

# Ground cover methods



## Great Barrier Reef Report Card 2016

Reef Water Quality Protection Plan



Australian Government



Queensland Government

## Ground cover methods

This report summarises the data and methods used for reporting progress towards the target for regional ground cover in the Great Barrier Reef Report Card 2016.

The target for ground cover is as follows (Australian and Queensland governments, 2013):

- Minimum 70 per cent late-dry-season ground cover on grazing lands by 2018.

Further detail about data processing and differences from previous report cards can be found in the ground cover technical report (DSITI, 2017).

## Background

### *Why measure ground cover?*

Ground cover is defined as the vegetation (living and dead), biological crusts and stone that are in contact with the soil surface. Ground cover is a key component of many soil processes, including infiltration, run-off and surface erosion. In the Great Barrier Reef regions, low ground cover can lead to soil erosion which contributes to increased sediment loads reaching the Reef lagoon and loss of productivity for grazing enterprises.

It is particularly important to maintain ground cover during dry periods or periods of unreliable rainfall to minimise loss of water, soil and nutrients when rainfall eventually occurs. This practice will also maximise the pasture response to rainfall. Implementing appropriate and sustainable land management practices, particularly careful management of grazing pressure, can help to maintain or improve ground cover, reducing erosion and improving the stability and resilience of the grazing system.

### *Factors that influence ground cover*

Ground cover levels are the result of complex interactions between landscape function (soil type, topography and vegetation dynamics), climate and land management. Some areas maintain naturally higher levels of ground cover due to factors such as high soil fertility and consistently high annual rainfall. The impacts of grazing land management practices on ground-cover levels in these areas can be minimal due to the resilience of the land to respond to pressures. In areas where rainfall is less reliable and soils are less fertile, ground-cover levels can vary greatly and the influence of grazing land management practices on ground-cover levels and on the species composition of the ground cover can be more pronounced.

A number of initiatives aimed at improving grazing land management in Great Barrier Reef regions are in place or are planned. They include programs which are improving management of ground-cover levels appropriate to the regional conditions, such as:

- the industry-led Grazing Best Management Practice program
- infrastructure projects such as fencing key areas and better distribution of watering points for stock
- trials of different grazing strategies
- a range of extension and education activities including development of online, interactive and reporting tools for accessing and viewing ground cover information.

## ***Reporting ground-cover levels for the Reef Water Quality Protection Plan 2013***

Progress towards the ground cover target is assessed by the Queensland Ground Cover Monitoring Program and is based on ground-cover monitoring data derived from Landsat satellite imagery that is calibrated by field data. While a range of factors influence ground-cover levels, reporting is presently focused only on information that describes regional ground-cover levels in the current and historical context. Rainfall data is provided here for context only as it is the primary driver of ground cover levels at a regional scale.

A range of products have been or are being developed by the Queensland Ground Cover Monitoring Program which account for the influence of climate, land management and soil type. These products are more appropriate for monitoring local-scale variability and differences in ground cover levels, but are of limited use for the regional-scale reporting required here. Access to some of these products is via the interactive online tool [VegMachine](#) and the online reporting tool, [FORAGE](#). Products that prove useful for describing ground cover levels at the regional scale will help to revise future ecologically-relevant and regionally-focused targets, and will be incorporated into future reporting. For example, a metric is in development which improves how the patchiness, or clumping, of ground cover is quantified and represented spatially using new imagery from the Sentinel-2A and 2B satellites.

## **Methods**

The following is a brief overview of the data and methods used for reporting regional ground cover in the Great Barrier Reef Report Card 2016. For further detail about data processing, refer to the ground cover technical report (DSITI, 2017).

### ***Ground cover data***

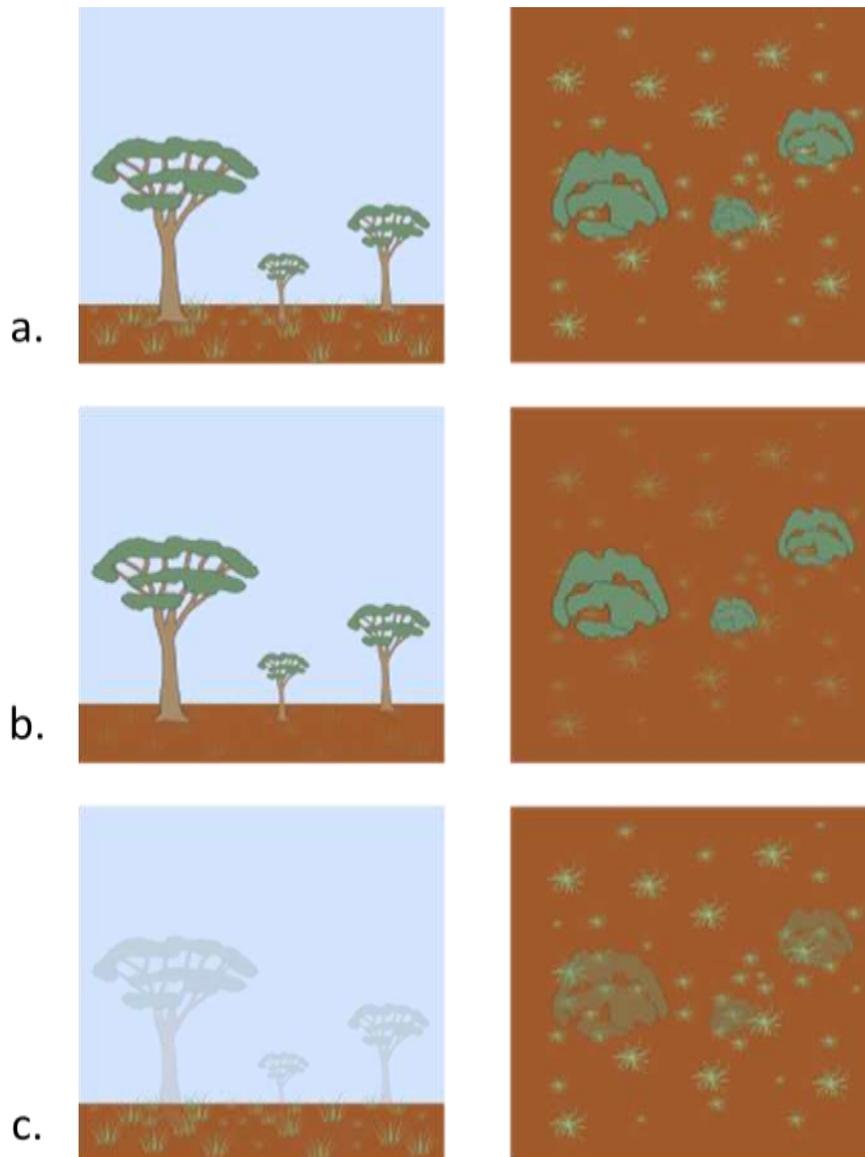
Reporting is based on the measurement of late dry season ground cover using Landsat satellite imagery which has been processed to produce fractional ground cover estimates, using field data for calibration.

#### *Landsat satellite imagery and fractional ground cover*

Measurement of ground cover for reporting is based on data derived following the fractional cover method described by Scarth et al. (2010) and Guerschman et al. (2015). The method measures the proportion of green cover, non-green cover and bare ground using reflectance information from late-dry-season satellite imagery from Landsat 5 Thematic Mapper (TM), Landsat 7 Enhanced Thematic Mapper (ETM+) and Landsat 8 Operational Land Imager (OLI). The spatial resolution of Landsat imagery is approximately 30 metres. The revisit frequency of a Landsat satellite is 16 days and the archive of Landsat data used here dates from 1987 to 2016.

The fractional-cover data is calibrated using over 1500 field observations from a range of ground, tree and shrub cover levels, and a range of environments. It is important to note that the fractional-cover data measures all cover as viewed from above by the satellite, including the trees and shrubs as well as the ground cover and bare ground. To estimate the level of ground cover, the fractional cover data is corrected to effectively remove the influence of trees and shrubs, providing estimates of the level of green ground cover, non-green ground cover and bare ground at ground level (see Figure 1 in Trevithick et al., 2014). The *fractional ground cover* method enables reporting in areas of higher tree cover—up to 60 per cent persistent green (i.e. woody vegetation) cover—allowing most (>90 per cent) of the grazing lands of the Great Barrier Reef catchment areas to be reported on.

As a final step, the green and the non-green ground cover fractions are summed to produce a total ground cover estimate, as erosion and run-off are influenced by all ground cover. This estimate of total ground cover is what is used for reporting here and is hereafter referred to simply as '*ground cover*'. Slight variations may occur in the results produced each year due to new updates and reprocessing of data.



**Figure 1: Schematic representation of the correction of the fractional cover data to estimate the fractional ground cover (Trevithick et al., 2014), used for reporting herein. (a) Fractional cover measures all vegetation cover including trees, shrubs and ground cover, as well as bare ground. The ground cover and bare ground are partially obscured by the trees and shrubs. (b) Next, a time-series approach is used to estimate the percentage of 'persistent' cover in the tree and shrub layers. (c) Finally, a correction factor is applied, based on field data, to effectively remove the 'persistent' cover in the tree and shrub layers, thus providing an estimate of the green cover, non-green cover and bare ground, all at the ground level – the fractional ground cover.**

### *Late-dry-season ground cover*

Late-dry-season ground cover is estimated using a seasonal composite of fractional ground-cover data. The seasonal composite is derived from each 16-day Landsat satellite image acquired throughout the season. It is produced by selecting the most representative per pixel estimate (i.e. 30 metre x 30 metre area) of fractional ground cover for the season; then, these areas are composited to generate a comprehensive regional dataset (Flood, 2013). This approach has the advantage of removing errors and outliers in the data, providing the most spatially comprehensive coverage as there is generally very little missing data due to cloud, cloud shadow or satellite sensor issues. For reporting here, spring (September–November) seasonal composites (for the period 1987 to 2016) are used, as this best approximates the late dry season.

## **Reporting regions and grazing lands**

Reporting is based on the six natural resource management (NRM) regions which the Great Barrier Reef region comprises:

- Cape York region
- Wet Tropics region
- Burdekin region
- Mackay Whitsunday region
- Fitzroy region
- Burnett Mary region.

Grazing lands in the reporting regions were spatially-defined based on the most recent land-use data provided by the Queensland Land Use Mapping Program (DSITIA, 2012). The most recent version of the mapping is current to 2009 for all reported regions except for Cape York and the Wet Tropics which are current to 2013 and 2015, respectively.

A *reporting region* is defined as that part of an NRM region which is grazing land and has less than 60 per cent persistent green (i.e. woody vegetation) cover.

### ***Reporting ground cover***

This report provides a regional overview of late-dry-season ground-cover levels in the Great Barrier Reef region based on analysis of seasonal (spring) total ground cover data. The statistics are calculated for each pixel (i.e. 30 metre x 30 metre area) and then summarised (i.e. averaged) for each of the regions.

Statistics reported for each region include:

- 2016 mean late-dry-season ground cover
- 29-year mean late-dry-season ground cover (1987 to 2016)
- the percentage of the region's reporting area with late-dry-season ground cover less than 70 per cent in 2016
- the percentage of the region's reporting area with mean late-dry-season ground cover less than 70 per cent for the 29-year period, 1987 to 2016.

Graphs show the distribution of ground cover for each region across the range of ground cover levels. Maps of ground-cover percentages have been provided for the entire Great Barrier Reef region, and for each reporting

region, as a visual representation of the statistics listed above. A map comparing ground cover decile rankings for 2016 with long-term mean levels has also been produced.

It is important to note that averaging ground cover across whole regions can mask localised areas of lower cover, particularly in large catchments with a strong rainfall gradient (e.g. the Burdekin and Fitzroy). The mean ground cover reported here is, therefore, indicative of general levels of ground cover within the reporting region. For additional level of reporting, the reporting regions are further divided into catchments (and sub-catchments for larger catchments) in the ground cover technical report (DSITI, 2017).

### **Rainfall data**

Rainfall data is provided for current and historical context as rainfall is the primary driver of ground-cover levels at the regional scale. In general, high rainfall in the preceding seasons results in higher ground cover levels and low rainfall in preceding seasons results in lower ground cover levels. Rainfall data was obtained from Scientific Information for Land Owners ([SILO](#)) as a five-kilometre grid. For each reporting region, the mean annual rainfall was then calculated from October to September for each year from 1986, to align the mean annual rainfall with the late-dry-season reporting period.

### **Scoring system**

A standardised scoring system is used for each of the key indicators in the Reef Report Card. The scoring system is used to assess and communicate the status of the indicator against the Reef Water Quality Protection Plan (2013) target.

### **Ground cover target**

Minimum 70 per cent late dry season ground cover on grazing lands by 2018.

**Table 1: The colour-coded ground cover scoring system**

Grade	Status	Criteria – mean ground cover for late dry season 2016	Colour
E	Very poor	0–30%	Red
D	Poor	30–39%	Orange
C	Moderate	40–49%	Yellow
B	Good	50–69%	Light green
A	Very good	70–100%	Dark green

## Qualitative confidence ranking



A multi-criteria analysis is used to qualitatively score the confidence in each indicator used in the Reef report card from low to high. The approach combined the use of expert opinion and direct measures of error for program components where available. Ground cover has received a four-bar confidence ranking.

## References

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