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FarmImpact – Developing sustainable water and energy solutions for farms in South Africa

Client II – International partnerships for sustainable innovations

Improved water use in agriculture is essential in order to successfully adapt to climate change. In the "FarmImpact" project, German and South African partners combine technical solutions with ecological approaches and investigate the effects of windbreak hedges on the microclimate and productivity of wine and fruit growing in South Africa's Western Cape region.

Investigating agricultural water use

Water scarcity is one of the biggest challenges in South Africa, alongside the effects of climate change, human vulnerability and the loss of biodiversity and ecosystem functions. Agriculture in particular is threatened by pronounced dry seasons and water scarcity. As the centre of wheat, wine and fruit farming, the Western Cape is hugely important for the nation's food security. In addition to this, South Africa has been a major exporter of agricultural and forestry products to Europe for many years.

The German-South African joint project "FarmImpact" develops innovative and integrative solutions for improved water and energy management for South African agriculture. The project uses the Climate Smart Agriculture approach, which includes both environmental (land management) and technological (irrigation) measures to reduce water use. The interdisciplinary project will link together field measurements and modelling of the water consumption of wine and fruit crops.

Measuring a vineyard's microclimate.

Windbreak hedges and digital irrigation

One of the main goals of the windbreak strip is to reduce the water requirements of agricultural crops. These protective strips create different field areas which have different evapotranspiration properties and a correspondingly lower need for irrigation. In order to adapt irrigation to the reduced water needs, "FarmImpact" will provide an application-based data basis, providing the farm with information about actual water use and future demand. The novel aspect of this research approach lies in the intelligent combination of networked microclimatic measurements, drone-based remote sensing, wind field modelling and ecophysiological modelling (Expert-N). The aim is to achieve a solid scientific basis for agricultural-economic assessment and optimized water management.

The "FarmImpact" concept aims to use windbreak strips in order to grow water-efficient agricultural, wine and fruit products based on new scientific methods. Against this backdrop, the development of a web-based software tool for predicting the actual need for irrigation in the operational areas that have been restructured by the water efficiency concept is a completely novel approach. In the space between two windbreak strips, there are typically zones with different reductions in wind speeds and evapotranspiration rates. By integrating current weather forecasts, measurement data from the soil moisture sensors installed in the zones and the results of microclimatic ecophysiological modelling, the prediction tool can accurately dictate the actual irrigation needs for a specific farm and directly link them to controllable irrigation systems where appropriate.

Sustainable water and land use

"FarmImpact" is working to develop practical recommendations for regional agriculture based on many years of field measurements. In the course of this, the project pursues multiple goals. These include the design of a water-efficient agricultural method for improving crop water use through windbreak hedges, including improved tree

selection and a technological aid for predicting irrigation needs. In addition to this, the project also aims to increase soil fertility, reduce soil erosion and provide additional ecosystem services through integrated landscape measures, such as windbreak strips, ecological support zones, land management. Furthermore, an integrative agro-technical concept will help increase economic resilience at the operative level.

In "FarmImpact", the integration of digital technologies in a combination of online measurements with data warehousing, drone remote sensing, modelling and a software-based decision support system will drive the second stage of the digital transformation of the agriculture sector, thus enabling the realization of Agricultural Production 4.0. With the help of the water demand analysis and an optimized concept of wind protection hedges, the agriculture industry can use water resources more efficiently and adapt production to the future challenges posed by climate change.

Trees reduce wind speed and improve water use.

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