DEALING WITH DROUGHT

Capture that water!

The ability to dispose of surplus water is in Dutch people's DNA. But nowadays the Netherlands faces increasingly frequent dry periods, making it at least as important to hold onto water. There is plenty of experimentation going on with methods that benefit both farmers and nature. 'We are looking for a new happy medium between wet and dry.'

TEXT RENÉ DIDDE **PHOTO** VINCENT JANNINK / ANP **INFOGRAPHIC** STEFFIE PADMOS

> ‘Water level management in the Netherlands has got to change’

Drought has become a serious problem in the Netherlands. In 2018, even in the soggy western part of the country, the grass went yellow from lack of rain. Farmers’ incomes dropped due to small harvests and they had to buy extra fodder for their cows, while nature suffered a severe blow. Drinking water companies had to pump up more groundwater than they were licenced for to maintain an adequate supply. Extremely low water levels meant that inland shipping plied the Waal and the IJssel rivers with half the usual cargo.

2019 was dry too, especially on higher ground with sandy soils – and that means one third of the Netherlands. These areas can only get a limited amount of water from the Rhine and the Maas and are dependent on the water stored in the soil in winter, and on rainwater in spring and summer. If it doesn’t rain, both nature and the agriculture sector are in trouble. And even though 2020 is not yet over, there is already talk of ‘the third dry year in a row’. Farmers were already having to irrigate in April, and wildfire destroyed 800 hectares of the Deurnsche Peel nature reserve, with residents of three villages having to be evacuated. Ditches and streams in sandy soil areas had dried out before summer had even begun, in spite of the fact that we had had a wet winter, with February actually the wettest month since meteorological records began.

DRY FEET

Dutch water management has traditionally been focused on ‘keeping our feet dry’ and draining off water. Now we have got to get to work on ways of creating buffers of water to see us through dry periods better, say the experts. ‘Water level management in the Netherlands has got to change. We must capture more water on high sandy soils, for example, so we can cope with drought,’ says Petra Hellegers, professor of Water Resources Management in Wageningen. ‘That is already being done in more and more places by installing barrages. The groundwater level goes up, and both agriculture and nature are better served as a result.’

Hellegers has noticed that this sometimes means a clash between the best interests of agriculture and of nature, particularly if they are located close together. ‘It is a political issue: how can we manage the water effectively in times of drought? Where should the water be allocated to nature and where can it go to agriculture? If they are close together, you have to be quite precise about it. It is a fine balance. I am all in favour of the typically Dutch “polder model” of broad consultation used by the water boards, in which farmers, nature organizations and companies are all represented.’

LATIN FOR EARTHWORM

In several different projects, Wageningen is working with stakeholders to study how to improve water management so that nature, leisure activities and agriculture can all cope better with periods of drought. In the past four years, the Lumbricus research programme has gained experience of improving the soil and water management on the high sandy soils in the east and south of the Netherlands. A number of researchers from several disciplines in Wageningen are participating in the project, along with experts from Twente University, Radboud University Nijmegen, the Louis Bolk Institute and KnowH2O consultancy. The water research institutes Deltares and KWR are involved too. The total budget comes to eight million euros, largely raised by the research institutes and water boards, with two million euros in co-financing by the ministry of Infrastructure and Water Management.

‘The basis for improvement is the soil,’ says Bas Worm, strategic advisor to Vechtstromen water board, responsible for an area of hilly sandy soils, clay soils and remnants of raised moorland in Overijssel and Drenthe provinces. Worm is the architect of Lumbricus. ‘In 2015, I saw six different research proposals come in, involving a smart barrage, growing deeper rooted tall fescue grass, promoting soil life to improve water retention, and innovative forms of drainage. I thought: why don’t we do all that research in a coordinated fashion in one part of our watershed? Then we can see whether these measures are complementary or perhaps undermine each other.’

With a nod to Worm’s surname, the water board called the new project Lumbricus, Latin for earthworm, the animal whose underground wriggling enriches soil life and enables crops to send down deeper roots, and rainwater to seep deeper into the soil.

SAND REPLENISHMENT

One of the project’s research locations lies in Stegeren, near Ommen, along the Overijssel Vecht – a reasonably sized river that drops in height significantly. The common intervention of retaining water by slowing the current would be tricky here, says Worm. ‘That has to be done without building new barrages, because the river has to stay navigable for the pleasure boats.’

One of the research projects therefore involved creating a side arm of the river and doing some sand replenishment. ‘Like a small-scale version of the well-known offshore “sand engine”, the stream deposits sand itself, so the streambed gets raised, >

DEALING WITH DROUGHT

The Netherlands faces increasingly frequent droughts due to lack of rain. Plenty of experimentation is going on with methods of capturing water.

Dutch soils

Drought is mainly a problem on the higher-lying sandy soils that can only get a limited amount of water from rivers. These soils cover one third of the Netherlands.

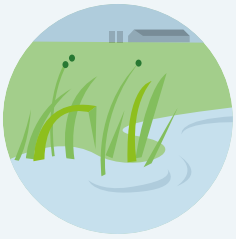
Sandy soil
Rivers

Slowing the flow

One way of retaining water for longer is to slow the flow in ditches and streams. This gives water more time to seep into the ground and replenish the groundwater supply.

The flow of water can be slowed by:

Building barrages



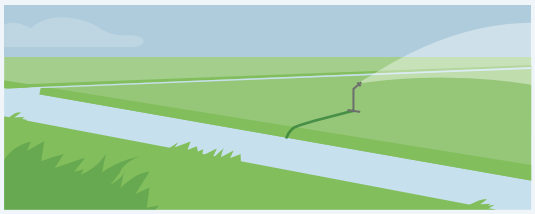
Mowing the banks less often

Digging side arms

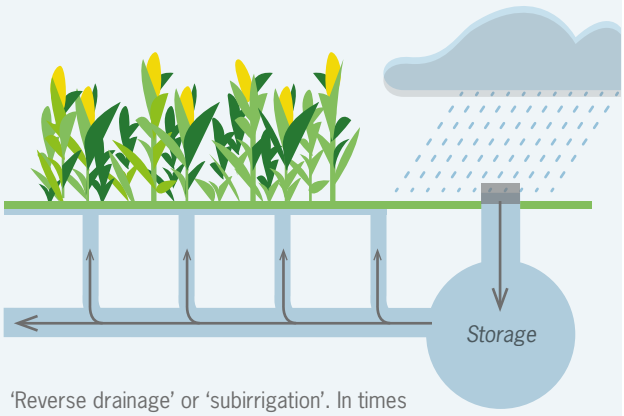
Replenishing sand

Capturing water on farmland

Farmers can also hold onto water for longer and use it more efficiently on their land by methods including:



Storing drainage water in ditches and wells, to use it on the land in times of drought.



'Reverse drainage' or 'subirrigation'. In times of drought, the underground drainage system below the crops is not used to drain off water but to bring water directly to their roots.

> ‘If I want to go on farming, and my two children too, we will have to adapt’

the flow of water slows down and the water level goes up.’ Another way to slow down the flow of the river is to mow the riverbanks less often, so vegetation flourishes.
Although the report containing the Deltares researchers’ results is not out yet, they have used drone footage and laser techniques to observe a change in the river’s profile, with more variations and transitions between shallow and deep sections. Worm: ‘That creates opportunities for nature, as well as for farming in times of drought. On the other hand, this measure could also cause flooding on farms downstream in winter and spring. We are looking for a new happy medium between wet and dry.’

INFLATABLE SKIPPY BALL

According to Lumbricus project leader Mirjam Hack-ten Broeke, improving the large-scale water management by the method used in the trial on the Vecht would be a long-term project. More immediate results are achieved when land users in the area harvest more rainwater. ‘They have to do so in the waterways of the system, the ditches and streams, raising them as high as possible,’ says Hack-ten Broeke, who is Soil, Water and Land Use team leader at Wageningen Environmental Research. This doesn’t have to be done with expensive, high-maintenance barrages. It can also be done by simple means such as culvert covers, closing drains or raising small barrages located on farms with planks. Waterways can also be blocked with a bulk bag or an inflatable skippy ball. This is a large rubber ball that farmers can pump up and use, in consultation with the water board, to close off ditches. If they need to till the fields, or if heavy showers cause flooding, they can deflate the ball and let the water flow away. That way, the measures taken to capture water don’t prevent the drainage of excess water from thunderstorms or heavy winter rain. ‘If you let the captured rainwater filter through the sandy soils, it reaches the groundwater and you refill those supplies,’ says Hack-ten Broeke.

REVERSE DRAINAGE

Another way in which land users can capture more rainwater is through drainage pipes. Seven farmers experimented with this in the Lumbricus project. Together with KnowH2O, Ruud Bartholomeus of KWR water research institute has been following this ‘climate-adaptive drainage’ experiment closely. ‘You use the drainage pipes not just to get rid of water under wet conditions, but also to then capture it in ditches and newly dug wells,’ explains Bartholomeus. Another promising approach is reverse drainage or ‘subirrigation’, a method by which the farmer pumps water back up into his drainage system and to his crops in times of drought.
In one of the trials in Stegeren, surface water is pumped to the fields using two solar panels and a battery. Bartholomeus: ‘Because the water goes straight to the roots of the crop underground, none of it gets lost, as it does when sprinklers are used from above.’ And it can be done at night. ‘The farmer can stay in bed and doesn’t have to go through his crops or field with huge reels of hosepipe,’ says Bartholomeus, who is a Wageningen alumnus and works one day a week at the Soil Physics and Land Management chair group. He stresses that a lot of questions remain to be answered. ‘When there are differences in levels, do you get the drainage water close enough to the roots of the crop? And does it work for all crops?’
Bartholomeus is doing research on different sources for subirrigation too. The system can make use of drainage water from lower-lying wet fields, surface water from the region, or shallow groundwater – five to eight metres deep.

CAPTURING WINTER RAINFALL

There is even a trial going on in which a farmer is watering his land with purified water from a sewerage water purification installation. ‘We are keeping a careful eye on the effects of all these measures and estimating the implications for the nearby nature,’ says Bartholomeus. ‘The consumption of groundwater in periods of drought goes down if excess water is stored for longer, for example by ensuring that as much winter rainfall as possible infiltrates the soil in sandy areas. Both agriculture and nature benefit from that.’
One of the farmers participating is dairy farmer Robert Geertman. ‘I don’t pump the water from a wet plot into the ditch, but to a dry plot on higher ground,’ says Geertman, who has 100 cows and 60 heads of young cattle on over 56 hectares. He is conducting this trial on nearly 3 hectares of his land. ‘Draining water from the wet plot is going fine, but I’m not getting the water far enough onto the dry plot,’ he says. But he is not giving up. ‘I’ve got to do something,’ he says. ‘The climate is changing. If I want to go on farming, and my two children too, we’ve got to adapt. I hope we can stay here. The nature here along the Vecht is stunningly beautiful. That is important. Agriculture doesn’t have to get 10 out of 10, and nor does nature. But I think that with the Lumbricus measures, we can co-exist while both scoring a clear 7 out of 10.’

NO SPONGE FUNCTION

The results of the trials in Stegeren and the southern trial location near Horst will be made available this autumn. There are

PHOTO PROGRAMMA LUMBRICUS

Sand replenishment on a side arm of the Vecht River in Overijssel province. The aim is that the river itself deposits sand so that the riverbed is raised, the flow is slowed down and the water level goes up.

experiments going on with barrages and infiltration, as well as with enriching the soil life with wriggling earthworms, adding compost and planting a deeper-rooted grass called tall fescue instead of ryegrass.
Hack says, though, that raising levels of organic matter in the soil may be good for the soil life and soil fertility, but doesn't do much for the soil's 'sponge function' – its water retention capacity – in the Netherlands. 'And yet people have been claiming for years that compost is a good solution to drought.'
The researchers used the data on water management conditions to test and expand a water management tool called WaterVision Agriculture (Waterwijzer Landbouw in Dutch). 'That way you can quantify the effect of measures on the crop yield, using information about hydrology and the soil. Farmers and the water board can see, for instance, how much less crop spoilage they can expect if they apply subirrigation,' says Hack. For nature, there is the WaterVision Nature tool. 'With this, water boards and nature organizations can find out whether the water management approach matches the nature-related objectives they have set for a particular area. Which types of vegetation are promising, and what does a change of water management mean for things like drought stress, oxygen stress or acidity?'

DISSEMINATION OF KNOWLEDGE

Although Lumbricus is still going on, a follow-up project, Climate Adaptation in Practice (KIMAP), already started this spring. 'We need to disseminate the knowledge gained from the local pilot projects to all users in the region,' says KLIMAP project leader Myriam de Graaf of Wageningen Environmental Research. Besides the research consortium Lumbricus, seven water boards and the provinces of Gelderland, North Brabant and Limburg are participating in KLIMAP. 'Water boards and provinces can find out whether their current policy and measures against drought are adequate, or whether any adjustments are needed.' The programme runs until 2024. Half of the budget of 6.5 million euros comes from the top sectors Agri & Food and Water & Maritime. The other half comes from water boards, provinces and a few companies.
De Graaf, who has worked for Limburg water board for 13 years, wants KLIMAP to contribute to ensuring that rural areas can withstand climate change better, in periods of both drought and heavy rainfall or flooding. She too thinks the measures will benefit both agriculture and nature. But, she warns, in the long term it may turn out that spatial planning must change and farming systems must be adapted. 'It is possible that certain kinds of farming cannot continue in the same way. This could lead to different crops and different business models for the farmers. If we want to capture excess precipitation in the winter in a stream valley in order to get through dry periods better, then it would be better to move sensitive crops such as asparagus, lilies or trees in nurseries out of that valley,' says De Graaf. 'Because in the winter the land there is too wet, and in dry periods those crops require a lot of water. Of course those decisions are not for us researchers to make, but we would like to provide the basis for the decisions.' ■

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