Climate indices for informed agricultural decision-making

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Across South Africa, commercial and subsistence agricultural activities are widespread and highly diversified, ranging predominantly from livestock farming (e.g., cattle, sheep and goats) to crop farming (e.g., maize, wheat, sugar cane and fruit trees). These activities are extremely vulnerable to changing and variable climatic conditions, which during recent years have resulted in increasingly adverse impacts on South Africa's agricultural sector.

Livestock losses, reduced crop yields, pest and disease outbreaks, and farmworkers' deaths associated with increased air temperatures as well as hotter than normal summer season temperatures, have been witnessed in recent years. Furthermore, rainfall patterns have become increasingly irregular, with frequent flooding and drought events, as well as high variability in the amount and distribution of rainfall during the wet season, which has also been linked to poor crop yields, low-quality crops and even entire crop failures.

Accessible climate information

Climate information has always been important for the smooth running of agricultural activities as it helps producers make informed decisions on crop and livestock selection, planting dates, irrigation schedules and many other agricultural practices. However, with the progression of climate change, climate information has become even more important for agricultural decision-making in South Africa, yet such decision-making has some associated challenges.

A contributor to this is that relevant climate information is not always easily accessible for producers, and when such information is available, it is not always presented in a manner that is easily understood or relevant for farming activities. The latter is extremely important because the way in which climate information is presented can substantially hinder or help farming activities.

Value of climate indices

One way to present climate information is through climate indices (see *Figure 1* for examples). A climate index represents a statistical measurement that summarises daily/monthly data, for a specific region and period, in terms of average to extreme conditions. Moreover, it provides valuable information towards understanding temporal trends as well as patterns of variability.

There are many different types of climate indices that exist for the range of climatic variables. For a variable such as rainfall, some climate indices include the total wet season rainfall amount, the number and average length of dry spell periods, or the number of heavy rain days. Some indices for temperature include a count of very hot days or frost days occurring during the growing season.

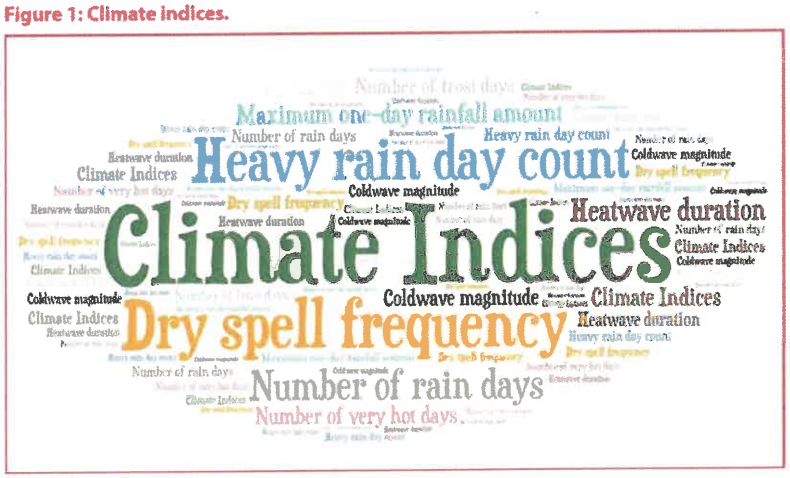
Indices and decision-making

All climate indices can be applied towards decision-making. Indeed, many types of decisions can be based on information derived from a climate index.

The following are a few good examples:

- Producers can use the count of very hot days to inform various decisions related to crop management, irrigation and overall farm planning.
- They can use this information to guide their choice of crop varieties, and for regions with high counts of very hot days, they can select crops that are more resilient to high temperatures.
- Planting schedules can be adjusted to avoid sensitive growth stages during periods of extreme heat, and irrigation schedules can be planned based on the likelihood of very hot (and even dry) days.
- Producers can adjust harvest schedules to avoid peak heat periods, especially for heat-sensitive crops.
- They can even incorporate historical data on very hot days into long-term planning for crop rotations, land use and other strategic decisions.
- Some pests and disease thrive in hot conditions; thus, producers can use this information to determine what

Figure 1: Climate indices.



Photos from the stakeholder meeting held in Tzaneen, Limpopo.

added vigilance is required during the warmer summer months.
- For livestock, additional shade and cooling mechanisms can be provided during periods of extreme heat.

Navigating dry conditions

A rainfall example in a decision-making context is the manner in which producers apply the number and duration of dry spells towards enhancing their resilience to natural climate variability, as well as for more sustainable agricultural practices. Producers can select crops based on the dry spell characteristics of a region – for example, if dry spells occur very frequently, drought tolerant crop varieties can be utilised.

In this same region, this knowledge of frequently occurring dry spells can also prompt water conservation methods, such as mulching to conserve soil moisture, while rainwater harvesting can also be undertaken for water supplementing during dry spells. Producers can adjust planting dates based on expected dry spells, while this information can also be applied towards optimising irrigation schedules.

In terms of livestock management, forecasts of frequent dry spells for a season can be applied towards decisions regarding supplementary feeding options, as well as herd reductions.

Many other decisions can be based on an understanding of dry spell characteristics. Using information from climate indices can indeed help producers enhance their ability to mitigate and adapt to changing climatic conditions while improving the resilience of their agricultural operations. Therefore, the value of obtaining information in the form of climate indices cannot be stressed enough.

New app for information sharing

Through the *Umlindi Newsletter*, the Agricultural Research Council (ARC) has long been presenting climate information in the form of climate indices, such as the standardised precipitation index, providing a measurement of the degree to which rainfall for a period (e.g., one month) is wetter or drier than average conditions.

Although the information presented in the newsletter is extremely valuable, it is static, thus a producer cannot necessarily query the data to determine, for instance, if there is a long-term trend of an increasing frequency of very hot days occurring. Therefore, at the ARC, we are developing a web-based app that will feature climatic information in the form of climate indices.

The app is similar to the *EskomSePush* app. Like the *EskomSePush* app, our forthcoming app will provide key information around which a lot of important planning and money saving decisions can be made. Therefore, this app will be extremely beneficial for producers and other stakeholders, as well as for those involved in other climate sensitive activities, such as water resource management, fire management and tourism, across South Africa.

In highlighting the forthcoming app, note that it will operate in all regions of South Africa. The expected release date is February 2026, and until then interested parties can participate in guiding its development by undertaking a survey (*www.forms.gle/uJEvLHwXD9vmUk1e6*) that aims to explore how climatic information is obtained and applied over South Africa.

Although the project team has consulted with stakeholders operating in and around the Tzaneen region of Limpopo, this survey was developed to obtain wide-ranging inputs so that this app can support decision-makers involved in climate-sensitive activities all over South Africa. For details and updates regarding this app, refer to our GitHub site (*www.github.com/climindex/hydroclimsa*). SF

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The *Umlindi Newsletter* can be accessed at *www.arc.agric.za/arc-iscw/Pages/News-Articles.aspx*, or for more information, send an email to Dr Sarah Roffe at RoffeS@arc.agric.za.

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