Farmers measure water – Netherlands

EAFRD-funded projects

NETHERLANDS

Digital futures

Location
Gouda

Programming period
2014 – 2020

Priority
P2 – Competitiveness

Measure
M16 - Cooperation

Funding (EUR)
Total budget 1 500 000
EAFRD 150 000
National/Regional 350 000
Private / own 500 000
Other (Waddenfonds)
500 000

Project duration
2018 – 2020

Project promoter*
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This project combined state-of-the-art sensoring techniques and models with a participatory monitoring process with farmers and water authorities to create a common understanding of the main local challenges and possible solutions to enhance water quality. In addition, the process empowered individual farmers to become equal partners with water authorities as they gained knowledge and access to data. Problems with water management differ between regions, but the process of jointly collecting, learning from and acting on data can be applied across regions.

Summary

Water-management in coastal areas has become increasingly complex due to the effects of climate change and land subsidence. Challenges require measures optimised to local conditions and a close cooperation between stakeholders.

In this project, sensor techniques were used by farmers and governmental bodies such as Dutch water authorities in a process of participatory monitoring. Within pilot-groups, data was shared via a live dashboard and considered in regular meetings, to enable joint learning about the local system's functioning. Joint dialogue has given a foundation for effective solutions across a broad support base.

The AquaMobile (handheld device to measure EC in surface waters) developed in this project

Results

The project resulted in an average of 15 farmers per pilot region who gathered data on salinity and/or groundwater-levels with the developed sensor techniques.

In total more than 80 farmers gained insight as to the salinisation status of their fields, by measurements of Electrical Conductivity (EC) with the AquaPin at different depth. Based on these measurements the urgency for measures on individual fields could be understood.

Over 100 farmers measured salinisation of surface waters in different branches of the water-system, resulting in more than 20 000 measurements. From these measurements, spatial and temporal patterns could be gathered. Such data give insight into possible optimisations of fresh water flushing of the water system.

Over 50 farmers measured hourly groundwater levels with the AquaPin. Previously, insight into temporal changes of groundwater levels was rarely available to farmers, but a lot of useful information can be gathered from such regular measurements. For example, how quickly levels react to rainfall and drought, or, in the case of the farmers in the peatland pilot, to what extent surface water levels affect groundwater levels within a field.

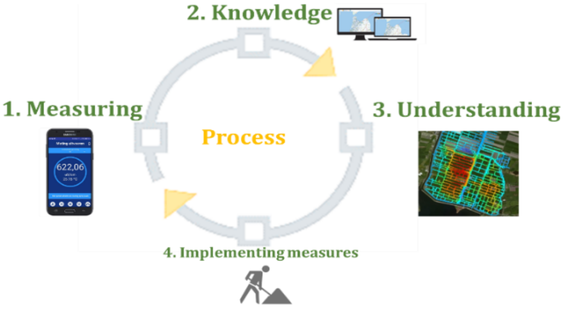
* The Project promoter/beneficiary is an EIP-AGRI Operational Group (https://ec.europa.eu/eip/agriculture/en)

Context

Dutch water authorities traditionally have had responsibility for managing surface water in order to enable current land use to continue. During periods of heavy rainfall, water is pumped out of the system to avoid damage to crops, while fresh water is supplied, mostly in summer, to areas suffering salinisation or drought. As periods of heavy rainfall and droughts are occurring on a more regular basis and environmental goals are becoming more ambitious, water management is becoming increasingly complex.

In response to this evolving challenge, measures need to be designed to reflect local conditions, such as soil and land use, and local surface and groundwater flow patterns. Groundwater levels in coastal regions often lie below sea level, causing an upward seepage of brackish/saline deep groundwater, the rate of which increases with sea-level rise and land subsidence. The spatial patterns of such upward seepage greatly affect appropriate measures and their future mitigating potential. Similarly, the effectiveness of measures to rewet drained peatlands highly depend on local soil properties and groundwater flow patterns. A further challenge is that the point source of high concentrations of nutrients and pesticides are often only traceable in the smallest stream-branches of a water system, before they become too diluted to identify the individual sources of an overall poor water quality.

To find the best strategies to address such challenges, an integrated exchange of knowledge and data is required on water quantity and quality parameters, such as groundwater and surface water levels and concentrations of chloride, nutrients and pesticides. However, monitoring is costly, and as a result, governmental observation points are mostly limited to the main branches of a water system and to some key parameters.



To identify the best management strategies there is a need for more local data. Furthermore, the practical implementation of measures potentially affecting the management practices of farmers and their businesses requires a cooperative approach.

To implement measures successfully a wide support base and common understanding is needed among the different stakeholders in the region.

Objectives

The main goal of the project was to improve water quality and the availability of fresh water, and to support sustainable crop cultivation.

Every region has its own characteristics and challenges to achieve this. The project therefore aimed to identify regional challenges with farmers and water authorities through a participatory monitoring approach.

By using smart sensor techniques, that the intention was to identify data bottlenecks in the water system.

Cooperation between government and farmers will then enable a dialogue that would increase mutual understanding and provide a knowledge and support base to implement effective measures.

Activities

The project was developed in six stages.

Project initiation

The project was initiated in 2018 in cooperation with three northern coastal provinces in the Netherlands (Friesland, Groningen and North-Holland), three water authorities (Wetterskip Fryslan, Waterschap Noorderzijlvest and Hoogheemraadschap Hollands Noorderkwartier) and the farmers' representative organisation LTO Noord. The combination of project partners ensured participation of governmental bodies responsible for water management, and enabled close ties with target participants, namely local farmers.

Choice of pilot regions

To trial participatory monitoring with farmers, several pilot-regions were chosen in consultation with project partners. Most were located in predominantly sandy or clayey polders along the coast and on the island of Texel, where upward seepage of saline groundwater poses a risk of salinisation. The focus in these regions was on measurement of Electrical Conductivity (EC), which is a measure of salt-concentrations in surface water and in shallow groundwater in agricultural soils. One pilot was located in drained peatland where measures are needed to maintain high groundwater levels, so that peat degradation and accompanying subsidence and CO_2 emissions are reduced. The focus in this region was on measuring groundwater levels in agricultural fields.

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The result was a distribution of pilot regions among the provinces with varying challenges and agricultural business types and differing stages of implementation of mitigating/adapting measures.

Recruitment of participants

Potential participants were approached via the local network of the farmers' organisation LTO Noord. Recruitment was carried out via a series of sessions for each pilot area, which involved the introduction of project activities and goals and the presentation of available sensor techniques.

Sensor techniques consisted of an EC handheld device, the AquaMobile (Fixeau.bv), connected with an app via Bluetooth for surface water measurements, and a modular telemetric sensor pole, the AquaPin (Fixeau.bv), which is equipped with sensor modules at flexible depths and installed directly in the soil. Module options included an EC sensor and a pressure sensor for groundwater levels. Both AquaPin and AquaMobile data were collected in a central database and visualised within a pilot specific dashboard.

Participatory monitoring process

After recruitment of participants, each pilot started a participatory monitoring process in which data was jointly collected and discussed. This was done through frequent sessions with participants and project partners over the two-year duration of the project. The result was a collective understanding of the main local challenges and options for potential mitigation.

Dashboard and model development

In parallel with participatory monitoring, an online dashboard to present data was continuously improved to support quick and easy interpretation of measurements by participants, for example by indicating threshold values on measured time series. Furthermore, fast-running models were developed to quickly generate predictions based on weather forecasts, both for surface water quality, groundwater levels and soil moisture.

Continuation

The project has recently come to an end, however most pilot locations continue monitoring and the initiative has been extended to an increased number of regions and participants. Monitoring in drained peatlands will be extended to 125 participants with the addition of soil moisture measurements. Similarly, monitoring of salinisation has been extended towards 150 participants. Simultaneously, the online dashboard will be further improved.

Main results

The project resulted in an average of 15 farmers per pilot region who gather data on salinity and/or groundwater-levels with the developed sensor techniques.

In total more than 80 farmers gained insight as to the salinisation status of their fields, by measurements of EC with the AquaPin at different depth. This gave insight on the presence of fresh rainwater lenses and temporal changes due to periods of rainfall and drought. Once a farmer gained enough knowledge of a particular field, the AquaPin could be moved to another field. Based on these measurements the urgency for measures on individual fields could be deduced.

Over 100 farmers measured salinisation of surface waters in different branches of the water-system, resulting in more than 20 000 measurements. From these measurements, spatial and temporal patterns could be deduced. Such data give insight into possible optimisations of fresh water flushing of the water system.

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Key lessons

The project created a network between governmental bodies, farmers' organisations and individual farmers, as well as specialists on salinisation and hydrology. This network was strengthened by frequent meetings.

The initiative is transferable to any region facing water quality or quantity issues, with multiple stakeholders. It is adapted to local challenges and knowledge gaps by choosing appropriate parameters to measure, such as groundwater and soil moisture status, EC or nutrients. Ready to use sensor techniques were developed in this project. The initiative can be applied to a wider range of water challenges by ongoing development of sensor techniques for additional parameters of interest.

Additional sources of information

https://waterinnovatieprijs.nl/inschrijving/boeren-meten-water/

www.veenweidefryslan.frl/onderzoeken-en-innovatie/boeren-meten-water

www.fixeau.com

www.acaciawater.com/pg-28008-7-124798/pagina/boeren_meten_water.html

* This project has been categorised under 'Digital futures' by the nominating National Rural Network

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