NORTH EUROPEAN RESPONSE **TO DROUGHT**

WaterCAP - a cluster project

The WaterCAP cluster project partners have utilised and developed technical tools to improve the availability of fresh water resources. In addition, the results will reduce human vulnerability to climate change and improve flexibility in adaptation to climate change.

The technical systems and method are:

» Soil mapping system. Locates aquifers and measures salinisation levels. Results in better water management and prevents overexploitation and salinisation.

» Water management decision-making system. Monitors soil moisture in advance of irrigation.

» The systems are used in combination and the resulting actions are organised and implemented in cooperation with stakeholders. This improves the understanding of the significance of the scarcity of water, for example in the Mediterranean region and strengthens resilience to drought.

The tools and method support the implementation of the EU Water Framework Directive and the EU white paper ‘Adapting to climate change: Towards a European framework for action’.

WaterCAP

Soil mapping locating aquifers and measuring salinisation levels

Sea levels are rising and are threatening freshwater lenses; the beating hearts of freshwater supplies and dependent ecosystems in coastal regions. New innovative airborne mapping, and online monitoring systems, coupled with groundwater-surface water modelling systems are offering communities new ways of dealing with climate change challenges. The solutions are cost-effective on a regional scale, transferable to other EU regions and exportable worldwide.

The WaterCAP cluster project partners have utilised better and faster data acquisition techniques. For example, new airborne systems that enable the collection of huge datasets in just a week, without disturbing ground activities, while online monitoring enables long-distance access to large amounts of field data.

Models tested on the Wadden Islands (The Netherlands, Germany and Denmark), are being used to forecast hydrological conditions and groundwater extraction capability. In this way, money can be saved and sustainable ecosystem services can be safeguarded.

Additionally, saltwater intrusion in aquifers will be accurately mapped using the Airborne Geophysical TEM system. This is crucial information because by knowing the exact location of the saltwater-freshwater boundary, the effects of water extraction in drought periods can be preciously modelled to prevent up coning of saline water and thus avoid salinisation of the aquifers (in Australia, local areas are currently struggling with salinisation of the coastal aquifers due to extensive water extraction in drought periods. The Airborne geophysical TEM system is currently being used in these areas to improve water management).

» The modelling will reduce uncertainty within water management and ensure optimal decision-making because the long-term effects of extraction can be predicted (even by taking different drought scenarios into account).
» Better information on the availability of water.
» Predictions of the effects of different drought scenarios through hydrological modelling.
» A system that improves the ability to manage groundwater in a sustainable way and reduces energy consumption.
» Better water management because water can be used where it is most needed; as defined between the users.

Water Sensing System

A sensor measures soil moisture in the topsoil at different depths. The farmer can see the updated data online, so he knows exactly how much moisture is available for the crops in the field at different depths in the soil. This knowledge is combined with local weather station information (precipitation and evaporation data). In addition, the data is combined with the geological characterisation of the fields and their soil types. At this level, the farmer can see how the weather impacts the soil moisture.

Crops have different water requirements in relation to plant species, season and the growth stage of the crop. Combining all of the above information means that the farmer knows if his crops require water during each dry period and whether he has to irrigate his fields immediately or if he can wait for a few more days. The system has been tested within the WaterCAP cluster project in an area with starch potatoes, sandy soils and during a water shortage period in summer (North Eastern part of The Netherlands). About 40 farmers have used the system. The system has also been used outside Europe (Egypt, Tunisia, Kingdom of Saudi Arabia, South Africa) and on small scale EU pilot projects in Spain and Cyprus (DESIRAS)

Advantages of the water sensing system:

The introduction of water sensing systems at farm level can target real-time irrigation requirements for a specific field, based on crop requirements.

» Saves the farmer money because he will only irrigate where and when irrigation is required.
» Saves energy.
» Efficient irrigation reduces demand on the freshwater supply (water consumption reduced by 15–20%).
» In the pilot projects in Spain and Cyprus, water consumption was reduced by up to 50%.
» Farmers become more aware of water management and the ways they (can) influence water system.
» Knowledge about soil moisture is also an important factor in making more efficient use of fertilisers.

Integration of the systems

By combining the two systems described above, we are able to improve results and use data more efficiently. The Airborne geophysical TEM system provides detailed mapping of the near-surface geology, i.e. the distribution of clay and sand in the top 10 m of the soil. This information is crucial for farmers in their efforts to irrigate (and fertilise) cost-effectively and it is valuable information for determining where water sensors should be located and thus helps to optimise water sensing systems.

» By knowing the heterogeneity of the top soil the number of water sensors required can be reduced.

» Better use of the water (by the farmers) in combination with information about the availability of water will hopefully trigger other users to seek more efficient ways to use water in the long term.

The combined systems reduce vulnerability to drought, increase water availability, increase water use efficiency and reduce energy consumption.

Implementation

The implementation of the systems needs to follow a certain strategy and plan. The diagram below shows how the systems are integrated in an area/country:

1. Mapping of groundwater aquifer and soil layer and Analysis of current water irrigation system.
2. Stakeholder analysis and force field analysis to integrate local expertise on hot spots, data challenges and expected management developments.
3. Workshop: Kick-off and start-up

» Visualisation of the status-quo upper soil layer and water management system.

» Joint and integrated problem definition and analysis.

» Presentation of the systems used by WaterCAP: Airborne geophysical TEM system and the Water Sensing Decision System (WSDS).

» Identification of urgent water management problems and regions (pilot areas).

» Development of an experimental set-up for the identified pilot areas.

» Joint development of an observation and monitoring system.

4. Monitoring by Airborne Geophysical TEM system and data collection for the WSDS.
5. Stakeholder dialogue

» To identify the pros and cons of the system and its management, improvement

6. Workshop: Evaluation and Transfer

» Presentation of monitoring results.

» Presentation of experiences (pros and cons of the relevant stakeholders).

» Joint evaluation step: How to proceed? What has to be improved (communication process, methods, experimental set-up, etc.)? What were the benefits?

» Joint discussion: Are results transferable to other Mediterranean regions?

Key success factors

» Farmers take responsibility and ownership of the water management system. Local water supply companies and communities use the modelling in the management and regulation of water supply and consumption.

Costs

» Water sensing system and associated equipment, €2,000

» Data analyses, €550 per annum.

» Mapping subsurface and locating aquifers and salinisation, €5,000 per km2.

» Time required to implement mapping, install sensors and involve stakeholder is about one year.

Threats

The water management system may be too technical and farmers may feel that they are not qualified to use it or are unable to keep it operating.

More Information

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