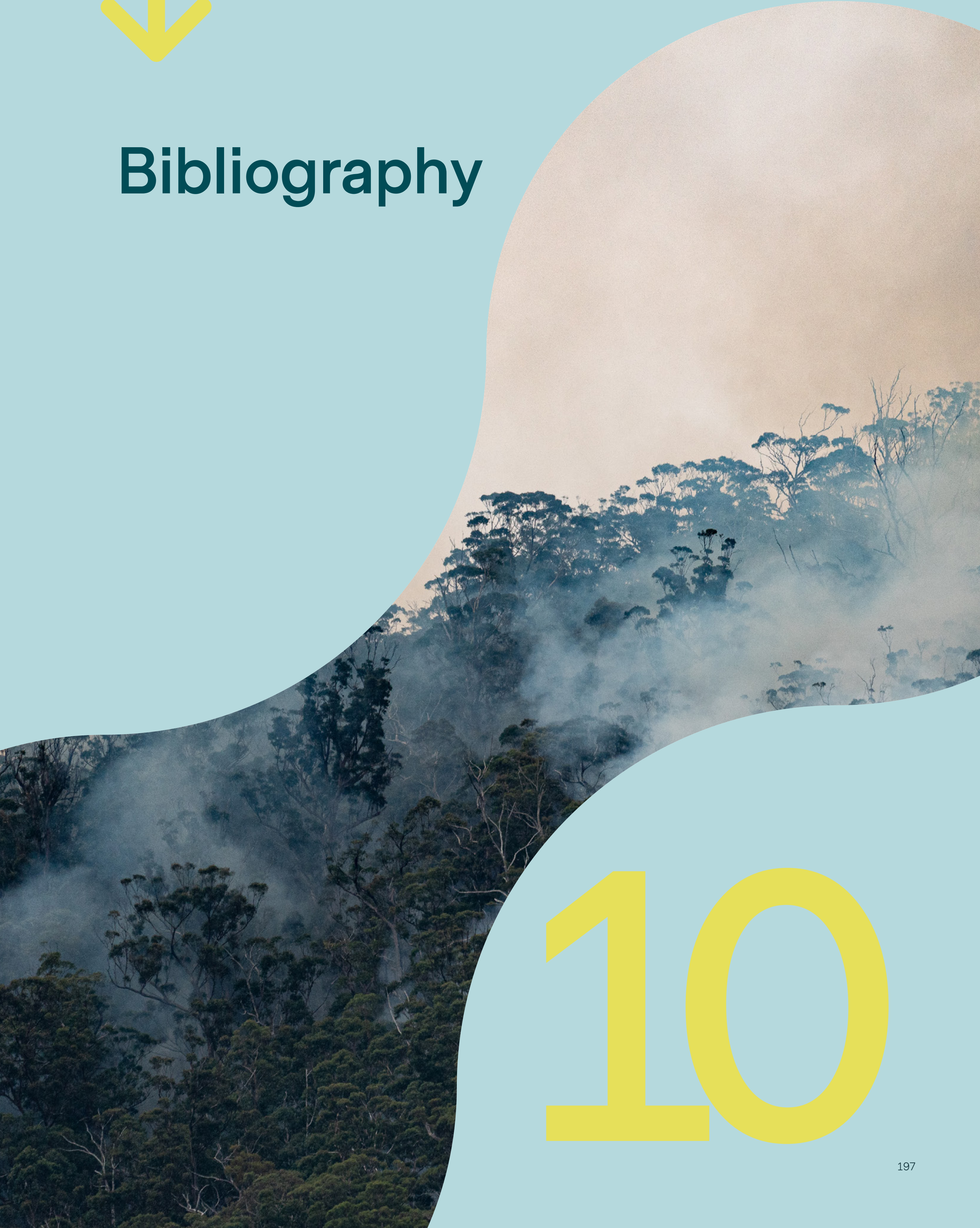

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