

International exchange on climate adaptation for agriculture

The aim of this brochure is to connect to international policy programmes and initiatives, exchange knowledge and learn from abroad on climate adaptation in agriculture. For this reason, this brochure provides an introduction to the Action Programme for Climate Adaptation in Agriculture, an explanation of the climate change impacts on the Dutch agricultural sector, the ambitions and progress of the action programme and examples of developments on climate adaptation in the Netherlands.

Climate adaptation in agriculture in the Netherlands

The last five years, the Netherlands agricultural and horticultural sector have been dealing with the impact of climate change. Hail damage in 2017, periods of drought during the summers of 2018, 2019, 2020 and 2022, floods in Limburg in 2021, and several storms, heavily impacted the sectors. This urgency calls to adapt agriculture and horticulture to climate change to ensure farmers livelihoods and food security now and in the future.

Climate change has consequences for the Netherlands. In 2014, the Royal Netherlands Meteorological Institute (KNMI) indicated that by 2050 the Netherlands will be warmer, wetter and more prone to summer drought, and that sea levels will have risen further. KNMI also expects that certain weather extremes, such as heat waves and heavy showers, will occur more frequently by 2050. In 2021, the Intergovernmental Panel on Climate Change (IPCC) predicted that climate change occurs even stronger and faster than expected in the KNMI 2014 scenarios. The impact of the four trends (warmer, wetter, dryer and sea level rise) of climate change on agriculture and horticulture differs per area, sector and cultivation. For example:

- **Drought** is a particular risk on the high sandy soils in the east and south of the Netherlands and affects all sectors.
- **Salinisation**, as a result of rising sea levels in combination with drought and land subsidence, plays a role along the coast (the west and north of the Netherlands) and in Flevoland (former Zuiderzee). Salinisation affects crops, including capital intensive salt sensitive crops, such as trees and flower bulbs. In addition, subsidence and salinisation also impact (dairy) livestock farming in the peat meadow areas.
- **Peak showers** can cause flooding throughout the Netherlands. Flooding is, for example, risk in the river area (floodplain flooding in the growing season) and the hill country in Limburg (flooding of the Meuse and tributaries).
- **Night frost, heat and sun** are risks in fruit cultivation.
- **More extreme weather conditions** have an impact on livestock farming. For example, heat stress in livestock during transport or in stables and pastures, lower crop yields due to drought or hail damage, and decreased number of animals grazing due to extreme (wet or hot) weather conditions. Lower crop yields also means less locally grown feed.

The Action Programme for Climate Adaptation in Agriculture

To prepare all Dutch entrepreneurs in agriculture and horticulture to deal sustainably and effectively with climate change, the Action Programme for Climate Adaptation in Agriculture¹ (further referred to as action programme) was set up by the Ministry of Agriculture, Nature and Food Quality (LNV) in 2020 in collaboration with other stakeholders. Central to achieving this goal are the five pillars: water system, soil system, crops and cultivation systems, livestock farming, and supporting instruments consisting of knowledge and innovation, regional approach and risk management.

The pillar approach of the Action Programme for Climate Adaptation in Agriculture

Pillar 1: Water System encompasses climate adaptation actions to strengthen national, regional and local cooperation on drought, flooding and water quality, including salinisation. The aim is to be prepared for periods of drought and to prevent future crises where possible by making agriculture and nature more resilient to the effects of climate change. In addition, the aim is to limit the damage caused by climate change, such as flooding, desiccation and the deterioration of water quality.

Pillar 2: Soil System encompasses climate adaptation actions to increase the sustainable management of agricultural soils as described in the National Programme for Agricultural Soils. Sustainable management of soils is a crucial factor in making agriculture climate-proof. Improving the soil structure and applying soil measures increases the water-retaining capacity of farming soils. In addition, improving soil quality in the broadest sense (physical, chemical and biological) can support crops in coping with extreme weather conditions.

Pillar 3: Crops and Cultivation System encompasses climate adaptation actions to make plants and cultivation systems more resilient to climate changes as described in the 2030 Plant Protection Vision. Climate-proof crops and cultivation systems also provide a pre-competitive stimulus for developing and preserving starting materials. In addition, this pillar aims to gain knowledge about adaptive cultivation systems and, where necessary, to improve regulations that restrain measures, such as hail covers, to protect crops against frost and extreme showers.

Pillar 4: Livestock Farming encompasses climate adaptation actions for livestock, such as dairy cattle, poultry and pigs, as described in the Benchmark for Sustainable Livestock Farming and the policy on new barn systems. Due to climate change, farm animals experience more heat and UV radiation. In addition, livestock gets exposed to new animal diseases due to climate change.

Pillar 5: Supporting Instruments consists of three supporting instruments: 1) knowledge and innovation, 2) a regional approach, and 3) risk management. These instruments provide comprehensive support for the goals in each of these pillars.

Over the past three years, several actions related to the five pillars have started. Examples of these actions are knowledge projects, the regional approaches to drought and flooding, and connections with other policy programmes and trajectories. These actions have set a basis for further shaping climate adaptation in agriculture and horticulture in the coming years. In the letter to the parliament of 7 July 2022, concerning the progress and continuation of the action programme, it is announced that the action programme and the pillars will be updated and continued until 2027. The ambitions of the action programme remain intact:

¹ ENGELSE VERSIE AP KAL INVOEGEN

- Creating **urgency and awareness** about the consequences of climate change in agriculture and horticulture in national and regional policy, in the sectors, and among chain parties.
- Providing more **insight and overview** of the risks, bottlenecks and chances for agriculture and horticulture and of what is happening in (policy) programmes and projects in the field of climate adaptation of agriculture. This includes several instruments and practical knowledge.
- Developing **partnerships, connections and cooperation** with relevant (policy) programmes and organisations, both within and outside the LNV domain, which contribute to climate adaptation of agriculture. This includes cooperation with the LNV team's climate adaptation of nature, circular agriculture, fertilisers and crop protection, and interdepartmental cooperation with the National Climate Adaptation Strategy and the Delta Programmes for Spatial Adaptation and Freshwater.
- Implementing an **area-oriented approach** to climate adaptation, agriculture and nature through programmes, such as the National Programme for Rural Areas (NPLG).

From 2023 onwards, the action programme will use the new KNMI'23 climate scenarios and other scientific insights to improve the resilience to climate change of agriculture. Also, new directions of the programme will be set up in the coming years together with the provinces, sectors and regional parties. One of these new accents concern international exchange to learn what other countries are doing about climate adaptation in agriculture.

In the past three years, several actions have been undertaken to reach the aim of the action programme by 2030. In the coming years, the action programme will include new directions, among which, international exchange to learn what other countries are doing for climate adaptation in agriculture. Although the action programme mainly has a national focus, the ambition is to learn from abroad, within in Europe and beyond. The aim of this brochure is to connect to international policy programmes and initiatives on climate adaptation in agriculture, exchange and learn from abroad. For this reason, this brochure provides an introduction to the Action Programme for Climate Adaptation in Agriculture, an explanation of the climate change impacts on the Dutch agricultural sector, the ambitions and progress of the action programme and examples of developments on climate adaptation in the Netherlands.

International approach: learning from abroad

The impact of climate change the Netherlands is experiencing is not peculiar. Some countries have been dealing with climate change related issues the Netherlands is only now confronted with, while other countries are newly confronted with climate change related issues the Netherlands has been facing for years. That is why it is important to learn from other countries and promote knowledge exchange. In 2021 all Dutch agricultural councils have been approached about their experience with climate adaptation in agriculture. The following questions indicate what we would like to learn from abroad:

- What are countries or regions doing about climate adaptation in agriculture and nature?
- Have governments made policy plans for adaptation measures in agriculture and nature?

- What are examples or practices from which the Netherlands could learn?
- Are there any knowledge and innovation projects currently being developed or executed on the topics of drought, water retention, efficient water use, soil measurements, crop and cultivation systems, livestock farming and knowledge and/or innovation from which the Netherlands could learn?

In addition to the inquiry and the English translation of the Action Programme for Climate Adaptation in Agriculture, this international brochure shares the actions and results of the Dutch approach to climate adaptation in agriculture over the period 2020 until 2022.

Actions and results of the Action Programme for Climate Adaptation in Agriculture

This chapter describes the actions and results of the Action Programme for Climate Adaptation in Agriculture over the period of 2020 to 2022. Especially the actions and results related to policy development and evaluation, (risk management) instruments, knowledge development and dissemination and regional approach, are included as they could be interesting for international exchange.

Policy development and evaluation

This subchapter elaborates on various policies that have been developed to assist farmers and other chain partners and governmental bodies, such as the provinces and water boards, to prepare for or deal with the impact of climate change, such as the action plan for heat stress in farm animals. Also, it discusses several actions that have been undertaken to evaluate the progress of the action programme and her goals, such as an inventory of Wageningen Research (WR) and a LNV community survey.

The new **Common Agricultural Policy (CAP)** and the **Dutch National Strategic Plan (NSP)** will start in 2023. The new CAP and NSP should contribute to achieving the sustainability goals of the **Green Deal** and **Farm to Fork strategy**. Farmers are rewarded for sustainability performance via eco-schemes as part of the new CAP. As such, these policy plans can increase the resilience of agricultural entrepreneurs against weather extremes due to climate change. For example, by adapting the water and soil system, and cultivations.

The **Dutch National Programme on Agricultural Soils (NPL)** aims to commit public and private parties to the aim to manage agricultural soils sustainably by 2030 and to sequester an additional 0.5 Mton carbon annually from 2030. The carbon sequestration goal results from the **climate agreement**. The NPAS is in line with the **EU soil strategy** for 2030 of which the objective is to achieve healthy soils by 2050 with concrete actions by 2030, and a new **Soil Health Law** by 2030.

The national Deltaprogramma (Delta programme), specifically the **Deltaplans Spatial Adaptation** and **Freshwater**, works on a more climate-proof and water-robust design, and sufficient freshwater

for, among others, agriculture. The **Flooding and High-Water policy table** aims to learn from the situation in Limburg to be better prepared to the consequences of periods with extreme precipitation. The **Drought Policy Table** has been set up to translate lessons learned from periods of drought to be more resistant for future droughts.

To minimise heat stress in livestock LNV developed an **action plan for heat stress in farm animals** in collaboration with chain partners and the Dutch Food Safety Authority (NVWA). The action plan includes actions on transport, slaughterhouses and farm management.

In 2019, LNV started the **LNV community**, which consists of 200 arable and livestock farmers who want to contribute ideas about policies of LNV. Through the LNV Community, the ministry would like to gain more insight into the world of individual entrepreneurs. In 2021, the LNV community is consulted about their experience, measures and needs concerning climate change. Based on the consultation, the conclusion is that the sector is well on its way to climate resilience by 2030.

In 2021, an **inventory**, by Wageningen Research (WR), researched the current status **of climate change and adaptation in agriculture and horticulture** in the Netherlands. From the inventory it is concluded that the risks and bottlenecks for agriculture and horticulture due to climate change are sufficiently identified. Yet, the opportunities due to climate change are insufficiently known. More focus is needed on the long-term adaptation strategies aimed at opportunities and perspectives from climate change (e.g., new crop varieties), increasing awareness about climate risks, and providing farmers perspectives via adaptation measures.

Risk management instruments

This subchapter discusses various risk management tools and instruments to provide insight, support and inform farmers to be able to prepare better for the consequences of climate change on their farmland or farm animals. Examples of climate change impacts are weather extremes, such as hail, heavy precipitation patterns and drought related water shortages.

In 2021, at the initiative of LNV the Netherlands Enterprise Agency (RVO) developed the **Water Requirement Viewer**. With this instrument, water boards can make better grounded decisions about water availability and limitations on abstraction of water for irrigation purposes in agriculture and horticulture during drought periods. For example, the viewer provides insights into actual drought stress of (capital intensive) crops based on satellite observation and the potential economic damage due to droughts.

WR has developed the **Climate Stress Test** for farmers. This test calculates the economic damage caused by climate change if arable farmers do not adapt their working methods and business setup. The following is determined: how big is the chance of drought, flooding, etc., and what would the damage be if the risk or event occurs. The average annual damage in the future is compared to the present. The Climate Stress Test will be further developed in the coming years for the purpose of risk management of farmers.

WR is developing a methodology to identify climate vulnerable areas via **impact maps** of the Netherlands. These maps can provide better insight and overview of what needs to be considered with the impact of climate change on agriculture and horticulture in the long-run, nationally and regionally.

LNV and insurance companies have set up the **Multiperil Crop Insurance**. This insurance ensures farmers against damage to crops caused by extreme weather (for example, hail, rainfall, (night) frost, storm, drought, snow, sleet and fire caused by lightning). This insurance is to ensure business continuity and is subsidized by the government.

The Animal Health Service for livestock farming has developed a **tool** for **predicting heat stress** in various animal species (dairy cows, calves, poultry, sheep, goats and pigs) using the weather forecast for the coming week. The user can be automatically alarmed when the weather forecasts are such that heat stress could occur.

Besides LNV's Water Requirement Viewer, Climate Stress Test, Impact maps, Multiperil Crop Insurance, and the heat stress forecast, the **Agriculture Water Indicator** and the **Agro Climate Calendar** were developed by other organisations.

The **Agriculture Water Indicator (WWL)** is a practical tool to calculate the influence of water management and changes on crop yields. The tool is, therefore, suitable for calculating the hydrological effects of climate change on the change in crop yields. The impacts of climate change considered are droughts, peak showers and salinisation.

The **Agro Climate Calendar** provides a simple overview of which climate factors for crops in the current climate pose the most risk of damage by giving a monthly frequency of the most harmful climate factors, such as extreme weather conditions and diseases and pests. Subsequently, it provides an indication of how the frequencies of risks of yield loss and crop damage shift with a changed climate.

Knowledge development and dissemination

This subchapter describes several examples of knowledge development and dissemination projects to inform and support farmers to be able to prepare better for the consequences of climate change on their farmland or farm animals. Knowledge and innovation are important to achieve a more climate proof agriculture. Climate adaptation requires measures to be taken by the agricultural entrepreneur. The responsibility for this lies with the entrepreneur, but the parties in the chain and governments can help with this. On the one hand, this concerns conducting research and developing and applying new techniques and working methods. On the other hand, there is a need to share existing knowledge of, for example, farmers and water boards. In order to be able to do this effectively, the Ministry of Agriculture, Nature, and Food Quality has set up a knowledge agenda and approach to climate adaptation in agriculture.

The **public private partnership (PPP) KLIMAP** researches an overarching approach to design development pathways to a climate proof design and management of the soil water system on sandy soil. The KLIMAP project 'Climate Adaptation in Practice' is working on tools necessary for the climate proof design of Dutch elevated sandy soils, a menu which visualises the effects and feasibility of measures, and development paths. Working on development paths is a continuous process for adapting quickly and flexibly to climate change with local actors to achieve long term goals for the area. Experimental farm plots, living labs and a serious game function as development and demonstration environments on various scales. In doing so, the effectiveness of measures, new revenue models and perspectives for actors in the area are explored.

The **PPP Low Netherlands 2100** develops land use visions for 2050 to 2100 of the low rural area in the Netherlands and describes the choices that ensure climate and water robust systems now and in the future. By thinking of 2050 to 2100 instead of current land use, space is created for nature-based solutions that, for example, can cope with the rapid environmental changes such as ground level subsidence, sea level rise and salinisation. In addition, attention is paid to future business models for the various stakeholders and to new land use types. Together with all stakeholders a rural area, which is economic, social and water robust, can be developed within one generation.

The **PPP Climate Adaptive Open Cultivation** encompasses four different sub studies on measures that a farmer can take to keep the risks of climate change manageable in a targeted manner. The subprojects are: 1) mapping the impact of climate change and climate factors on arable crops, 2) climate proof (seed) potato cultivation in practice, 3) sustainable solutions to solve soil compaction, and 4) economical irrigation and water quality in the cultivation of starch potatoes. These projects are closely linked and carried out in conjunction.

The **PPP Towards climate resilient dairy farming in the Achterhoek** aims to develop, share and demonstrate knowledge and innovations that are needed for integral sustainable and climate resilient development of dairy farms on sandy soils in the region 'Achterhoek'. The project will provide insight in potential effects of current and future weather conditions on dairy farming and will provide building blocks for development towards more climate resilient dairy farms. Knowledge transfer is a core part of this project, to increase knowledge about climate adaptation among future users and to promote climate resilience in practice in the Achterhoek and beyond.

The **Climate Adaptation Network Field Cultivation (KANO)** focused on passing on knowledge through knowledge sharing to farmers and horticulturists on field crops. The emphasis was on making climate change visible and open to discussion for individual agricultural companies and subsequently exchanging knowledge about concrete measures that entrepreneurs can take to make their company more resilient to climate change. To this end, the project utilised knowledge from national and regional projects, shares practical experiences, and develops knowledge products.

The **Climate Farm Demo**, a project by among others WUR and LTO, focuses on climate adaptation and mitigation. It aims to accelerate the uptake of innovations by farmers by demonstrating these

innovations on practical farms, learning from each other and connecting innovation questions with knowledge partners. Climate Farm Demo is a major European project with 80 partners from 27 European countries and a duration of 7 years. The project consists of a network of 1500 demo farms in 27 European countries for knowledge development and exchange within and across borders and 10 living labs towards co-creation of solutions for persistent region-specific climate changes. To increase impact, activities have been included on the standardisation and roll-out of climate and carbon tools and the exploration and exchange of reward mechanisms that can help in the envisaged transition.

In 2021, **Task force Agricultural Water Management (DAW)** set up a knowledge distribution project to farmers for sustainable soil management and climate adaptation. The participating farmers voluntarily take measures on their own farm or participate in one of the 500 projects to gain more knowledge on these issues. Examples of measures DAW provides to farmers for sustainable soil management and climate adaptation are retaining water on sandy soils to prepare for droughts, increasing self-sufficiency by storing freshwater in the ground or in basins, implementing drip irrigation and drainage, and flushing ditches with freshwater to reduce salinity.

The Action Programme for Climate Adaptation in Agriculture is part of **the National Adaptation Strategy (NAS)** which aims to amplify and accelerate climate adaptation in the Netherlands. As part of the NAS, the ministry of LNV is working on a LIFE IP climate adaptation project which aims to develop a dynamic knowledge agenda, a regional approach, and a dialogue with the financial sector to foster investments in climate adaptation in agriculture and nature.

Regional approach

This subchapter elaborates on the regional approach. The impact of climate change differs strongly per region, and water and soil system. Therefore, climate change requires a regional approach. Collaboration on regional scale makes it possible to jointly take overarching measures. Governments can facilitate and stimulate measures and remove obstacles in legislation and regulations. Examples of regional approach are also described under the heading “knowledge development and dissemination”. Other examples of the regional approach are the regional online connection sessions on adaptation of agriculture and nature, and the NPLG.

In 2021, LNV organised four **regional online connection sessions** with partners from the rural area. These sessions aimed to connect governments and social parties, including farmers, to solve concrete challenges in specific areas within the Netherlands regarding to the effects of climate change. Solutions to these challenges include water availability, spatial adaptation, nature-based solutions and agriculture. The soil and water system needs to be the guiding principles for spatial decisions and land use more than ever. The subjects of the four sessions were fruit cultivation and drought in Tielerswaard, a collaboration between the national government and the region Achterhoek, flooding and drought in Maarheeze, and climate change and the peat meadow area. The achievements of the sessions were concrete possibilities for jointly achieving multiple social goals, creating a network, and exchanging knowledge about the state of affairs of relevant programmes.

The **National Programme for Rural Areas** (NPLG) is a policy programme developed to achieve an integrated approach in the field of water, nature, nitrogen and climate for a vital rural area. Since areas differ for example in terms of soil, climate and culture, the integral approach differs per region. Therefore, local governments, such as provinces, municipalities, and water boards collaborate to develop a regional approach to reach the national goal of 50% reduction in nitrogen emissions in 2030 and European commitments related to climate and water. Part of the regional approach of the Action Programme for Climate Adaptation in Agriculture is to engage with the NPLG to come to a regional approach which is climate resilient for the long run.

Examples of international exchange and collaboration

This subchapter describes several examples of international exchange and collaboration. The focus lies on salinisation projects as one of the climatic trends the Netherlands is dealing with. Although the examples are not initiatives of the action programme, the ministry is involved herein.

The Interreg project **SalFar**, co-funded by the North Sea Region Programme 2014-2022, focused on the degradation of farmland due to salinisation. The main driver for increased salinisation in the North Sea Region is the continuous rise in sea level. Sea level rise leads to increased seepage of seawater and a higher risk of flooding, pushes seawater inland and leads to ever increasing salinisation of farmland in the North Sea Region as well as in other parts of the world. Without adequate countermeasures, this will lead to loss of food production capability and severe damage to coastal economies. The SalFar project developed innovative methods for coastal agriculture across the North Sea Region by setting up field labs in each partnering country. In the field labs, a multidisciplinary team of climate experts, researchers, educators, farmers, entrepreneurs and policymakers researched the salt tolerance of various crops, demonstrated alternative farming methods under saline conditions and created new business opportunities for farmers and food producers, and entrepreneurs.

There are several international projects set up in collaboration with the Netherlands Enterprise Agency (RVO). One of these projects is **the Impact Cluster DE-SALT**, a consortium of Delphy International, Salt Doctors, Nectaerra and local commercial farmers. The project highlights Dutch technology in saline agriculture, water management and agroforestry. In addition, it aims to set up a commercial enterprise and business case for saline agriculture.

The Netherlands Food Partnership (NFP) and the Netherlands Water Partnership (NWP) started a **Saline Water and Food Systems Partnership**. The ambition is to improve coordination and cooperation between Dutch organisations, strengthen the international position of the Netherlands on salinisation and strengthen its contribution to tackling salinisation in Low- and Middle-Income countries. As a result, the partnership contributes to Sustainable Development Goal 2 – Zero Hunger. The Netherlands Food Partnership (NFP) is, in context of the partnership, in discussion with the Knowledge Cluster Salinization about coordination of activities, such as knowledge and research.

Within the Food and Agriculture Organisation (FAO) of the United Nations, there are two working groups, **International Network of Salt-Affected Soils (INSAS)** and **Global Framework on Water Scarcity in Agriculture (WASAG)**, with knowledge experts from the public and private sectors across the globe that collaborate from the perspectives of water, soil as well as plant breeding to mitigate and adapt to climate change. Together they have developed a salinisation map of the world as well as the FAO technical guidelines for saline agricultural farming. Besides that, the FAO is looking into setting up knowledge hubs in diverse regions (Asia, Africa and Latin America) in order to accelerate knowledge sharing between and from the regions.

Continuation of the Action Programme for Adaptation in Agriculture

Over the next four years (2023-2027), LNV will continue on the course set by the Action Programme for Climate Adaptation in Agriculture. This is in line with the increased urgency based on the IPCC report on the acceleration of climate change, our experiences in the Netherlands with weather extremes recent years, the need among the sectors and partners of the action programme and recommendations from knowledge institutions, such as WR.

The ambitions of the action programme will remain intact and are focused on drawing attention to the consequences of climate change for agriculture and horticulture, providing an overview, working together and connecting with other (policy) programmes and organisations. From 2023, the new KNMI-scenarios and other insights will be used to improve the policy for climate-robust agriculture. For interim monitoring we will hold a broad consultation among agricultural entrepreneurs on climate adaptation in 2023 and make a second interim assessment in 2026 for the follow-up approach towards 2030 and 2050 or 2100. New emphasis will be placed in the coming years, together with the provinces, sectors and regional parties on, for example, international exchange.

As of 2022, the Agricultural Council of The Netherlands in France, commissioned by LNV, will conduct an exploration of the adaptation and mitigation policy, activities and measures for agriculture in Belgium, Spain, Italy, Germany and France. The research also focuses on the work of the Organisation for Economic Cooperation and Development (OECD) related to climate change and agriculture. Besides this, the Action Programme for Climate Adaptation in Agriculture is open for further policy- or knowledge-related exchange with other countries, for instance as a follow up of the online exchange in 2021.

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