

**Lessons learned**

Climate buffers are often not considered when an urgent solution is needed, so a long-term mindset is necessary to take the steps to implement them successfully. Corporations need to be convinced of the economic benefits and/or concern for future environmental benefits and intergenerational equity. While better for the environment, climate buffers are not always solely conservation areas, but also places of recreation and residential areas, so conservation-based funding and support may not always be possible. Climate buffers take a lot of space to develop and function properly, so some productive agricultural land and private property may need to be converted and compensated respectively. Since 2019 the Dutch Climate Buffer Coalition added the climate mitigation function of wet ecosystems to its scope: besides cushioning water safety and water shortage effects by climate change, many climate buffers are also able to absorb more CO<sub>2</sub> or to prevent CO<sub>2</sub>-emissions, e.g. by rewetting peatlands which retards peat oxidation. Climate buffers who do both, adaptation and mitigation, we call 'squared' climate buffers.

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 ▶ <https://www.eurosite.org/>  
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**Literature/Links/ Additional information**

Information:  
 ▶ [www.klimaatbuffers.nl](http://www.klimaatbuffers.nl)  
 ▶ <http://themasites.pbl.nl/natuurlijk-kapitaal-nederland/natural-capital-netherlands/results/sustainable-use-of-nature-is-good-for-the-economy>  
 Evaluation:  
 ▶ <http://www.climatebuffer.eu/index.html>  
 ▶ <http://news.sgi-network.org/news/details/2013/1306/natural-buffers-against-climate-change/>  
 Information about climate change impacts in different areas:  
 ▶ <https://www.waterwinst.nl/page/andere-initiatieven/klimaatbuffers/>  
 ▶ <https://www.eurosite.org/dutch-climate-buffers/>  
 ▶ <https://www.eurosite.org/eurosite-highlights/natural-climate-buffers-study-tour-follow-up/>  
 ▶ [https://us3.campaign-archive.com/?u=ca1c49cda13b17ff4ff665dc0&id=cdb1464a32IPCC\\_2014bIPCC\\_2014b](https://us3.campaign-archive.com/?u=ca1c49cda13b17ff4ff665dc0&id=cdb1464a32IPCC_2014bIPCC_2014b)

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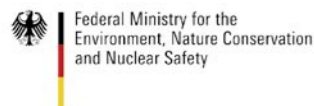
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Flooded Wetland in De Onlanden, Netherlands, 2012.

## Natural Climate Buffers in the Netherlands – learning from best practise to adapt to climate change effects

The Netherlands have struggled with rising sea levels, floods, and restricted land space for a long time, but recent predictions concerning climate change have added a new urgency to the efforts to conserve natural resources and protected coasts and riverbeds against increased tides and precipitation, as well as retaining freshwater for times of drought.

Natural climate buffer projects have been successful in cushioning climate change impacts such as flooding while increasing biodiversity in natural ecosystems as they are allowed to expand, creating more room to absorb increased rainfall and tidal waters. By revitalizing natural processes many climate adaptation project serve as natural carbon sinks and thus contribute to climate mitigation as well. Around 30 natural climate buffer projects (varying from 50 to 2500 hectares) have been realized from 2006 to 2014 to adapt to climate change. On an equal number climate buffer projects work is in progress. In a second phase, projects will be realised from 2017 to 2022 and transfer the concepts “from pilots to main-stream”. More than 50 projects are planned for the future.

- ▶ **keywords:** groundwater, climate change, climate adaptation, climate mitigation, ecosystem restoration, biodiversity, wetlands, bufferzones, fresh water, Natura 2000, nature-based solutions

**Pressures/ drivers**

Climate change is one of the main global challenges we face today. In the coming decades, the process of global warming will not only influence our way of living but also impact heavily on natural resources and wildlife. The problems that arise from the fact that our climate is changing are manifold and of great concern especially for a country like the Netherlands: rising sea levels, higher floods, more severe and more frequent droughts and peatland subsidence.



Water retention Leuvenumse Beek, Gelderland, Netherlands 2014

**Quality objectives**

Natural climate buffers are nature areas specially designed to reduce the consequences of climate change. They will not only guard against flooding but will also store water for dry periods. In this way, these areas can offer security but also attractive natural sceneries for people, habitats for plants and animals and space for economic developments. Natural climate buffers like coastlines, riverbanks, marshlands or dunes, can help to cope with greater peak flows and water shortages. They can support storage of water to decrease flood risk and droughts and they can improve fresh water supply.

**MS/region/ locality/location**

Coastal areas and riverbeds in the Netherlands have been converted and restricted by agriculture and coastal defence structures such as dykes, not allowing for natural buffers to form and protect residential areas from flooding. This also prevents the retention of freshwater as rivers become narrower and peat bogs are converted to farmland. Polders near the coast are also becoming increasingly susceptible to flooding and increasing tidal waters, and the costs of defence structures and draining to keep these areas dry are unsustainable. Natural climate buffers are suitable solutions in river basins on smaller and larger scale. If connected well, beneficiary impacts are on waterbody scale.



Salt marshes in the Wadden Sea, Friesland, Netherlands, 2017

**What were the problems?**

Climate change poses a global threat and affects people and countries worldwide with varying degrees of intensity geographically. Due to the increased greenhouse gas emissions, temperatures are rising globally and on regional scale. On the one hand, for the Netherlands this means rising sea levels and more frequent heavy rains, but also longer periods of drought and heat waves.

According to the IPCC report, sea levels will continue to rise in the future. For the Netherlands, an average increase of 60 cm by 2100 is predicted, in a broad uncertainty range up to 3 m in 2100 (5 % chance). In addition, climate change also brings more intense rainfall, which results in the overflow of rivers and reservoirs. As one third of the Netherlands is already below the sea level the consequences of climate change pose a particular threat to the coastal and river regions and thus for social, agricultural and economic sectors and nature itself. Effective solutions to protect the country and the residents are therefore urgently needed.

Large parts of the coastal and river areas in the Netherlands have been restricted to intensive agriculture (after the US the Netherlands has become the world's largest exporter of agricultural products) and the construction of dams, dykes and sand drift barriers to protect the land of extreme flooding events.

Dykes are a measure to protect floods, but must withstand the constant pressure of intense flooding and thus have to be maintained to prevent a dyke breakage. Dikes are rather short-term and unsustainable mono-functional and inflexible solutions which are therefore quite cost-inefficient. Additionally, modern dykes are disturbing the landscape structure and in the future, due to the increasing intensity of the floods due to land subsidence and climate change, dykes have to be expanded and increased structurally which means additional costs.

As the climate changes throughout Europe, species migrate to escape the drier, hotter climates and reach northern Europe. Natural climate buffers can offer more room to connect natural areas and thus create migration zones for climate-driven species migration. When climate buffers are designed as bufferzones around nature reserves these become more robust which helps ecosystems surviving climatic extremes.



Level gauge in Salt-marshes in the Wadden Sea near Groningen, Netherlands.

**Relevance for WFD**



Natural water retention in De Onlanden, Netherlands, proved to ease the flood risk for the nearby city of Groningen in 2012 by lowering the water level by 40 cm within 24 hours.

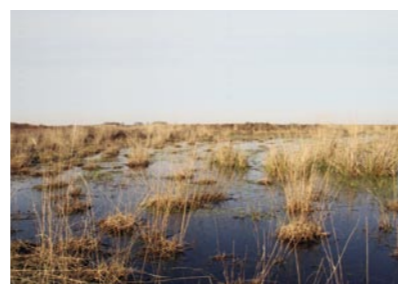
Natural climate buffers give space to natural processes in and around WFD-waterbodies, which is contributing to restoration of hydromorphological structures, an obligation in the WFD. Because climate buffers are retaining local, system specific precipitation or water supply, water quality and habitat conditions are improving.

Natural climate buffers on permeable soils serve infiltration in groundwater bodies and keep/bring them in good quantitative and qualitative status. Natural climate buffers make WFD-measures climate-proof.

Natural climate buffers contribute significantly to the objectives of the Birds and Habitats Directives and Nature 2000, so to the objectives for Protected Areas as stated in art. 4.1(c) of the WFD.

**Objectives & measures adopted**

Natural climate buffers could be the answer to an unpredicted future and bring a long-term solution to deal with the challenges the Netherlands are facing as a result of climate change. Natural climate buffers provide space for natural processes to unfold. They adapt to climate change and mitigate impacts, and improve and ensure quality of both natural and human life. Natural climate buffers are nature based solutions because they are building with nature and provide ideal conditions to cushion the impacts of climate change.



Restoration of wetlands in Dwingelderveld.



left: Water retention in Dwingelderveld (Drenthe) in 2013. – right: Natural water retention in De Onlanden (Groningen)

Natural climate buffers will increase biodiversity and improve environmental conditions throughout the country as well as increasing the area necessary for the land to adapt to climate change. The coalition will also discuss innovative measures to ensure economic benefits and the sustainability of natural climate buffers.

Innovative use of dams and conversion of farmland will result in peat bogs forming to absorb floodwaters and retain freshwater for the human use. Climate buffers will be used to protect polder areas from flooding by increasing sand deposits along coastlines. This can be accomplished by increasing sea grass fields and mussel beds and removing sand drift barriers.

Natural climate buffers also store water for long drought periods. Allowing rivers to resume their natural courses and expand their banks to give room for increased rainfall will prevent flood damage inland, as well as giving different river dwelling species another chance to breed in the Netherlands in their natural habitat.

Natural climate buffers provide 'blue' ecosystem services. Natural climate buffers of all types improve the quality of rural and urban space, which provides still more ecosystem services to social and economic functions as recreation, biodiversity, business climate etc.

**Actors/ Procedure**

Climate Buffer Coalition, consisting of Ark Nature, Natuurmonumenten, National Forest Service, Bird Life International the Netherlands, the Wadden Sea Society, LandschappenNL, the World Wildlife Fund and the Provincial Nature and Environment Federations. Up to mid 2014 the Coalition was co-financed by the Ministry of Infrastructure and Environment and in the period 2016-2022 by LIFE (LIPFE IP Delta Nature).

**Results/ Assessment**

Actual contribution of measures to meeting WFD objectives is often impossible to estimate due to no/in-sufficient monitoring, time needed for biota to react.

**Costs and benefits**



Restoration of wetlands in Dwingelderveld, Netherlands, provides storm water retention for flood protection downstream – Climate Buffers Tour April 2018.

A cost-benefit analysis can be used to determine the productivity of converting agricultural space into climate buffers. Revenues from recreation and waterfront housing can make climate buffers more economically realistic. Furthermore, costs of maintaining and updating (making higher, broader, stronger) structures such as dykes are recurrent and steep.

In many cases natural climate buffers are cheaper than building higher dykes. A financial study in 2014 conservatively assessed the financial short term benefits of around 20 climate buffer projects on "at least" 45 million Euros yearly (Sterk Consulting, Leiden). On the long term natural climate buffers create savings for maintenance or further investments and deliver benefits from different ecosystem services.