



# FORESIGHT

## 2018/19 Trial - User Guide

<b>Introduction</b> .....	<b>2</b>
<i>Access</i> .....	2
<i>What is Foresight?</i> .....	2
<i>The 2018-19 fire season trial</i> .....	2
<i>Background</i> .....	2
<i>Audience</i> .....	3
<i>Foresight versions</i> .....	3
<i>Disclaimer</i> .....	3
<b>Navigating the display</b> .....	<b>4</b>
1. <i>Boundaries</i> .....	6
2. <i>Indicators</i> .....	6
3. <i>Legend</i> .....	12
4. <i>Time bar</i> .....	12
5. <i>Time step</i> .....	13
6. <i>Zoom</i> .....	13
7. <i>Cell data</i> .....	13
8. <i>Expand</i> .....	14
9. <i>Meteograms</i> .....	14
<b>Acronyms</b> .....	<b>17</b>
<b>Troubleshooting</b> .....	<b>17</b>

## **Introduction**

### **Access**

<https://foresight.ffm.vic.gov.au>

Anyone with a FireWeb username and password will be able to access the application.

### ***What is Foresight?***

Foresight is an online bushfire risk visualisation tool. The system displays key forecast bushfire weather variables and indices across Victoria for the week ahead on a single interactive map display. Designed for emergency managers who wanted a zoomable, easy-to-use system that consolidates fire behaviour products on one interface, Foresight assists Victoria's decision makers analyse bushfire risk to inform strategic, tactical and technical decisions.

### ***The 2018-19 fire season trial***

As a new product, Foresight will be available on a trial basis for the 2018/19 fire season. Existing products on EM Drive and FireWeb, such as images from FireMod, district meteograms and fire behaviour estimates, will continue to be available and these should still be used to support operational decisions. While Foresight is being trialled, it is not intended for operational use.

All users of Foresight are requested to register here: <https://www.surveymonkey.com/r/LC6HMQ5> as collection of information from users is an important part of the Foresight trial. By registering you will be able to receive updates on improvements and issues and provide feedback. Following the fire season, a review will be conducted to determine if Foresight will be endorsed as an official product.

### ***Background***

Foresight has been developed in response to findings of a cross-agency user needs assessment conducted in 2017. The assessment report recommended improvements to the interpretability, accessibility, interactivity, reliability, consistency, transparency and compatibility of information for hazard prediction. Foresight brings together several data sets used for bushfire readiness into an easy to use interface towards achieving this goal.

The development of Foresight has been led by Predictive Services Victoria on behalf of bushfire emergency management agencies in Victoria. Initially developed with Code for Australia, Foresight was expanded with the assistance of the Technical Solutions Unit (TSU) in DELWP and Stock Software and is now hosted by TSU.

Thanks to all the generous staff of FFMVic and CFA who contributed to the development of the concept and helped to guide the design.

Funding for this product has been jointly provided by EMV, DELWP, CFA and MFB.

## Audience

Foresight is intended to assist a wide range of people working in bushfire management roles across Victoria. Foresight was developed with a user-centred design approach. Three key user groups were considered which encompasses a range of roles across the state (Figure 1).

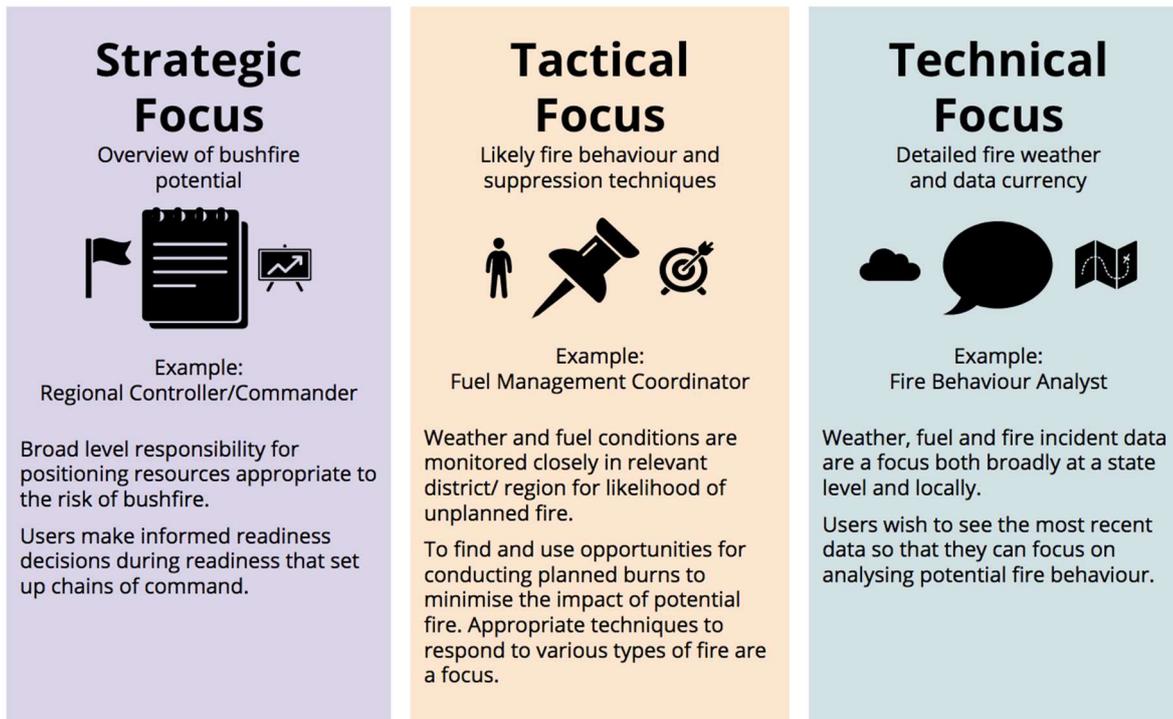


Figure 1. User groups considered when Foresight was designed.

## Foresight versions

Foresight (<https://foresight ffm.vic.gov.au>) contains live data for the week ahead and data sets are updated as they become available. This version of Foresight is being trialled by emergency management staff around Victoria in 2018-19 with the long-term intention that pending success with the trial, it will be used to inform real-time operational decisions.

A historic version of Foresight, to be called Hindsight, is also being developed (<https://hindsight ffm.vic.gov.au>). Hindsight will display weather and bushfire behaviour datasets from the week of the historic bushfire events (e.g. Black Saturday (7/2/2009) and Ash Wednesday (16/2/1983)). Hindsight can be used to demonstrate how Foresight works, particularly when the current data in Foresight is benign, as well as offering a benchmark for comparison purposes. One key difference from Foresight, will be that Hindsight will display data that has been back-casted from real observations (rather than displaying the forecast weather from those weeks).

## Disclaimer

**Foresight is a forecast product generated from Victorian Government and Bureau of Meteorology data. This material may be of assistance to you, but the State of Victoria does not guarantee that the application is without flaw of any kind or is wholly appropriate for your purposes and therefore disclaims all liability for error, loss or damage which may arise from reliance upon it. All persons accessing information via Foresight should make appropriate enquiries to assess the currency of the data.**

## Navigating the display

When you enter Foresight, you will see a grey map of Victoria (Figure 2). Select an indicator from the Indicator drop-down list to get started. This will add data to the map and cause the time bar to appear.

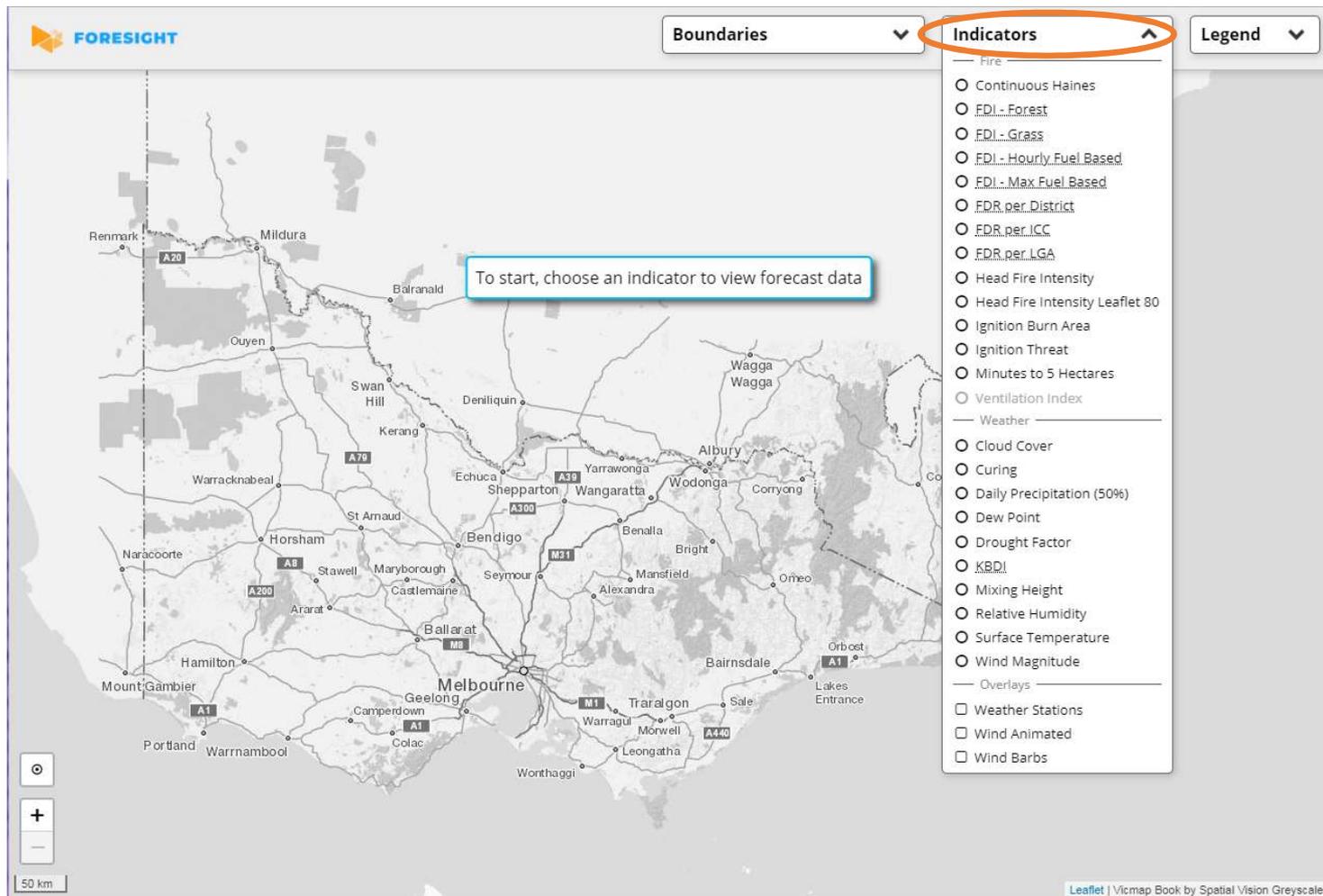


Figure 2. Initial appearance of Foresight

The features of the main screen are introduced in Figure 3 and Table 1. Further information about each feature is then in numbered sections, with numbers matching the numbers used in the figure and table.

It is worth noting that the web address of Foresight changes based on the selected map extent, boundaries and indicators. This allows you to create a bookmark for your favourite view, for example 'Hourly fuel-based FDI for Ararat ICC.'

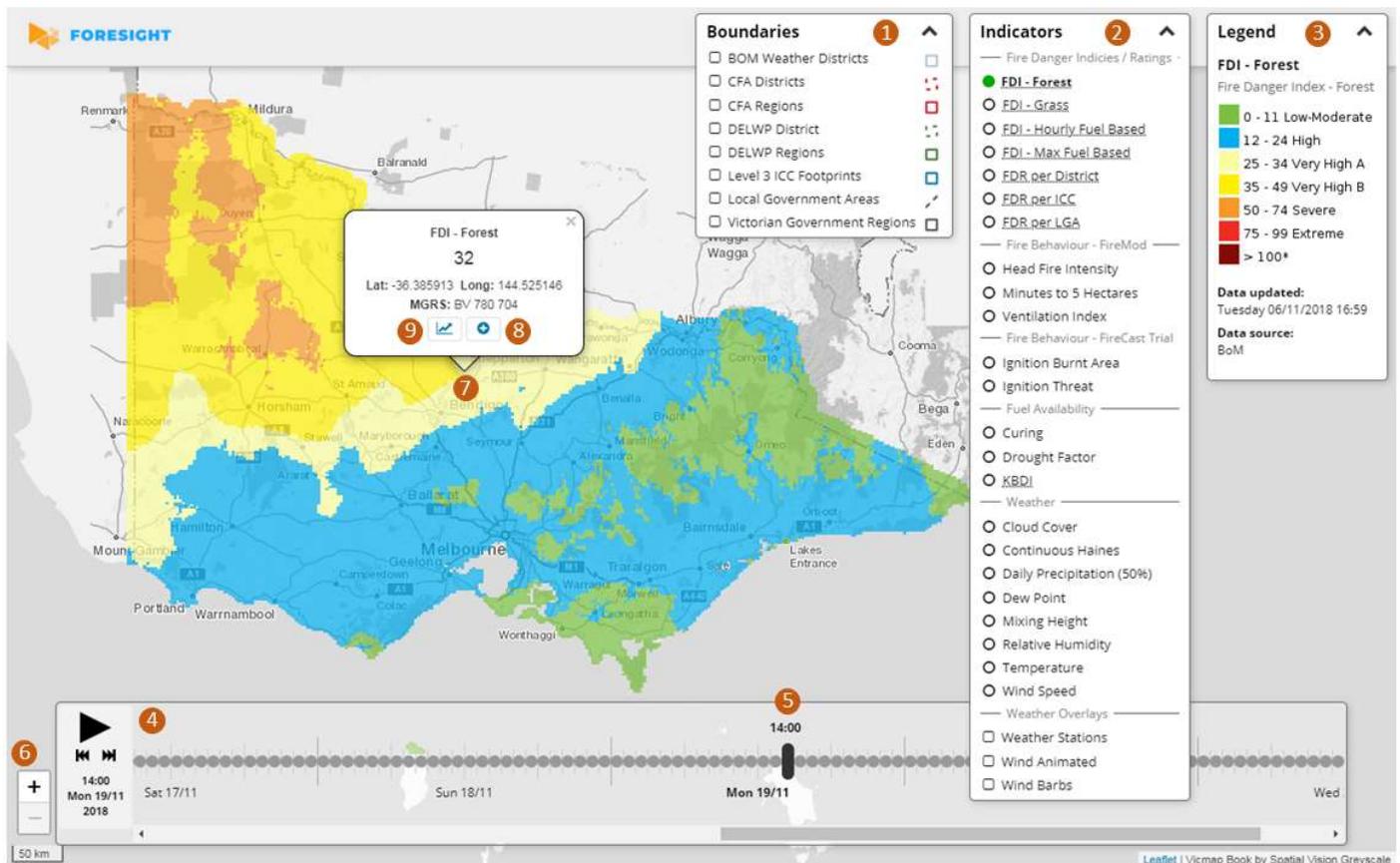


Figure 3. Features of the Foresight display

Table 1. List of features of the Foresight display

Number	Feature Name	Purpose
1	Boundaries	Turns on the administrative boundaries for a range of agencies
2	Indicators	Selects the bushfire behaviour indicator you would like to view
3	Legend	Describes the scale of the relevant indicator and states the date and time the data for that indicator was created and the data source
4	Time bar	Play, pause and skip forward or backward through the data, and see what time in the forecast you are viewing
5	Time step	Indicates the selected date and time for the data that is being displayed in the map.
6	Zoom	Zoom the map in and out. You can also use your mouse to zoom and pan in the map.
7	Cell Data	Retrieves the data for that individual cell, including the latitude and longitude and grid reference
8	Expand Cell	Opens a larger cell data pop up that includes the cell data for all indicators for the selected point.
9	Meteograms	Access graphs displaying key indicators through the forecast period. When your point of interest is within 10km of an AWS, review how accurate the forecast has been tracking against actual readings

## 1. Boundaries

Using the ‘boundaries’ drop-down (Figure 4), several agency administration boundaries are available to view on the map. Multiple boundary layers can be switched on at once. Below you can see the level 3 ICC Footprint boundaries (Figure 5)

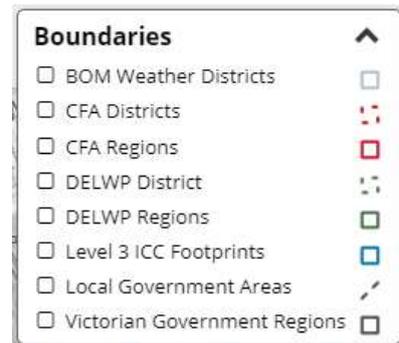


Figure 4. Boundaries drop-down

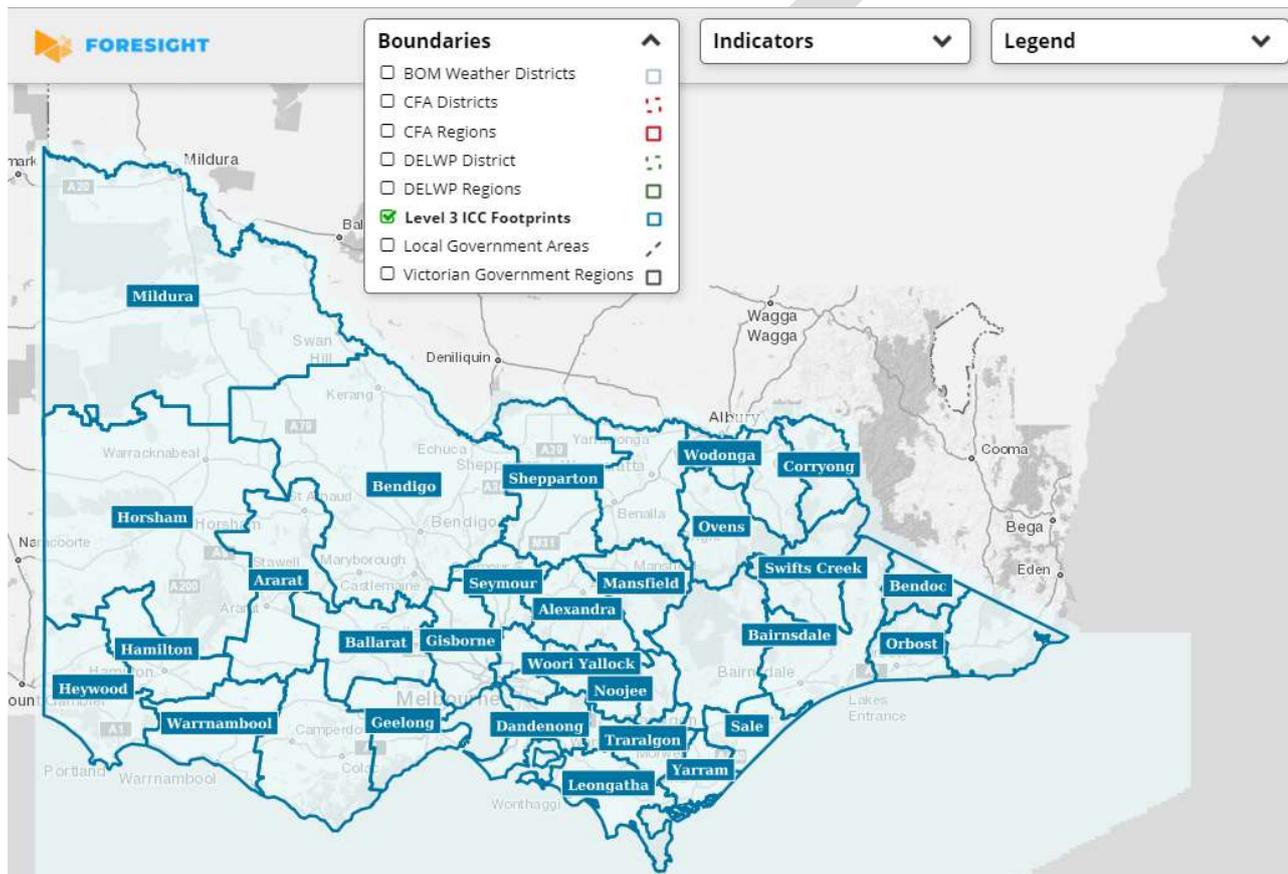


Figure 5. ICC Footprint boundaries

## 2. Indicators

The ‘indicators’ drop-down (Figure 6) includes a range of bushfire weather variables and risk indices commonly used by emergency services in Victoria. An indicator can be displayed on the map by selecting an indicator from the list in the drop-down. This drop-down is organised into groups. Only one fire indicator or weather indicator can be displayed at a time.

Table 2 provides the descriptions, source, temporal and spatial resolution of each indicator available in Foresight. Extra information about some of these products can also be found in the Product Guide and the Predictive Services Video Series.

The location of weather stations can be displayed on the map by selecting 'weather stations' from the 'indicators' drop-down. Two types of weather stations appear (Figure 7), these are Automatic Weather Stations (AWS) (shown by a blue circle) and non-AWS (shown by a purple circle).

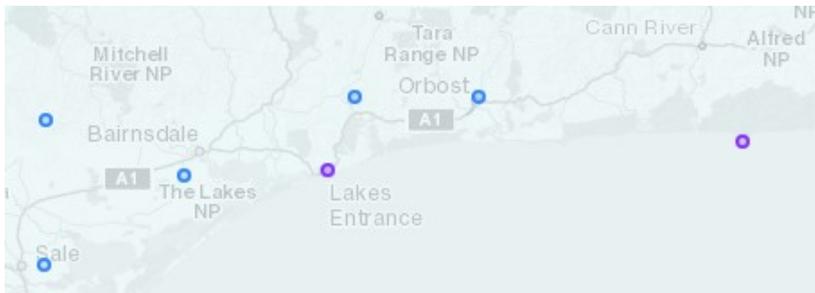


Figure 7. The appearance of weather stations

Two wind layers are also available to be displayed. One is an animated wind layer (Windy) (Figure 8) the other is a traditional wind barb layer (Figure 9).



Figure 8. The appearance of the animated wind layer - Windy



Figure 9. The appearance of the wind barb layer

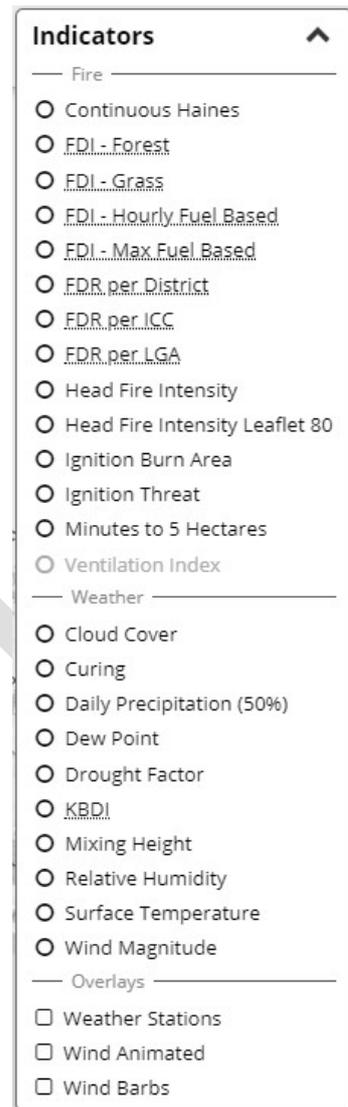


Figure 6. Indicators drop-down

Table 2. Foresight indicator descriptions

Indicator Group	Indicator	Description	Source	Source System/Product	Data point duration (temporal resolution)	Cell size (spatial resolution)
Fire Danger Indices/Ratings	FDI Forest	Forest Fire Danger Index expresses fire risk and behaviour for forest fuels. Inputs include temperature, relative humidity, average wind speed at 10 m and fuel availability (drought factor).	BOM	Gridded Weather^	Hourly	3 km
Fire Danger Indices/Ratings	FDI Grass	Grass Fire Danger Index expresses fire risk and behaviour for grass fuels. Inputs include temperature, relative humidity, average wind speed at 10 m and fuel condition (curing).	BOM	Gridded Weather^	Hourly	3 km
Fire Danger Indices/Ratings	FDI Hourly Fuel Based	A combined map of forest and grass FDI. The FDI displayed for each cell is based on the predominant fuel type for that cell. To determine which fuel type applies to a cell of interest - open the expanded cell data pop-up and compare the FDI forest and FDI grass values to the FDI Hourly Fuel Based.	TSU (method from CFA)	FireMod*	Hourly	3 km
Fire Danger Indices/Ratings	FDI – Max Fuel Based	An aggregated layer showing the daily maximum hourly fuel based FDI for each grid cell.	BOM	Gridded Weather^	Daily	3 km
Fire Danger Indices/Ratings	FDR per District	The forecast Fire Danger Rating for each BOM weather district calculated from the highest maximum fuel based FDI that applies to at least 10% of the BOM weather district for that day.	DELWP – TSU (method from CFA)	FireMod*	Daily	3 km
Fire Danger Indices/Ratings	FDR per ICC	The forecast Fire Danger Rating for each Incident Control Centre footprint calculated from the highest maximum fuel based FDI that applies to at least 10% of the ICC footprint for that day.	DELWP – TSU (method from CFA)	FireMod*	Daily	3 km
Fire Danger Indices/Ratings	Trial layer - FDR per LGA	Trial layer - The forecast Fire Danger Rating for each Local Government Area calculated from the highest maximum fuel based FDI that applies to at least 10% of the LGA for that day.	DELWP – TSU (method from CFA)	FireMod*	Daily	3 km
Fire Behaviour - FireMod	Head Fire Intensity	A measure of how hot fires will be or the rate of heat release per unit length of flame combustion extending from the leading edge of the fire front to the rear of the flaming zone.	DELWP – TSU	FireMod*	Hourly	3 km
Fire Behaviour - FireMod	Minutes to 5 Hectares	A measure of how fast an ignition will grow or the number of minutes it would take for a point source ignition to reach 5 hectares in size.	DELWP – TSU	FireMod*	Hourly	3 km

Indicator Group	Indicator	Description	Source	Source System/Product	Data point duration (temporal resolution)	Cell size (spatial resolution)
Fire Behaviour - FireMod	Ventilation Index	A measure of the potential of the atmosphere to disperse airborne pollutants such as smoke from a stationary source. It is based on both the current wind speed in the mixed layer and the mixing height.	DELWP – TSU	FireMod*	Hourly	3 km
Fire Behaviour – FireCast TRIAL	Ignition Burnt Area	FireCast trial layer - Shows the predicted burnt area of a fire starting in that location. Calculated using the Phoenix RapidFire model and based on a 1pm ignition on the selected day and assuming no suppression.	DEWLP - FFRAU	FireCast#	Once-daily	1 km
Fire Behaviour – FireCast TRIAL	Ignition Threat	FireCast trial layer – Shows the predicted potential house loss of a fire starting in that location. Calculated using the Phoenix RapidFire model and based on a 1pm ignition on the selected day and assuming no suppression.	DEWLP - FFRAU	FireCast#	Once-daily	1 km
Fuel Availability	Curing	A measure of the amount of fuel available to combust or the percentage of dead material in grasslands.	BOM (CFA provides data to BOM)	Gridded Weather^	Daily	3 km
Fuel Availability	Drought Factor	A measure of the proportion of fine fuel that is flammable based on the degree of wetting by rainfall and the rate of drying of the over the last 20 days	BOM	Gridded Weather^	Three-hourly	3 km
Fuel Availability	KBDI	Keetch Byram Drought Index - A measure of the cumulative moisture deficiency in the upper soil layers (top 200 mm of the soil profile) and is used as one of the parameters in the calculation of drought factor.	BOM	Gridded Weather^	Daily (from 11am)	3 km
Weather	Cloud Cover	A measure of the percentage of cloud cover in the atmosphere.	BOM	Gridded Weather^	Hourly	3 km
Weather	Continuous Haines	A measure of atmospheric stability and dryness that may cause erratic fire behaviour in going fires.	BOM	Gridded Weather^	Three-hourly	3 km
Weather	Daily Precipitation (50%)	Amount of rainfall (mm) for which there is a 50% chance of exceeding in the 24 hours from 15UTC	BOM	Gridded Weather^	Daily	3 km
Weather	Dew Point	A measure of the moisture content of the air and is the temperature to which air must be cooled for dew to form.	BOM	Gridded Weather^	Hourly	3 km

Indicator Group	Indicator	Description	Source	Source System/Product	Data point duration (temporal resolution)	Cell size (spatial resolution)
Weather	Mixing Height	A measure the upper height, in metres above sea level, to which the lower atmosphere will undergo mixing (mechanical or turbulent) resulting in a nearly uniform air mass.	BOM	Gridded Weather^	Hourly	3 km
Weather	Relative Humidity	The most commonly used measure of atmospheric moisture and is defined as the ratio of the amount of water vapour measured to that which air could hold at saturation.	BOM	Gridded Weather^	Hourly	3 km
Weather	Temperature	Ambient air temperature at ground level.	BOM	Gridded Weather^	Hourly	3 km
Weather	Wind Speed	The 10-minute averaged wind speed, based on a 10-metre standard height. Wind gusts can be 40 percent stronger than the average speeds presented.	BOM	Gridded Weather^	Hourly	3 km
Weather overlays	Weather Stations	Locations of Automatic Weather Stations (AWS) and other non-automatic weather stations from which the BOM collects observation data. AWS generally provide observations every half hour. Non-AWS data is less frequent (e.g. twice daily).	BOM	BOM observations	n/a	n/a
Weather overlays	Wind Animated	An animated representation of forecast wind particle movement. It is produced by windy.com using global weather forecast ensembles.	windy.com	Windy	Hourly	9 km
Weather overlays	Wind Barbs	A combined indicator of forecast wind speed (10-minute averaged wind speed, based on a 10-metre standard height) and wind direction.	BOM	Gridded Weather^	Hourly	3 km

#### *^Gridded Weather*

The Gridded Weather is a compilation of datasets (NetCDF files) of forecast weather variables for the present day and the week ahead. The Gridded Weather is produced by the BOM using the Graphic Forecast Editor (GFE) system. The Gridded Weather is produced at a 3km resolution using data sourced from a range of global weather forecasting models. The Gridded Weather data files are updated twice daily. A full update of all days in the forecast period occurs in the afternoon update. The morning update (usually completed by 6am) provides updated NetCDF files where only the data for the current day has been updated.

#### *\*FireMod*

FireMod uses the Gridded Weather, together with fuel and topography datasets, to calculate a range of forecast fire weather and fire behaviour spatial data sets. The FireMod system is maintained by TSU within Forest, Fire and Regions at DEWLP. FireMod will be triggered to run when the BOM release updated Gridded Weather.

#### *#FireCast*

FireCast uses the Phoenix bushfire simulator in a cloud-computing system to model the fire behaviour of 288,00 ignition points on a 1km grid across the state. FireCast runs once a day in the morning after the Gridded Weather is produced. The system has been developed by the Forest and Fire Risk Assessment Unit within Forest, Fire and Regions at DEWLP.

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### 3. Legend

The 'legend' drop-down Figure 10 displays the legend of the indicator. Units of measurement are displayed next to the indicator name. The colours and classes in legends are generally consistent with existing BOM, CFA or DELWP products.

The legend drop-down includes the source of the data and the time and date of when that data was created at the source location.

It is important to note that the data for the current and coming six days is sourced from the most recent forecast files available; this is the date and time shown in the legend. Modelled data displayed for the previous two days is sourced from the last created forecast for those days.

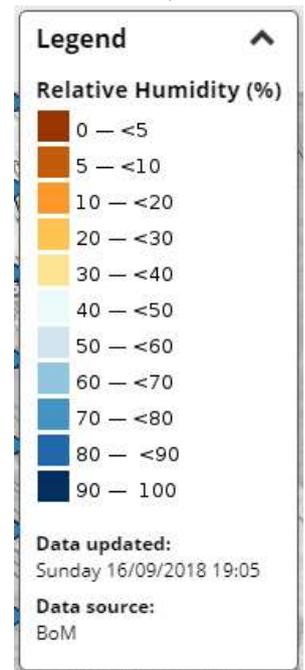


Figure 10. Legend drop-down

### 4. Time bar

When an indicator is selected, the time bar (Figure 11) appears. The time bar includes a nine-day period:

- Two days prior to today
- Today, and
- Six days ahead.

Figure 11. Foresight time bar



The time bar will automatically be positioned at the current date and hour when you open or refresh Foresight.

When you press the 'play' button Foresight will automatically move through the time steps for the selected indicator. When it reaches the last time step, it will automatically start from the current time point and cycle again through the time steps. The 'pause' button can be used to halt the animation.

The 'fast forward' and 'rewind' buttons move forward or backward in 24-hour jumps from the selected time step. For example, this can be used to view the 13:00 hours forecast on consecutive days.

## 5. Time step

The vertical black marker  in the time bar identifies the selected 'time step'. The 'time step' shows the time/date of the forecast being displayed. You can click anywhere along the time bar to shift the time step. It is also possible to move to a different time step by clicking within a meteogram (refer to Meteograms).

The grey data markers  in the time bar indicate the duration of data points for the selected indicator. The duration may be daily, 3-hourly or hourly. The data point duration for each indicator is listed in 'Error! Reference source not found.'. If there is an absence of data in the nine-day period, then the grey data markers will be absent at relevant time steps.

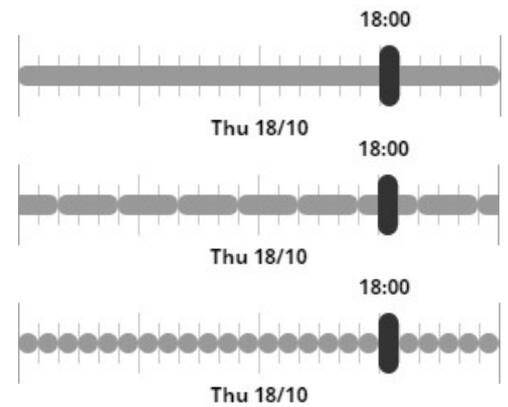


Figure 12. Differing length of data points in Foresight

## 6. Zoom

The 'plus' and 'minus' zoom buttons  allow a user to zoom in and out in the map window. The scroll wheel on your mouse can also be used to zoom and pan in the map.

It is worth noting that the web address of Foresight changes based on the selected map extent, boundaries and indicators. This allows you to create a bookmark for your favourite view, for example 'Hourly fuel based FDI for Ararat ICC.'

## 7. Cell data

In the map, you can click your mouse to select a point location. When a point is selected a cell data pop-up appears (Figure 13). This pop-up includes the:

- numerical indicator value for the cell for which the selected point falls within;
- latitude and longitude and MGRS grid reference for that point;
- graph button (for opening meteograms); and
- expand button (for obtaining more detailed cell values).
- name and proximity of the nearest weather station to that point (if there is one within 10km);

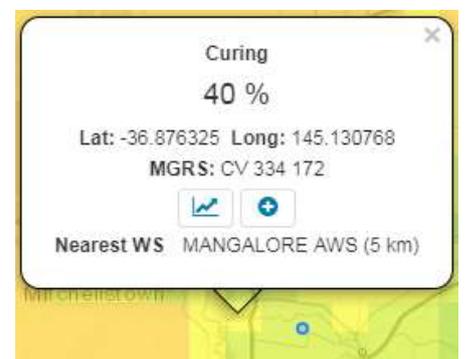


Figure 13. Primary cell data pop-up

### 8. Expand

In the cell data pop-up, the 'expand' button  can be clicked to open a secondary pop-up (Figure 14) which displays the numerical values for all fire and weather indicators for the cell for which the selected point falls within.

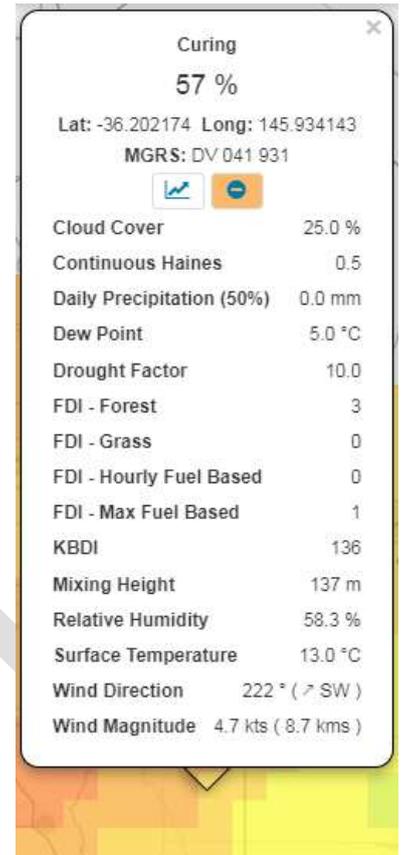


Figure 14. Secondary cell data pop-up

### 9. Meteograms

In the cell data pop-up, the 'graph' button  can be clicked to open the meteogram window (Figure 15). A meteogram is a graphical representation of one or more meteorological variables with respect to time, whether observed or forecast, for a location. It is useful for viewing a trend in weather variables and indices and how they may be interacting over time. This can be important for identifying risks in fire behaviour such as a lack of overnight recovery.

The meteogram window displays six meteograms. These meteograms mirror the meteograms already available in other products (refer to Table 3).

Table 3

Meteogram	Precedent Product
Relative Humidity and Cloud Cover	DELWP Fire District Meteograms
Temperature and Dew Point	
Forest Fire Danger Index and Grass Fire Danger Index	
Wind Speed and Direction	
Fireline Intensity - Bushfire conditions	Fire Behaviour Estimates
Fireline Intensity – Planned burning conditions	Planned Burning Fire Behaviour Estimates

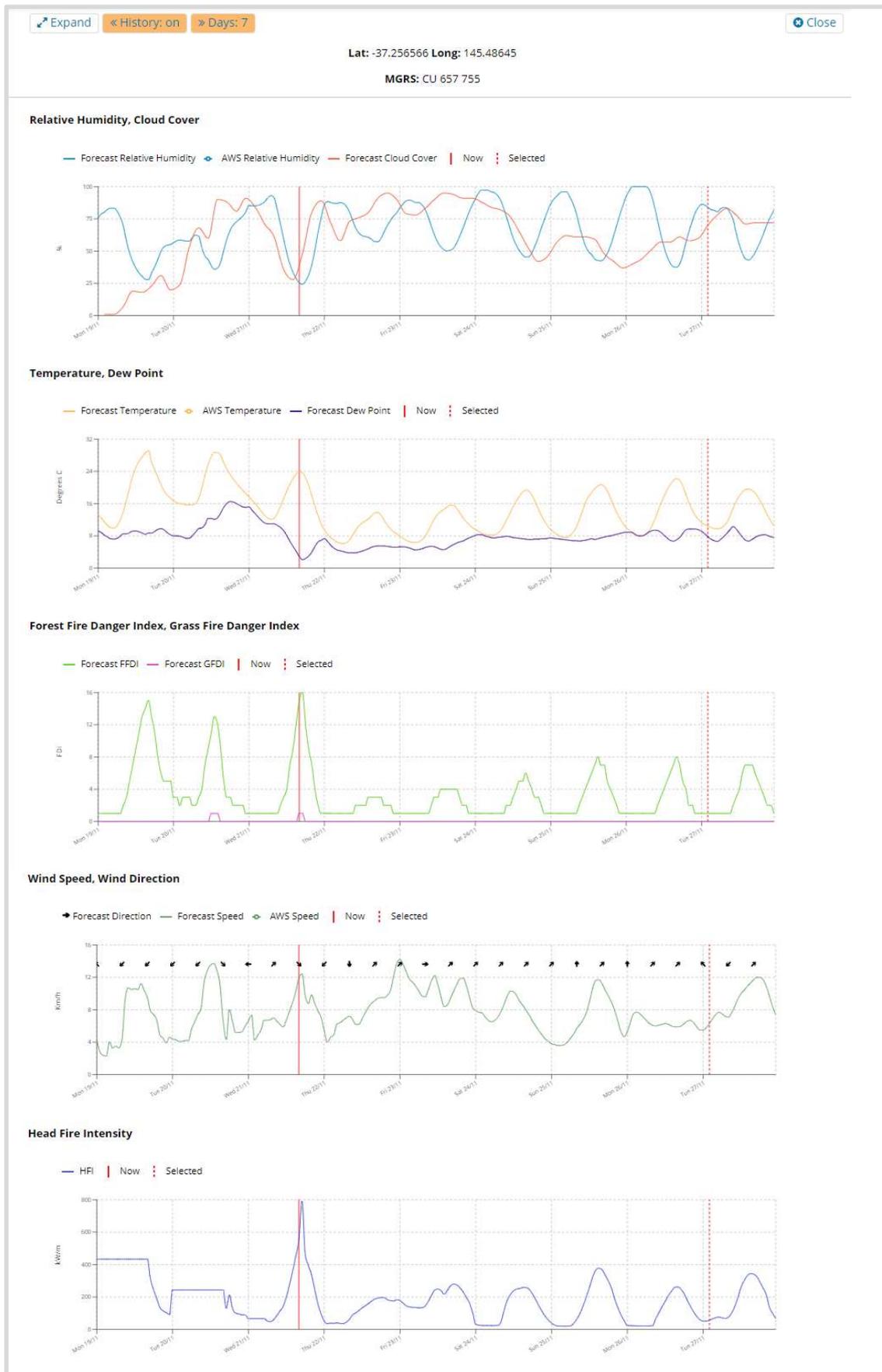


Figure 15. Meteogram window

Within each meteogram, the selected date and time is represented by a dashed red line (Figure 16). The solid red line shows the current date and hour (now).

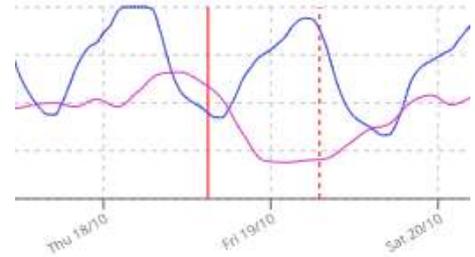


Figure 16. Now and selected time steps

Scrolling over a data point in a meteogram will reveal the numerical value for that indicator at that time step (Figure 17).

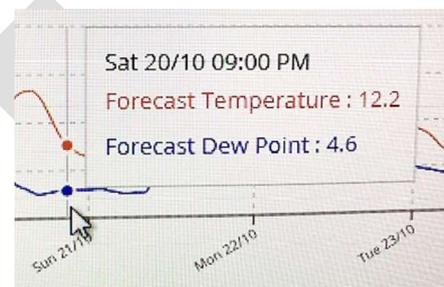


Figure 17. Data will appear upon scrolled over

Use the 'expand' and 'compress' buttons to change the size of the meteogram window to fully or partially occupy the main window.

Click the 'history' button to switch on/off the visibility of the two days prior to the present within the meteograms.

Use the 'days' button to switch between visibility of a two-day or seven-day forecast period within the meteograms. AWS are fully automated BOM weather stations that collect a large set of weather variables according to stringent methods. Data is reported on a half hour frequency. Non-AWS are weather stations that generally collect fewer variables and data is usually reported less frequently (e.g. twice daily). Portable weather stations will also appear if any have been deployed in the state.

If a weather station is within 10km of the selected point, then observation data for the nearest weather station is also shown on the meteogram (Figure 18). This allows comparison of the forecast (predicted) conditions against the observed weather (actual) at the nearby weather station. This is important for helping to assess the reliability of the forecast.

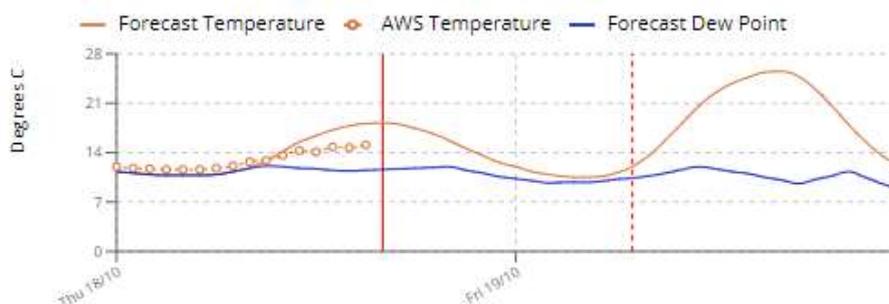


Figure 18. AWS observation data in a meteogram

## Acronyms

DELWP	Department of Environment, Land, Water and Planning
BOM	Bureau of Meteorology
CFA	Country Fire Authority
FDI	Fire Danger Index
FDR	Fire Danger Rating
FFRAU	Forest and Fire Risk Assessment Unit
FFMVic	Forest Fire Management Victoria
GFE	Graphical Forecast Editor
ICC	Incident Control Centre
LGA	Local Government Area
MGRS	Military Grid Reference System
TSU	Technology Solutions Unit

## Troubleshooting

Since Foresight is a new platform some unexpected technical errors may occur from time-to-time. Table 4 lists some potential problems and solutions. The aim of the Foresight project is to create a platform that is helpful and works smoothly at a range of locations around Victoria, therefore to support this, it is important that users provide feedback about their experiences. If you have ongoing issues/frustrations, you are encouraged to report these by submitting feedback via clicking the 'Feedback' button within Foresight. Users of the trial version of Foresight are also encouraged to become a registered trial participant (you can register here: <https://www.surveymonkey.com/r/LC6HMQ5>) so that the breadth of both positive and negative experiences can be understood.

Table 4. Possible Foresight problems, causes and suggested solutions

Problem	Possible causes	Suggested solutions
Can't access Foresight	<ul style="list-style-type: none"> <li>• Incorrect FireWeb credentials</li> </ul>	<ul style="list-style-type: none"> <li>• Contact FFMVic Application Support</li> </ul>
Data loading slowly or not at all	<ul style="list-style-type: none"> <li>• Server overload</li> <li>• Poor internet connectivity</li> </ul>	<ul style="list-style-type: none"> <li>• Refresh or relaunch the Foresight page</li> <li>• Provide details via 'Feedback' button</li> <li>• Use existing products</li> </ul>
Error message or crash	<ul style="list-style-type: none"> <li>• Server overload</li> <li>• Poor internet connectivity</li> </ul>	<ul style="list-style-type: none"> <li>• Refresh or relaunch the Foresight page.</li> <li>• Provide details via 'Feedback' button</li> <li>• Use existing products</li> </ul>
Unsure of how to interpret the data	<ul style="list-style-type: none"> <li>• Unfamiliarity with the data sets and/or interface</li> </ul>	<ul style="list-style-type: none"> <li>• Read the indicator descriptions in the user guide</li> <li>• Talk to your local FBAN</li> <li>• Use existing products</li> <li>• Ask a question via 'Feedback' button</li> </ul>
Data sets appear incorrect	<ul style="list-style-type: none"> <li>• Source data set is incorrect</li> <li>• Error in data creation</li> <li>• Error in data retrieval</li> <li>• Error in data display</li> </ul>	<ul style="list-style-type: none"> <li>• Provide details via 'Feedback' button</li> <li>• Use existing alternative products</li> </ul>