CLIMATE CHANGE AND AGRICULTURE

Adaptive Interventions to Reduce Vulnerability

A Water Research Commission funded project

Climate change will affect the profit margins of farms throughout South Africa differently. It all depends on how rainfall, temperature and the subsequent need for irrigation will change the yield and quality of produce being farmed with in each region. In most cases in South Africa, the rainfall forecasts are very uncertain, but whatever happens to rainfall, increases in temperature are certain. This will inevitably lead to higher evaporation and the increased possibility of longer dry-spells, whiel the intensity of rainfall is likely to increase with a greater possibility of flooding

So says the research generated by this project for which agricultural economist Dr Hamman Oosthuizen, used farms in Hoedspruit, Carolina, Moorreesburg and Vredendal as case studies for his doctoral research at Stellenbosch University. He teamed up with climatologists and hydrologists from two South African universities to develop relevant data driven models.

His modelling study is among the end results of a broader initiative involving data and models from the Climate Systems Analysis Group of the University of Cape Town and the Centre for Water Resources Research at the University of KwaZulu-Natal. The project is funded by the Water Research Commission and the Department of Agriculture, Forestry and Fisheries. It investigates how climate change will impact agriculture, and assesses the vulnerability of crops, rangelands, farming households and enterprises. Appropriate ways by which farmers from selected areas could to manage their farms better with climate change in mind are also suggested.

"It's a given that the agricultural sector is physically and economically vulnerable to climate change," explains Dr Oosthuizen. "We therefore set out to find out just how climate change will be influencing farming endeavours and profitability at farm level in certain areas of South Africa."

"The impact of such financial vulnerability goes beyond the farm gate, because many rural livelihoods are interlinked with the agricultural industry," adds Dr Oosthuizen, whose findings have already been presented at international conferences in China, Mexico and Belgium. A paper detailing the Hoedspruit case study was published in the International Water Association's Water, Energy and Climate (WEC) conference proceedings.

Dr Oosthuizen among others developed the new integrated Crop Critical Climate Threshold (CCCT) modelling technique to model crop yield and quality under different climate sets. It integrates climatic, hydrological and economic models to determine how financially vulnerable farms are at ground level because of climate change.

The four selected case study areas used present dryland and irrigation farming in both summer and winter rainfall regions in South Africa.

Projections for the Hoedspruit area

Projections show that mango and citrus farmers in the Hoedspruit area should expect their profits to shrink along with seasonal shifts in rainfall and an increase in average temperature.

- Farmers with high debt ratios will be more financially vulnerable than those with low debt levels.
- Quality losses and a reduced fruit set can be expected.
- They will need to irrigate more.
- Irrigation water for the Hoedspruit area generally comes from the Blydepoort Dam. Water from the dam's catchment areas seems to be relatively assured.
- The erection of shade netting as an adaptation strategy will reduce financial vulnerability to climate change. The capital cost of these structures is, however, high and it may not be affordable to all farmers.
- Farmers will have to effectively manage their irrigation systems, conserve soil moisture and focus on the development of natural heat resistance cultivars.

Vredendal area

Vredendal in the Western Cape's winter rainfall area is a water stressed region with unpredictable water supply.

- Farmers should prepare for a decrease in grape yield and an increase in the need to irrigate.
- Farmers should plant cultivars that are more tolerant towards projected climate change.
- Shade nets may reduce the impact of climate change on yield and the quality of table grapes.
- Soil preparation and site selection for future plantings are crucial to ensure optimum production.
- Better moisture management can improve profitability.

Moorreesburg areas

Dryland grain farming dominates the Moorreesburg area in the Western Cape's winter rainfall area. Pastures and small livestock are also kept to produce mutton and wool.

- Rainfall may decrease with an increase in temperature, but with an increase in evaporation. No major changes in yield are expected for the intermediate future.
- Crop rotation and using conservation agriculture techniques will enhance profitability and sustainability.

Carolina area

Dryland farming dominates the local agricultural endeavours around Carolina, in Mpumalanga's summer rainfall area. Maize, soybeans, sugar beans, mutton and beef production are the main enterprises.

The projections show that:

- local farmers can expect an increase in yield over the long term
- temperatures will rise and, in some cases rainfall increases, but with an increase in evaporation.

Dr Oosthuizen warns that although all indicators point to increased profitability, the models he used cannot project extreme events such as floods or the impact of pests and diseases. He therefore advises Carolina farmers to follow a "no regrets" strategy involving crop rotation and conservation agricultural practices to positively influence profitability.

The main aim of the project was to determine how climate change threatens agriculture and what farmers are already experiencing, how they are dealing with the impacts and what future adaptations they could be making. The project held many stakeholder meetings in the 4 case study regions to hear from farmers and other stakeholders about their experiences and to check the findings, results and recommendations.

How was the research done?

The crop yield modelling was based on climatic data sets available from the Climate Systems Analysis Group (CSAG) at the University of Cape Town. These were also used to project future dam levels and irrigation needs, and the availability of irrigation water. The output from a selection of future scenarios was used as input for hydrological and agricultural crop models. The subsequent output form these was then used in eth economic models to produce the financial vulnerability findings.

More about the CSAG's role in the initiative:

The group produces the pre-eminent empirically downscaled climate model for Africa and provides weather station level responses to global climate forcings for numerous African stations. The group generated the empirically downscaled climate data for an envelope of IPCC accredited Global Climate Models (GCMs). Two climate data sets were generated for each case study area: one for the present climate (1971 – 1990) and another for the intermediate future climate (2046 – 2065). CSAG also performed the APSIM crop modelling to project changing crop yield under different climatic sets.

More about the CWRR's role in the initiative:

The UKZN hydrologists applied the CSAG climate data sets to the well-known ACRU model to determine future dam levels and the available of irrigation water.

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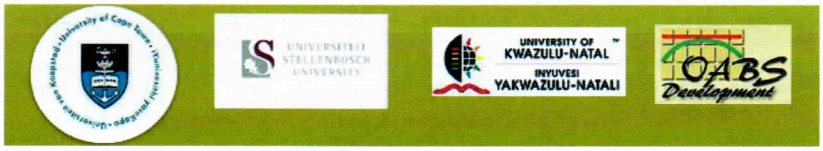

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