POLICY BRIEF

August 2018
The WRC operates in terms of the Water Research Act (Act 34 of 1971) and its mandate is to support water research and development as well as the building of a sustainable water research capacity in South Africa.

Modelling rainy season characteristics in Limpopo

Weather and climate variability are the major factors that affect inter-annual performance of crop production and yield in all environments. As a result, climate information has to be properly considered in planning of agricultural activities and decision-making. The South African agriculture sector is increasingly vulnerable to population growth, high input costs, climate variability and change. Resource poor farmers are particularly affected.

The common lack of useful packaging for the agrometeorological information to assist resource poor farmers to conduct their agricultural activities prompted the Water Research Commission (WRC) to launch a study in this regard. In particular, the study investigated rainfall characteristics, drought and floods with reference to crop production in the Luvuvhu River catchment of the Limpopo catchment. The project developed a web-based decision-support tool, the Luvuvhu Agroclimatological Risk Tool (LART), which will be used to provide agroclimatological risk information important to the production of rainfed maize in the catchment.

Background

Agricultural production varies significantly from year to year as a result of climate variability and change. The frequencies, means, extremes, deviations, exceedance of thresholds, spatial variability and trends of agroclimatological parameters are thus important to agriculture. This includes the onset, cessation and length of the growing season, rainfall volume, and the probability of dry spell occurrence.

In South Africa, recurring droughts have always been an endemic feature of the climate. The reliance of many farmers on rainfall, makes them especially vulnerable. Agriculture is usually the most susceptible sector to be affected by drought. Thus, in determining drought incidences, better agricultural decisions can be made.

This project thus aimed to assist farmers in making more informed choices on activities such as timing and planting as well as appropriate crop cultivars. In particular, the study focused on the rainy season characteristics, drought and flood risk affecting crop production in the Luvuvhu River catchment in the Limpopo Province.

Rainy season characteristics of the study area were determined with reference to maize production in the catchment.

The study area (Luvuvhu River catchment) has a humid subtropical climate that is fairly warm to hot during summer and dry in winter. Precipitation varies significantly across the catchment, and it is mostly determined by orographic patterns, with the highest rainfall occurring in the south-western area of the catchment. Large-scale commercial forests, fruits and vegetable farms are dominant in the high rainfall regions of the catchment, however, small-scale and subsistence livestock and rainfed maize farming play a crucial role in parts of the catchment.

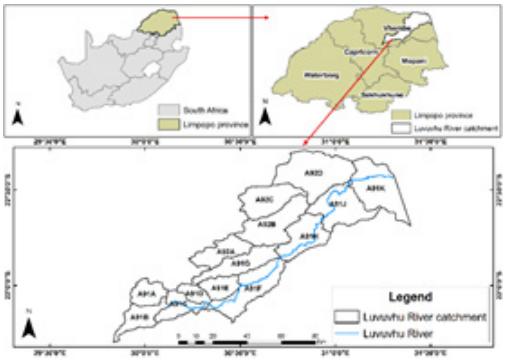

Figure 1 – Location of the Luvuvhu River catchment.

Main results

Prior to the project, there were six functional Agricultural Research Council (ARC) weather stations in the catchment, while other stations were clustered in the lower regions and some near the Kruger National Park were under-serviced.

The project thus improved the station network by installing four automatic weather stations (Figure 2).

A stand-alone patching tool was then developed to fill missing climate data (daily minimum and maximum temperatures, rainfall, solar radiation, water vapour pressure and wind speed) used in this study. Moreover, stakeholder involvement was conducted in a form of workshops where project team members visited sites in the Luvuvhu River catchment to present the seasonal forecasts, in preparation for agricultural seasons ahead. Recommendations were given accordingly.

The results given by the rainy season characteristics revealed that the Luvuvhu River catchment can be divided into different agro-climatic zones with different rainfall characteristics, viz. arid, semi-arid, sub-humid and humid. Seasonal rainfall ranges from 315 mm in the northern and eastern plains to more than 1 500 mm in the lower western parts of the catchment.

Early onset rains in October occur in areas situated in mountainous areas receiving more than 700 mm of annual rainfall, while onset occurs later in November in the low-lying areas of the catchment which receive less than 500 mm of annual rainfall.

It is therefore evident that rainy season characteristics of the catchment are influenced by rainfall distribution and topography. Furthermore, there is a high probability of crop failure if planting occurred following the first onset for dry areas of the catchment. Considering the rainfall analysis, it can be concluded that areas favourable to maize production at the catchment are Entabeni, Lwamondo, Levubu, Thathe, Tshiombo and Vreemedeling; while areas not suitable for maize production are Folovhodwe, Mampakuil, Phafuri, Phunda Maria and Sigonde.

The study further, revealed that planting a 120-day maturing maize crop in December would pose a high risk of frequent severe extreme droughts during the flowering to the grain-filling stage at Levubu, Lwamondo, Thohoyandou, and Tshiombo; while planting in October could place crops at a lower risk of reduced yield and even total crop failure. In contrast, stations located in the low-lying plains of the catchment (Punda Maria, Sigonde, and Pafuri) were exposed to frequent moderate droughts following planting in October, with favourable conditions noted following the December planting date.

Overall features of drought conditions revealed that climate change would enhance the severity of drought across the catchment. This was statistically significant (at 10% significance level) for the near-future and intermediate future climates, relative to the base period.

Figure 2: Meetings with stakeholders held by the study team in the Luvuvhu River catchment area.

The decision support tool

The main output from the project was a web-based decision support tool, the Luvuvhu Agroclimatological Risk Tool (LART), which will be used to provide agrometeorological risk information important to the production of rain-fed maize in the catchment (Figure 3).

The LART has two main components: climatological risk and forecasting crop yield. This will enable the user to obtain agroclimatological risks for different maize crop varieties for a planting window starting in October to January.

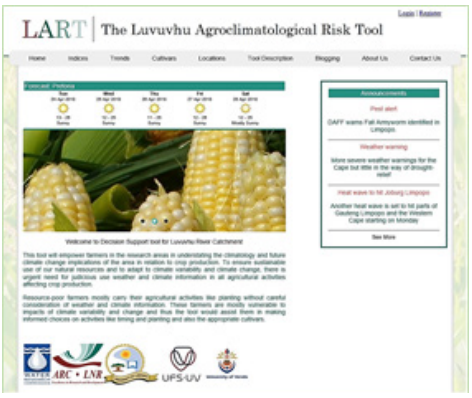

Figure 3: The LART decision support tool home web page.

Conclusions and recommendations

Agricultural production is more vulnerable today than ever before due to increasing population, high input costs and changing climate across the whole of South Africa.

Agricultural production varies significantly from one year to another due mainly to climate risks that affect the area. Recommendations based on this research are as follows:

- Information on rainy season characteristics of different areas should be communicated to extension officers and farmers during workshops.
- Farmers are advised to use seasonal forecasts as a guide in planning for the oncoming season.
- In early onset seasons, late maturing varieties should be planted and in seasons with late onset, early maturing and drought-tolerant maturities should be planted.
- Farmers at wet areas of the catchment are advised to plant both long, medium and early maturing varieties, whereas it is confidently advisable for farmers in the dry areas of the catchment to plant early maturing varieties.
- Analysis on previous droughts led to a recommendation of using October-November as the optimum planting date in the catchment.
- In order to reduce the risk of damaging drought conditions on maize, planting in October can be recommended at regions in the high to moderate rainfall regions, however, planting too early might place crops grown in these areas under drought stress.
- It is advisable for farmers located at the drier areas of the catchment to plant in November.
- It is recommended that there is proper dissemination of flood information from disaster management agencies to the farmers so that they can be properly prepared for the future.
- Sustainable water management measures (such as conservation agriculture) should be planned in order to mitigate the possible effects of climate variability and extremes under climate change.
- For the improvement of agricultural productivity, the Government needs to ensure that proper support such as effective early warning systems and input provision is provided.
- Essential communication between scientists, decision makers and the farmers can help in planning and decision making ahead of and during the occurrence of droughts.

Further reading:

Related project: ***Modelling rainy season characteristics and drought in relation to crop production in the Luvuvhu River catchment of the Limpopo Province*** (**Project No. K5/2403)**. For more information, Tel: (012) 761 9300, Email: info@wrc.org.za or Visit: www.wrc.org.za.