

A tool to decode CLIMATE DATA

TerraClim is a climate and terrain tool for the Western Cape that offers powerful decision-making support to pome-fruit growers. By Anna Mouton.

We are all aware that environmental variables such as temperature are decisive for pome-fruit production and quality. This implies that it should be easy for growers to use environmental data to figure out the causes of problems, and to optimise plans for new orchards. Unfortunately, in practice there are two main obstacles to this approach.

To learn more about these challenges, and how the TerraClim tool can help growers to

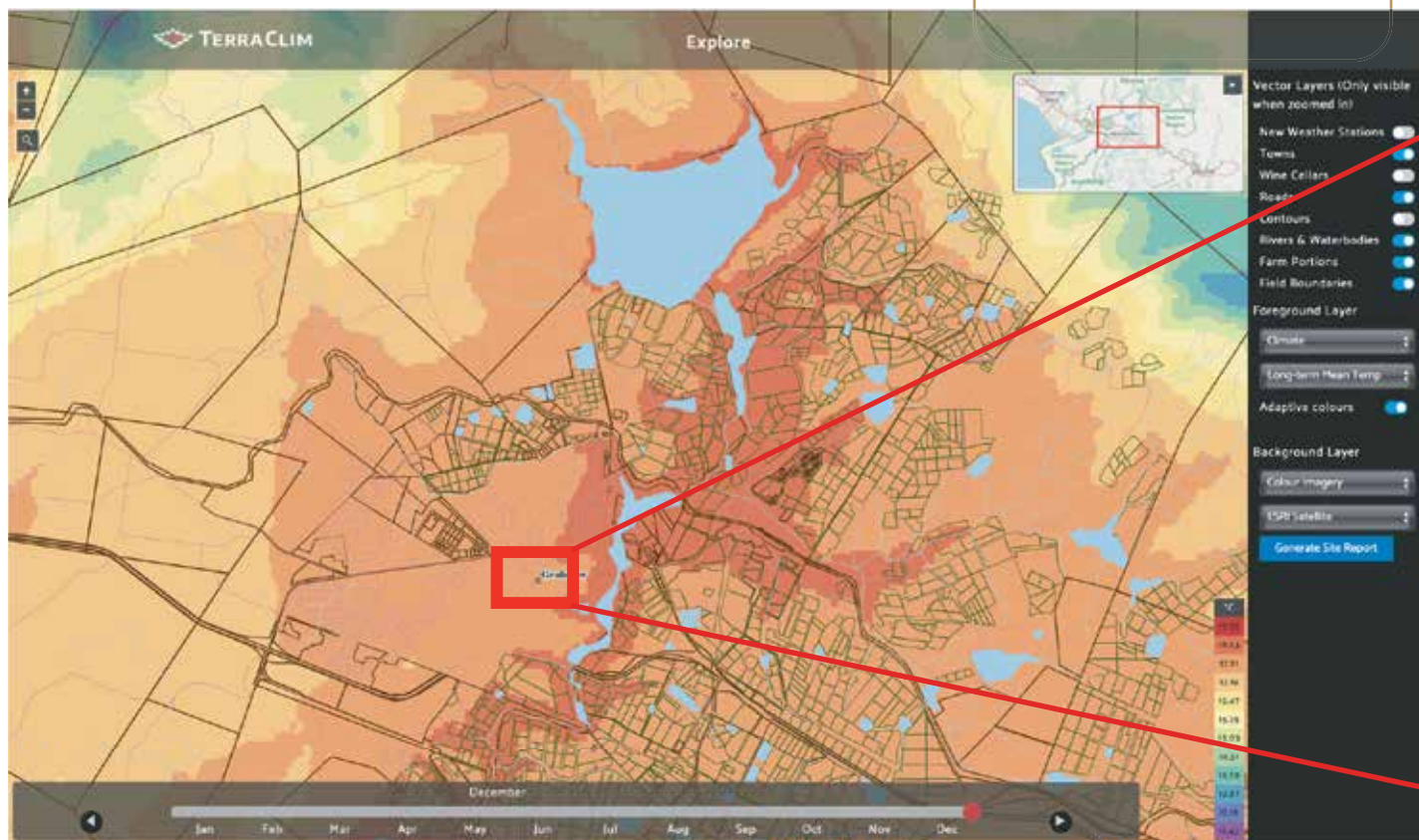
overcome them, *Fresh Quarterly* spoke with Dr Tara Southey, post-doctoral researcher in the Department of Geography and Information Studies at Stellenbosch University, and with Angelique Pretorius, technical manager at Kromco.

Filling in the data gaps

The first obstacle to using climate data is finding information for a specific site. A worst-case

The TerraClim dashboard allows users to select from a range of variables. This view shows roads, water bodies, farm portions, and field boundaries for the Grabouw area. The coloured overlay represents long-term mean temperatures for December, ranging from 12.87 °C for the coolest — darkest blue — to 18.63 °C for the warmest — darkest orange — parts of the map.

figure #1



scenario is where there is no weather station or logger near or on a farm. But even if growers have their own weather stations, they may still find that the data is too coarse-grained to inform decisions about specific orchards. TerraClim solves this problem by providing spatially continuous temperature data.

TerraClim merges climate data gathered from a network of weather stations, including iLeaf, SAEON, and MetosSA, with digital elevation models from GeoSmart to create high-resolution temperature maps. Within the TerraClim tool, users can zoom in to a specific field and access a dashboard that allows them to load maps showing different temperature, terrain, and bioclimatic overlays, such as long-term mean monthly temperatures, elevation, slope, daily-positive chill units, Utah chill units, and many more.

“For Hortgro specifically, we mapped the Elgin-Grabouw-Vyeboom-Villiersdorp area at a 5-metre resolution,” says Southey. “It becomes a very powerful tool when you start looking at temperature analysis over a five-

year period, and you start seeing how change is happening spatially and temporally.”

According to Southey, careful weather-station selection is important to accurately represent the complex terrain of the Western Cape. “We identified 200 weather-station points that we needed to better quantify climate change. Our selection is based on factors such as topography, elevation, and solar radiation.”

One of the strengths of TerraClim is that it can draw in data from many different sources. Southey says that they are always trying to include more data, provided they can reach an agreement with the custodians of the data.

Making sense of the numbers

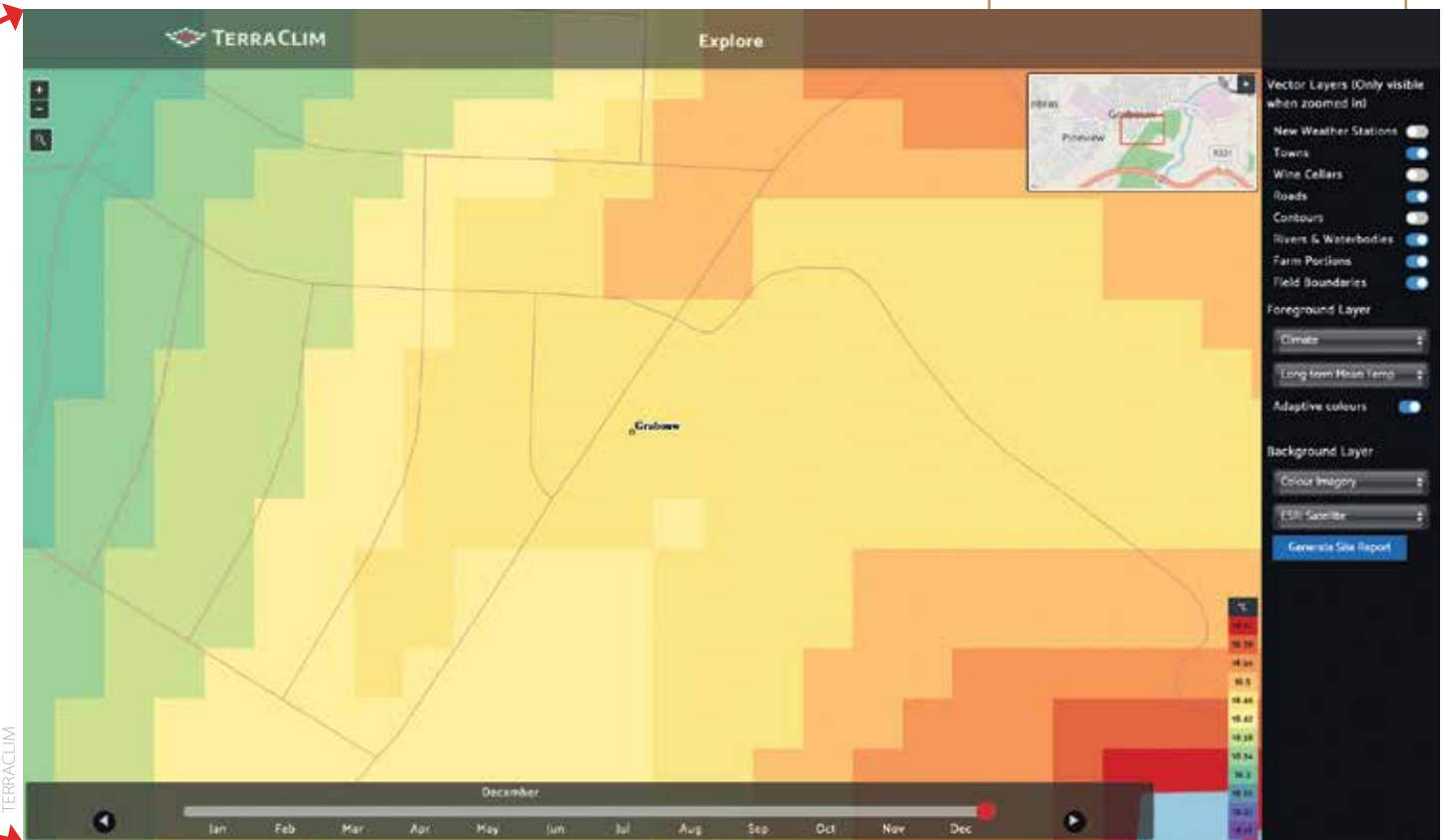
Having good data is one thing. Figuring out what it means is another. Southey says that her own research has taught her the value of correlating temperatures with crop responses over time, so as to link causes and effects. “You can start doing machine learning and identifying new trends, and then you can go

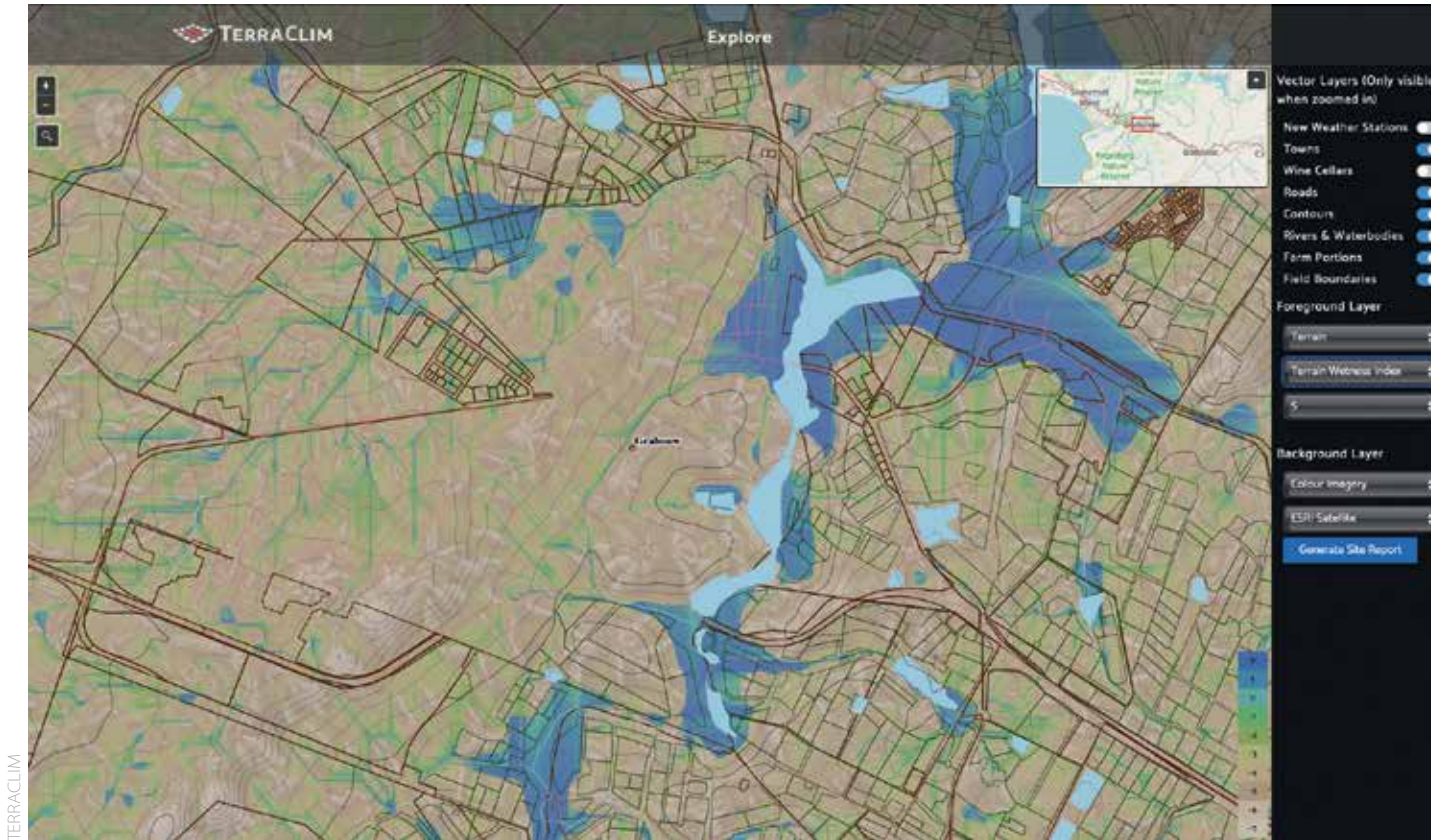
to the climate forecasters to tell them what they need to map.”

Pretorius says that she sees TerraClim as a tool to answer questions. “As an example, the finish — russeting — of Packhams throughout the Elgin-Grabouw-Vyeboom-Villiersdorp region has become worse over recent years. Packhams on a BP1 rootstock are often planted on marginal soils — my impression is that those stressed trees are most affected. But I want to take data

Users can zoom in to obtain higher-resolution data. This is the same overlay as Figure 1 but at a higher magnification which reveals more variation in temperature data.

figure #2





such as pack outs and primary defects, and then use TerraClim to see whether there is a relationship between finish and temperature and topography. If there isn't, we can start looking at other factors.”

TerraClim currently only models temperature, but by the end of the year it will also cover rainfall, relative humidity, and wind. The purpose, says Southey, is not to predict future change, but to learn from existing data. “I prefer to look at hindsight analyses. Part of the value of TerraClim is understanding how a crop is responding to climatic conditions.”

Although researchers are confident that temperature underpins many phenological processes, they are less certain about what exactly should be measured to assess risk and inform decisions. For a grower trying to plan a new orchard, or manage an existing one, it can be difficult to know what the key parameters are. Minimum, maximum, or mean temperatures? Hours above or below a threshold? And when is the crucial time of year?

“I’ve been showcasing TerraClim to pome-fruit growers,” says Southey, “and they’ve been excited about taking data that they

figure #3

TerraClim includes many terrain overlays. This example shows the aspect, with orange representing north, green representing west and east, and blue representing south. The contour overlay is also included.

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have on their orchards, and using machine learning to identify why their pear production has decreased in certain areas, or why has the colour of Pink Ladies been so great in some areas but not in others.”

Pretorius is definitely among the technical advisers who sees the potential. “If you take Pink Ladies, we are planting better strains of Cripps Pink because we want to remain competitive in overseas markets. The value of TerraClim lies in potentially guiding us to the best sites where we can plant our improved Cripps Pink cultivars so that we can get the maximum colour development on fruit.”

Big decisions need big data

TerraClim is one of the ways in which agriculture can reap the benefits of the information revolution, thinks Pretorius. “The advantage of this system is that the entire pome-fruit industry can buy in and feed this database, so that this big data can help us develop algorithms that give us answers.”

Pretorius points to the progress that the wine industry has made with TerraClim. “They are able to select an area of interest and say which cultivar will work best on which rootstock on that soil. I reckon we can do the same for pome and stone fruit.”

The wine industry were the initial funders of TerraClim. Hortgro came on board in 2019 with the project to map the Elgin-Grabouw-Vyeboom-Villiersdorp region. A new Hortgro-funded project will expand TerraClim to cover the Langkloof and Koue Bokkeveld. However, keeping the system going will depend on funding to cover costs such as data acquisition and website maintenance, not to mention the time and expertise of the climatologists who develop the software.

As far as Pretorius is concerned, TerraClim is a good investment. “I think the industry should take the initiative to combine forces to develop affordable technology for pre-harvest decision-making. I hope that we can involve the whole industry in this database, so that

figure #4

This example of a TerraClim terrain overlay shows the terrain wetness index, with darker blue shades representing wetter and lighter brown shades dryer terrain.

everyone can contribute data, and so that we can develop something to help us all to be more sustainable.”

Readers who have not yet tried the TerraClim tool can find it at www.terraclim.co.za.

