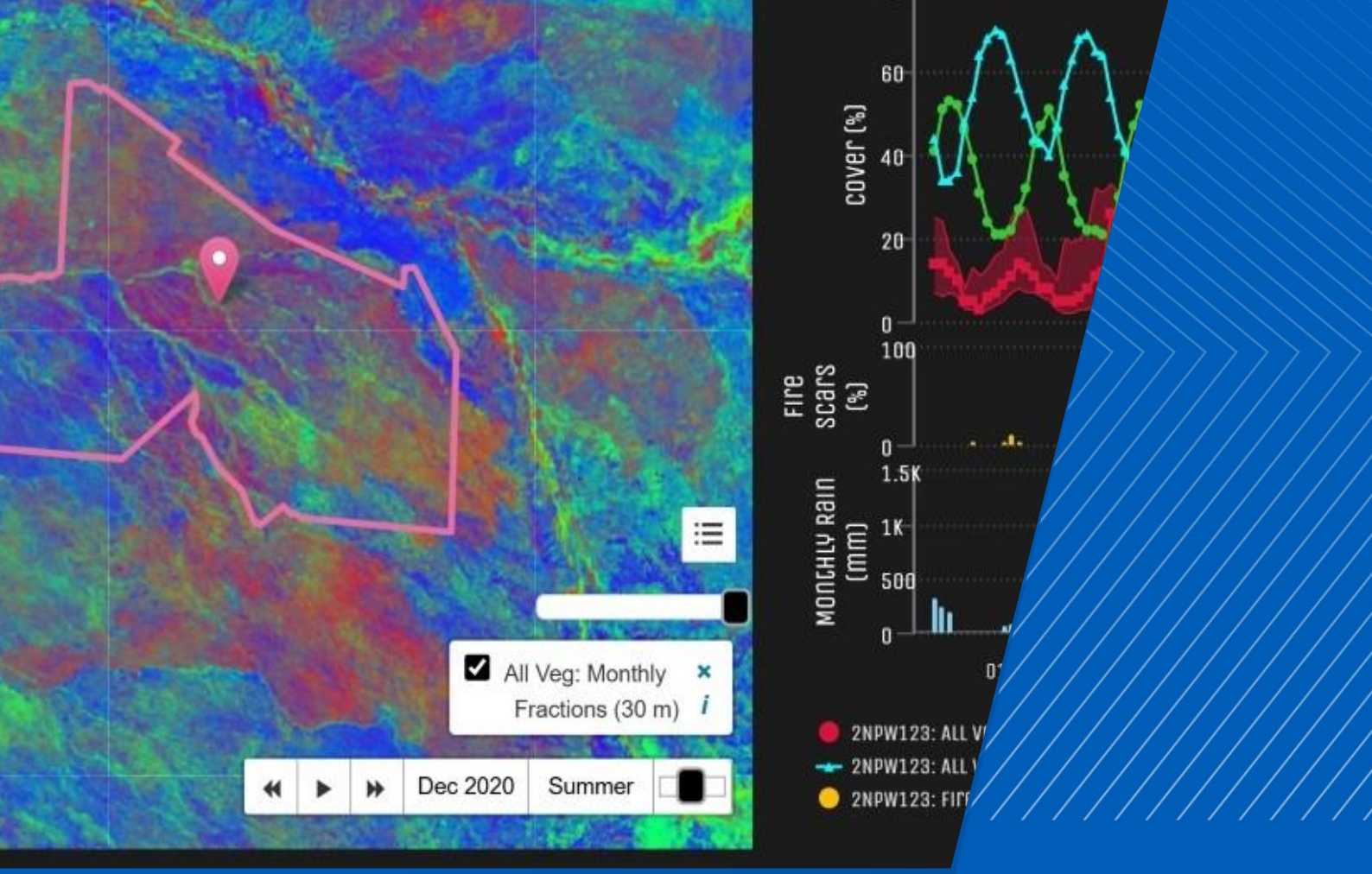

VegMachine User Guide

2026

DELIVERING FOR QUEENSLAND

Queensland Government

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Earth Observation and Social Sciences, Science,
Department of the Environment, Tourism
Science and Innovation.

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May 2026

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Acknowledgements
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VegMachine

Access VegMachine for free at

https://vegmachine.science-data.qld.gov.au/

VegMachine is an online tool to summarise decades of satellite data over Australia quickly and easily. By making these datasets freely available, it can help people looking after the land to understand and communicate patterns in the landscape and the outcomes of management decisions.

With VegMachine you can:

-
- Display satellite datasets of vegetation cover from 1988 onwards.
- ***Chart*** vegetation cover, fire, and rainfall datasets through time for user-defined areas. Instantly *connect* these charts with the image display, to better understand vegetation patterns through time and space.
- ***Extract and summarise data*** to conduct your own analysis.

It is available as a mobile app and for desktop use through an internet browser. The app offers best performance on mobile, while the desktop version is better for examining maps and charts in detail. The desktop version can also be installed as a desktop app.

To use as a mobile app, go to the webpage on your mobile, then save it to your phone's home screen. A separate mobile quick guide is also available as some features are slightly different.

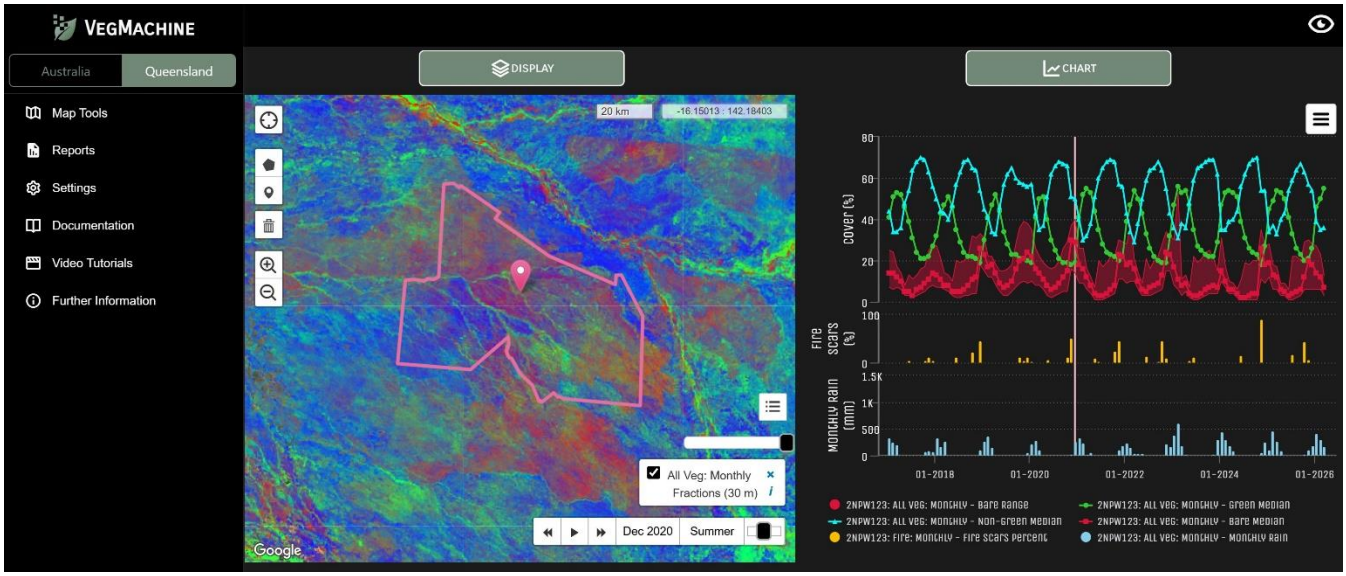

Figure 1 – Example of VegMachine desktop interface.

Display

Navigation

- *Navigate* the map window by clicking and dragging to your preferred location.
- *Zoom* to your preferred scale by scrolling in or out.
- Use the magnifying tools to zoom to features.
  - Click once to zoom to all features
  - Click twice to zoom to selected features
  - Click to zoom to full extent (Queensland or Australia)
- On mobile, *zoom to your current location* using your phone's GPS.
- *Search for a location* or *upload* your own spatial data using the ***Map Tools***.

Data display

Select a particular dataset to display in the map window display by clicking the *Display* tab and choosing one of the options. (On mobile, you will need to click *Display* twice). There are some datasets available Australia-wide, and more available just in Queensland. To access the additional datasets, activate the *Queensland* region button at the top of the main menu on the left. Find out more on ***Which dataset should I use?*** (page 8).

Once you have selected a dataset, you can then:

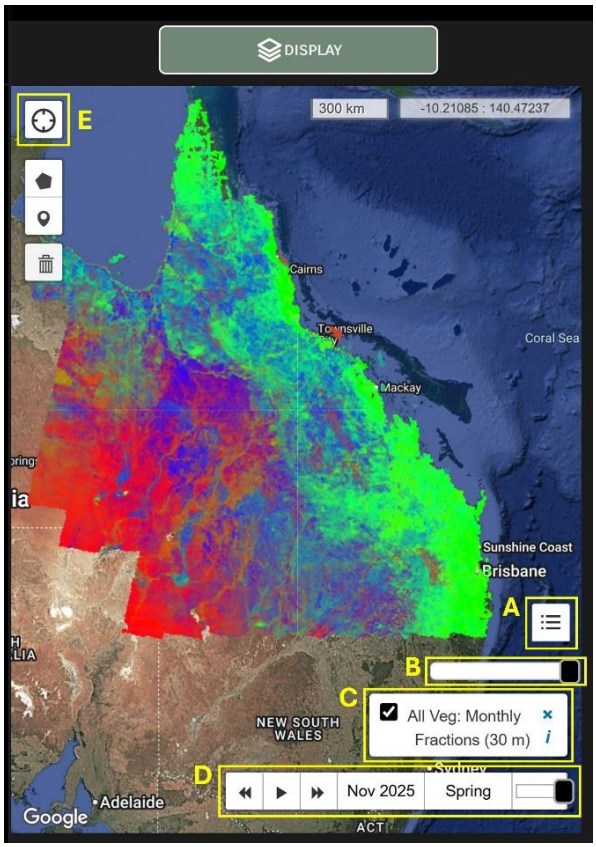

Figure 2 – Example of VegMachine map window display

A. Make the legend visible by clicking the legend button. Make it invisible by clicking the legend itself.

B. Change the transparency of the satellite dataset using the slider, with 0% transparency (i.e. completely opaque) on the right, and 100% transparency (i.e. only the base map visible) on the left.

C. Manage the dataset layer. The tick box ☑ turns the layer on and off, useful for comparing features with the base map.

   The ✖ removes the layer from the map.

   The info button *i* provides a brief description of the layer, as well as a link to the more detailed metadata.

D. Explore back and forth through time using the time slider.

E. Investigate the data values of individual pixels using the Pixel Identify Tool.

The first time you zoom to a particular location, the imagery may take a few moments to load. For future visits, this imagery is cached and will load more quickly. To easily cache all imagery, click the 'play' button on the time slider and wait for it to cycle through all the images.

For Queensland, it is also possible to view property boundaries via the Vector Overlays option under the dataset list. Due to the complexity of this layer, it is restricted to land parcels of more than 5 hectares, and is only visible when zoomed in.

Map Tools

Use *Map Tools* in the left-hand Main Menu (see Figure 1) to import, rename, and download your own spatial features, or search for a location.

- *Import Features*. Most spatial data formats are supported for import. Multifile formats, such as shapefiles, need to be in a single zip file.
- *Rename Features*. Multiple features can be selected for manual renaming. This is most useful for features drawn within VegMachine, but any feature can be renamed.
- *Download Features*. Features within VegMachine can be downloaded in GeoJSON format. All features are downloaded, not just those selected. Features persist across sessions. However, downloading them as a backup is advised if you wish to analyse the same areas in future.
- *Search for Location*. It is possible to search by feature label, address or coordinates within Australia. You can also search by property details for lots greater than 5 ha within Queensland.

Charts

One of the most powerful aspects of VegMachine is summarising years of satellite data over a particular area. First *create* and *select* an area of interest, then *extract* and *summarise* the data.

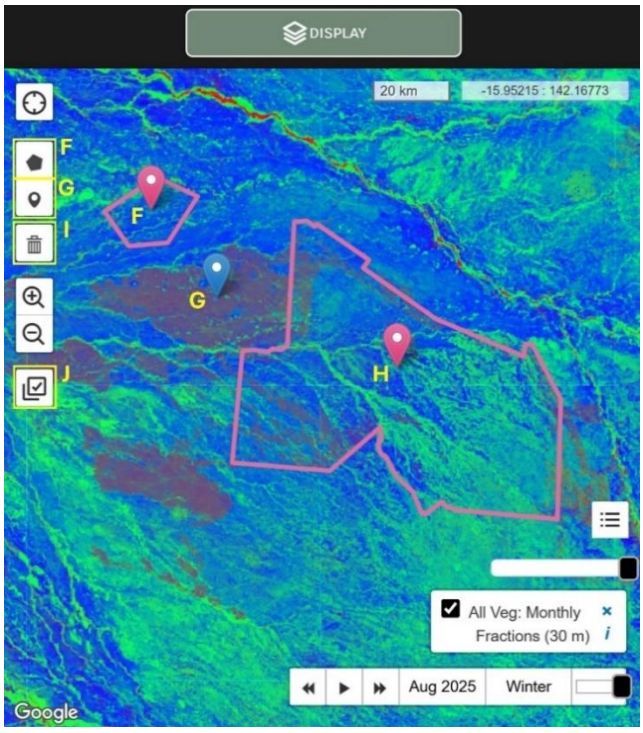

Figure 3 – Creating and deleting areas of interest

Create or delete an area of interest

Create an area of interest by:

- Using the polygon tool to manually create an area (see F on figure 3); or
- Using the marker tool to make ~1 ha circle around a point (see G); or
- Within Queensland, selecting a property boundary (layer available under Vector Overlays) (see H).
- On mobile, logging a point at your current location via the GPS tab; or
- Uploading a spatial file (via ***Map Tools***).

Delete an area of interest by:

- Clicking on the rubbish bin tool, then clicking on the polygon(s) you would like to remove (see I). 'Save' confirms this deletion, 'Cancel' cancels the deletion, 'Clear all' deletes all polygons.

Select an area of interest

Select an area of interest by clicking on your chosen polygon. Selected polygons will change from blue to pink (for example, see polygons F and H above, compared to the blue polygon G). You can select multiple polygons by using the multi-select tool (J). This multi-select tool is only visible when more than one polygon has been created. To deselect a polygon, click on it again.

Extract and summarise data

Once you have selected area(s) of interest, you can use the Chart options to *extract* summary data. The chart does not auto-update if you change the polygon selection in the map display. To chart a new area, select the relevant area then create a new chart.

Types of charts

Feature Handling affects how the areas of interest are analysed:

- The 'Combine' option analyses data from all selected polygons (from one to many) as a single region.
- The 'Compare' option allows comparison between two or more selected polygons.

Chart Menu has two options:

- 'Basic' charts show one dataset over time, using the average value across the selected area(s).
- 'Advanced' charts allow much more customisation. Multiple datasets can be selected, as well as different statistical summaries of the selected datasets, such as the median, trimmed range (5-95%), interquartile range (25-75%) and standard deviation.

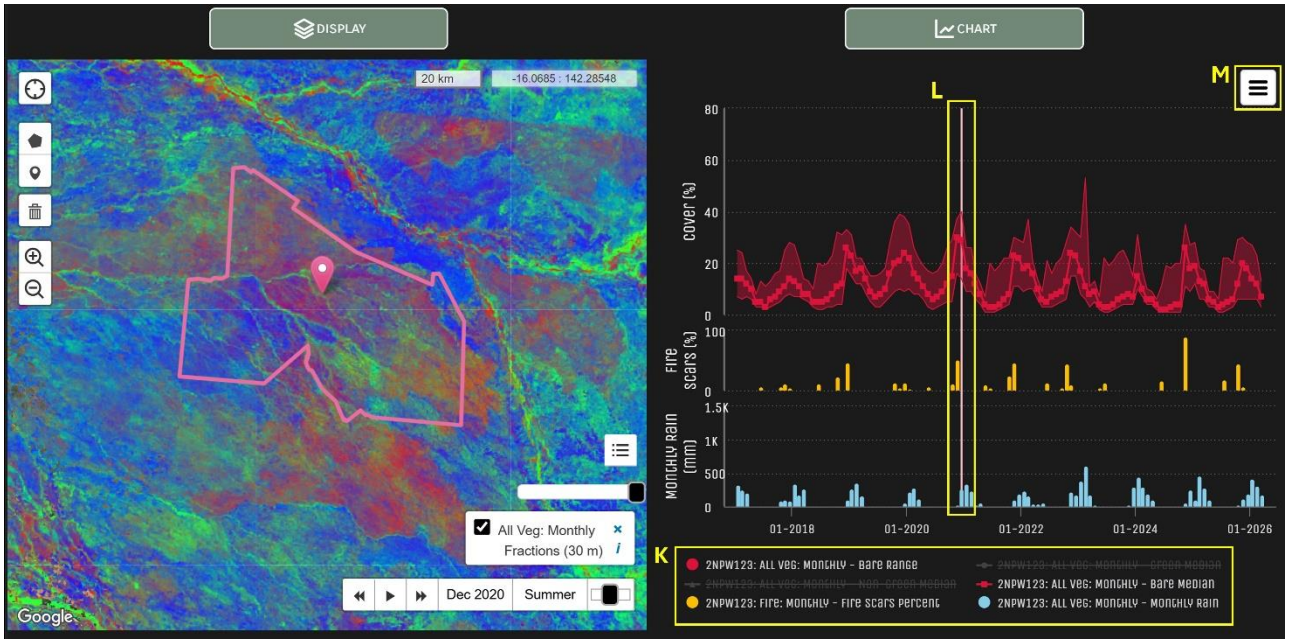

Figure 4 – Example of VegMachine map and chart window displays.

Interacting with the chart

Once you have made a chart (Figure 4), you can scroll up and down on the chart to zoom to a particular time period. Fine detail within charts may be easier to view in the desktop version of VegMachine rather than the mobile version.

- Click on the chart legend to turn individual datasets on and off (see K on Figure 4).
- Click on a particular datapoint to sync the map display to the relevant satellite product within the time series (see L).

Download data

- Download the underlying summary data, chart image and polygon details via the chart context menu (see M on Figure 4). Only datasets active within the legend will be downloaded. While polygons persist across sessions, we recommend downloading them if you wish to analyse the same areas in the future. The *download all (zip)* option includes a readme file, which includes details on the products and analysis conducted. This option is recommended for those using the data for further analysis.

Scale

Depending on the size of the area of interest, VegMachine creates summary statistics based on different spatial scales. For smaller polygons, summary statistics are based on all original pixels. For larger polygons, the pixels are rescaled, with summary statistics calculated on these larger pixels. Summary statistics for larger polygons will thus be less precise than those for smaller polygons. This is due to processing limitations as the number of pixels increases. You can manually select an appropriate scale using *Settings* > *Chart Settings* > *Sampling Mode* under the Main Menu on the left.

Settings

There are several options available to adjust the appearance of the charts, available via *Settings* > *Chart Settings* in the left-hand menu.

- *Axis Behaviour* allows the y-axis on charts to either stay at a fixed scale or adjust dynamically in response to the maximum values for each dataset. For datasets with consistently low values over time, using dynamic Y-axis behaviour may make small changes more visible in the chart. Alternatively, using a fixed scale allows for easier comparison between charts. If 'fixed' is selected, the y-axis for individual components can be made dynamic using the 'best fit' option for the *Cover Max* and *Rainfall Max* settings.
- *Rainfall Interval* determines how daily rainfall is aggregated in the chart: monthly, seasonal (3-monthly), annual, or the best fit (the maximum interval of the other displayed datasets).
- *Cover Max* determines the maximum of the y-axis as either the best fit for the data or 100%.
- *Rainfall Max* determines the maximum of the y-axis as either the best fit for the data or a user-nominated amount in mm.
- *Sampling Mode* determines how summary statistics are calculated. 'Adaptive' (default) prioritises speed over precision, using a pixel scale based on the size of the polygon. 'Pixel Resolution' allows the user to specify the pixel scale, from very fine (1 x, i.e. either 10 m (Sentinel-2) of 30 m (Landsat) to very coarse (256 x, i.e. 2.56 km (Sentinel-2) or 7.68 km (Landsat). If the user selects a scale that is too fine for the size of the polygon, there will be too many pixels for the summary calculations to be completed within a reasonable timeframe. If this occurs, three options will be provided: coarse while still having at least 500 pixels, VegMachine optimised, and the finest scale available.

Reports

Generate regional ground cover comparison reports for areas within Queensland by selecting a polygon, then clicking the 'Reports' item in the left-hand menu. A pdf report will then be emailed to you. These ground cover reports are designed for large properties. They compare the median ground cover with the regional ground cover for dominant land types within the area of interest.

Which dataset should I use?

VegMachine helps you explore vegetation cover datasets available within Australia. The most useful dataset will depend on the location of your area of interest, and the relevant vegetation characteristics and timeframe (Table 1). Some advanced or monthly datasets are only available in Queensland (Tables 1 and 2). To access these, activate the *Queensland* region button at the top of the Main Menu.

Vegetation characteristics

There are three main vegetation categories available within VegMachine: All Veg, Ground Cover and Woody Veg.

- *All Veg* datasets include both woody vegetation (trees and shrubs) and ground cover (grasses and forbs in the understory). Each pixel is then divided into either its proportion of green vegetation, dry vegetation and bare ground (Monthly and Seasonal Fractions), or proportion of total cover, i.e. green and dry vegetation combined (Monthly and Seasonal Total).
- *Ground Cover* datasets provide an estimate of ground cover for areas with less than 60% woody cover. Similar to *All Veg*, each pixel is divided into either its proportion of green ground cover, dry ground cover and bare ground (Monthly and Seasonal Fractions), or proportion of total cover, i.e. green and dry ground cover combined (Monthly and Seasonal Total).
- *Woody Veg* datasets use the persistent green dataset, based on areas that stay green over time. Due to the way this dataset is created, there is a time lag of 2 years. Note that while higher values in this dataset often relate to woody vegetation, non-woody areas with high moisture, such as irrigated golf courses or vegetation near rivers, may also appear as higher persistent green.

Advanced products

Several advanced products are available within Queensland.

- *Ground cover – Seasonal DRCM* The seasonal dynamic reference cover method (DRCM) product allows comparison of total cover across the landscape, showing the difference between actual cover and local reference pixels. Negative values indicate pixels which have less cover than the reference pixels for the season being analysed.
- *Fire – Monthly Fire Scars.* This dataset provides an estimate of burnt area at 10 m resolution. This dataset does not show active fires, but is useful for managing natural resources, assessing fire hazard and risk, and monitoring impacts over time. Some burnt areas may be missed or mapped later than the month they occurred due to cloud cover or misclassification. Small fires or low intensity burns under tree canopy may also be missed.

Time

There are two dataset frequencies available within VegMachine; monthly or 3-monthly seasonal composites. Individual satellite images are not available within VegMachine. The monthly and 3-monthly composite images are created by combining multiple individual satellite images, and there may be some areas of no data due to cloud and cloud shadow. There may also be inconsistent cover levels along the boundaries of the different satellite images which make up the composite, especially in environments where cover changes rapidly across the composite period. These features may look like stripes or blocks of higher or lower vegetation cover medians. These factors will have a greater impact on the monthly datasets than the 3-monthly datasets, as there are fewer individual images available for the monthly composite.

To examine vegetation cover over the **longer term**, the 3-monthly Landsat seasonal composites provide almost 40 years of data, allowing exploration of patterns and trends at the expense of fine temporal detail.

For dynamic environments where vegetation undergoes **rapid** change, monthly composites are more likely to capture this change than the 3-monthly datasets. These monthly datasets are only available from 2017 onwards. Very rapid changes (e.g. crop harvesting or rapid growth of annual species following rainfall) may still not be well represented in the monthly composites. To examine very rapid changes or those occurring before 2017, advanced users may need to access individual satellite images via other platforms.

Coverage

All products are available in Queensland, with a subset available Australia-wide.

The spatial resolution of the datasets will affect the ability to measure **smaller patches of vegetation**. The Sentinel-2 All Veg fractional cover dataset and the fire scar dataset are the only 10 m resolution cover datasets currently available on VegMachine. The 10 m fractional cover dataset provides the potential to observe finer scale detail from 2017 onwards for Australia, excluding South Australia and Western Australia. The monthly fire scar dataset is only available in Queensland.

Table 1: Comparison of basic products

	Vegetation characteristics			Time		Coverage		
	Include woody	**Include ground cover**	**Separate green and dry veg**	**Rapid change**	**Longer term**	**Include smaller patches**	**Australia wide**	**Qld**
All veg								
Monthly fractions (30 m)	X	X	X	X				X
Monthly Total (30 m)	X	X		X				X
Seasonal Fractions (10 m)	X	X	X			X	X excluding SA and WA	X
Seasonal Total (10 m)	X	X				X	X excluding SA and WA	X
Seasonal Fractions (30 m)	X	X	X		X		X	X
Seasonal Total (30 m)	X	X			X		X	X
Ground cover								
Monthly Fractions (30 m)		X	X	X				X
Monthly Total (30 m)		X		X				X
Seasonal Fractions (30 m)		X	X		X		X	X
Seasonal Total (30 m)		X			X		X	X
Woody Veg								
Seasonal Persistent Green (30 m)	X				X			X

Table 2: Comparison of advanced products

	Vegetation characteristics			Time		Coverage		
	Include Woody	Include ground cover	Separate green and dry veg	Rapid change	Longer term	Include smaller patches	Australia wide	Qld
Ground cover								
Seasonal DRCM (30 m)		X			X			X
Fire								
Monthly Fire Scars (10 m)	X	X		X		X		X

Example

Fires at Staaten River National Park, southern Cape York Peninsula

Located in northern Queensland, Staaten River National Park has a mix of monsoon tropical savanna grasslands and melaleuca woodlands[1]. The National Park is home to the Endangered Golden-shouldered Parrot (*Psephotellus chrysopterygius*), which requires a particular combination of grassland and open woodland for its nesting and feeding requirements[2]. Providing this mix of vegetation types requires careful fire management to ensure there are both high intensity fires to maintain open woody vegetation, as well as low intensity fires to protect feeding areas and manage the timing of grass seeding[1,2]. In this example, we show how VegMachine's advanced chart functions can be used to investigate fire and vegetation cover over time.

Fires are frequent in this National Park. VegMachine calculates the proportion of the property with fire scars each month, shown as orange bars in the chart window (*Figure* 5 and Figure 6). The largest fires generally occur during the late dry season in November as temperatures increase and vegetation dries out. In contrast, small burns are implemented by the land managers in the early dry season around June to maintain a suitable mosaic of fire severity. An example is shown in the display window for June 2024, with the long linear fire scars typical of prescribed burns (*Figure* 5). In the corresponding section of the chart, this fire burnt 15 % of the National Park, compared to the higher proportions for the larger fires later in the year (85 % in November 2024, for example - Figure 6).

Following a fire, the proportion of bare ground typically increases then declines as vegetation regrows following rainfall. Comparing the *median* bare ground value with the *range* of bare values provides information on the consistency of vegetation cover amounts across the National Park. For the June 2024 fires, median bare ground is very low (2 %), but this is not centred within the range (1-12 %). In this case, most of the National Park has high vegetation cover as there has been no recent fire, but small sections of the park have higher bare ground due to the recent prescribed burns. In contrast, the median bare ground (26%) during more extensive fires in the late dry season is centred within the bare range (10-35 %), with a more even spread of cover amounts across the National Park.

Vegetation cover is strongly linked to rainfall in this region. As can be seen in

Figure 7, rainfall in this region is very seasonal, occurring only in the warmer months of the year. In the National Park, highest rainfall typically occurs in December, with a characteristic peak in the green 'all veg' cover fraction several months later around March-April. This flush of growth then dries out, with the non-green (i.e. dry) vegetation cover peaking around August-October. Green vegetation cover is at its lowest proportion during this period, at approximately 20%. This vegetation that remains green throughout the year is likely to be woody vegetation and is modelled by the 'persistent green' dataset. This dataset is then used to separate the non-woody 'ground cover' component from the 'all veg' fractional cover dataset. Comparing the all veg green, ground cover green and persistent green median values during the dry-season shows all veg at around 20 % and persistent green remaining at around 15 %, while ground cover drops to below 5 % (

[1] Queensland Parks and Wildlife Service (2024) *Staaten River National Park Management Statement* https://parks.qld.gov.au/__data/assets/pdf_file/0032/166982/staaten-river.pdf

[2] Threatened Species Scientific Committee (2017) *Conservation Advice* Psephotus chrysopterygius *golden–shouldered parrot* https://www.environment.gov.au/biodiversity/threatened/species/pubs/720-conservation-advice-13072017.pdf

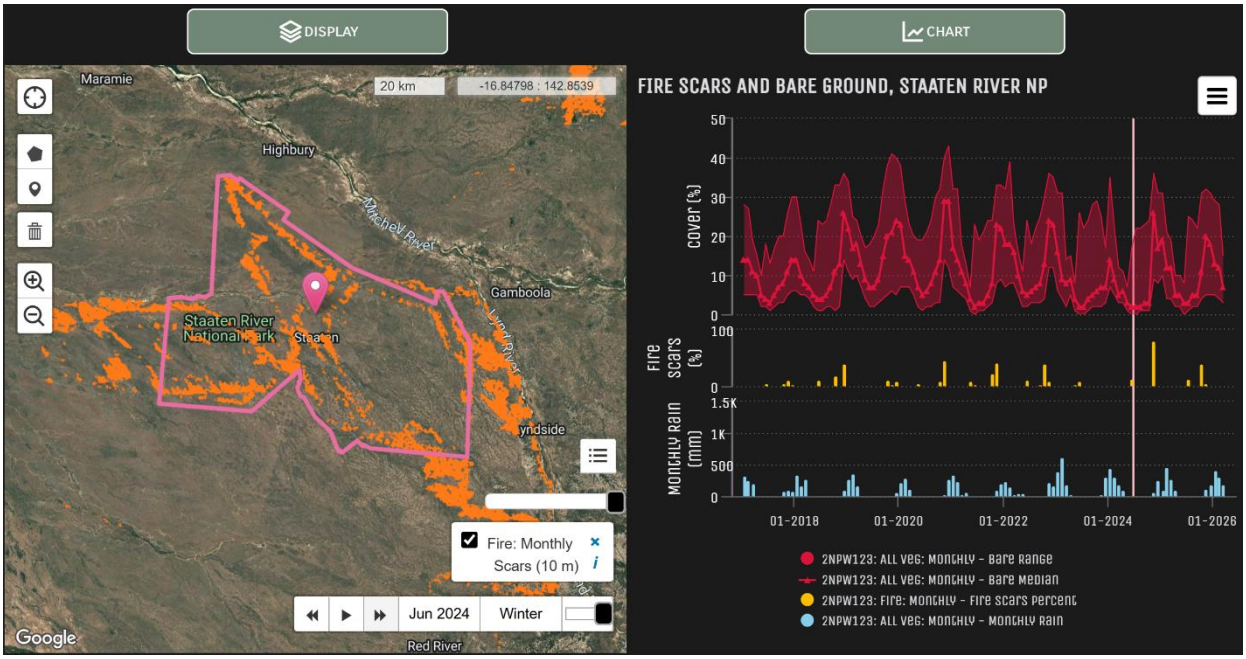

Figure 8).

Figure 5 – Fire scars from small cool season fires, June 2024

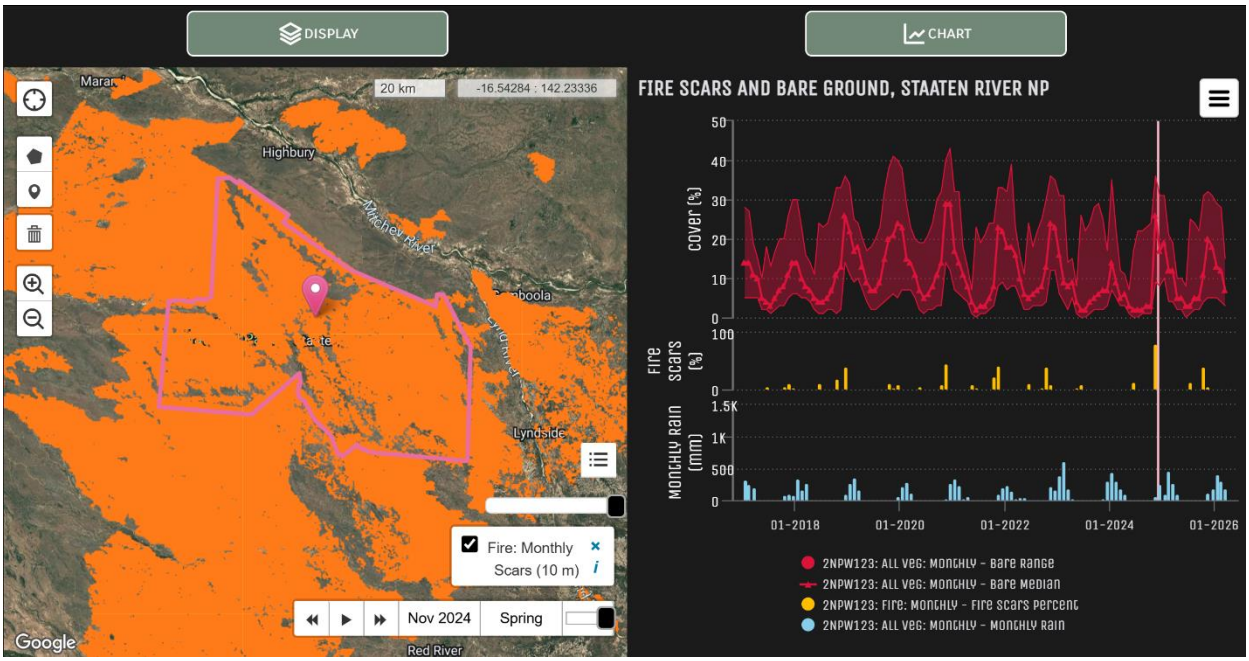

Figure 6 – Fire scars from extensive dry season fires, November 2024

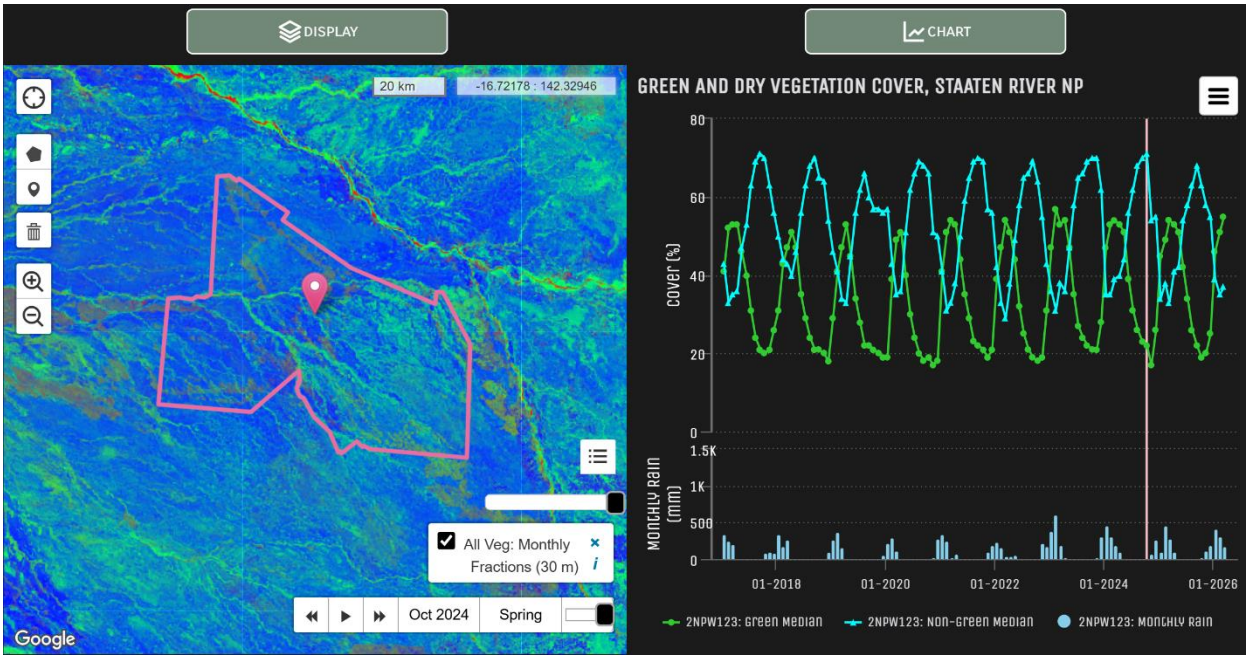

Figure 7 – Display window shows monthly fractional cover (i.e. 'all veg') during October 2024, showing a mix of green and dry vegetation cover. Small bare areas correspond with fire scars from June 2024 (Figure 5).

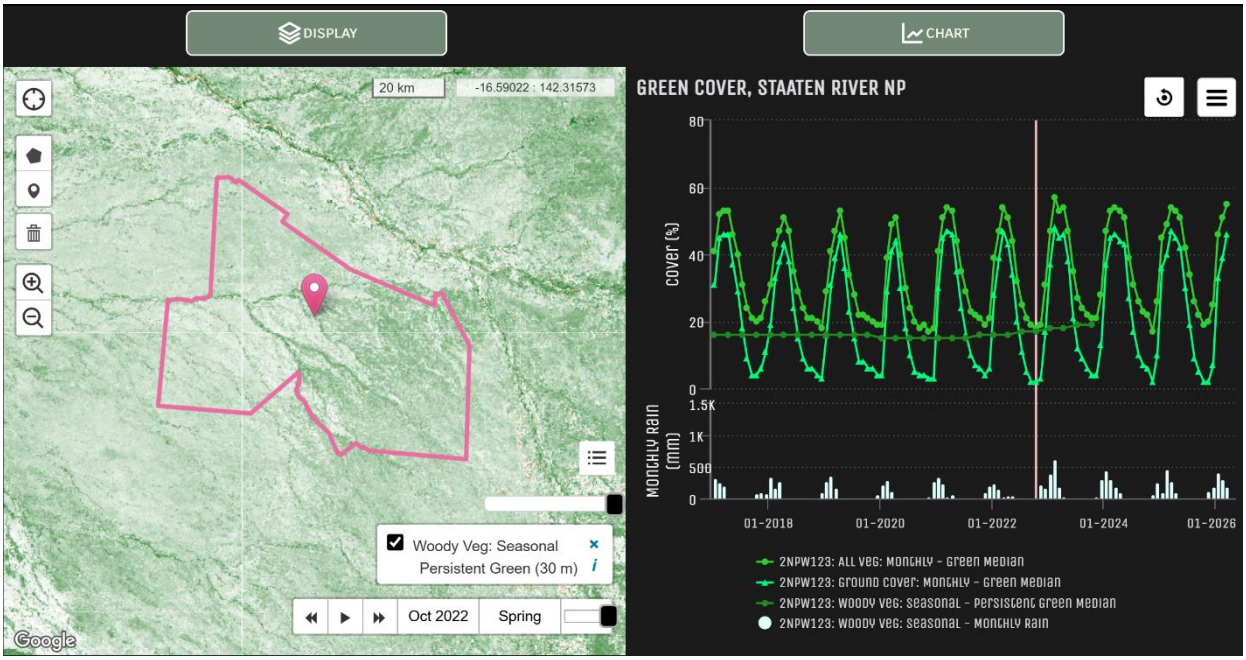

Figure 8 – Chart shows different ways of measuring green vegetation. Display window shows persistent green for Spring 2022, with darker green indicating areas of higher persistent green, likely to be woody vegetation.

This kind of data extraction could be used to analyse differences in fire frequency, timing and extent across the National Park and neighbouring grazing properties, as well as compare vegetation cover amounts at different parts of the property. Combining this remote sensing data with other information, such as nesting and feeding locations of the golden-shouldered parrot, could assist management in this very remote location.

Other examples

Researchers and practitioners have used VegMachine to assist with a range of applications. For example, they have:

- compared ground cover and run off from different grazing regimes;

  C.M. Thornton, A.E. Elledge (2021) 'Heavy grazing of buffel grass pasture in the Brigalow Belt bioregion of Queensland, Australia, more than tripled runoff and exports of total suspended solids compared to conservative grazing', *Marine Pollution Bulletin*, Volume 171, https://doi.org/10.1016/j.marpolbul.2021.112704

- analysed ground cover trends in relation to encroachment by Indian Couch;

  Spiegel, N. B. (2023) *Indian couch invasion: scope, production impacts, and management options*. Project Report. Meat and Livestock Australia, North Sydney, Australia. http://era.dpi.qld.gov.au/id/eprint/14414/

- monitored revegetation and stability of land condition following mining;

  Clay M, Nicolson L, Dunlop J and Purtill J (2025) A review of research and tools for grazing as a post-mining land use in Queensland: Technical Paper, Office of the Queensland Mine Rehabilitation Commissioner, Queensland Government, Brisbane https://www.qmrc.qld.gov.au/__data/assets/pdf_file/0023/335615/review-research-tools-for-grazing-pmlu-in-queensland.pdf

- analysed long term average woody vegetation in relation to fire frequency and soil carbon stocks;

  Haig J, Sanderman J, Zwart C, Smith C, Bird MI. (2024) 'Impact of fire return interval on pyrogenic carbon stocks in a tropical savanna, North Queensland, Australia'. *International Journal of Wildland Fire* 33, WF24006. https://doi.org/10.1071/WF24006

- analysed long term average woody vegetation in relation to land condition and beef production.

  Gobius, N. R., English, B. H. and Baker, K. M. (2025) Arresting grazing land condition decline in Queensland's northern gulf should be framed around improving business performance. In: 12th International Rangeland Congress IRC 2025, 2-6 June 2025, Adelaide, South Australia. https://era.dpi.qld.gov.au/id/eprint/15111/

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