Queensland Spatial BioCondition Framework (SBC) Factsheet

What is Spatial BioCondition?

Spatial BioCondition (SBC) is a mapping framework, aligned with Queensland's Regional Ecosystem (RE) and BioCondition frameworks. SBC integrates site-based vegetation condition assessment methods and remote sensing (RS) to predict the condition of vegetation for biodiversity across most ecosystems in Queensland. The current version provides 2019 condition predictions for Southeast Queensland and Brigalow Belt Bioregions only (Figure 1). The approach is systematic, repeatable, and able to incorporate new site-based and RS data as they become available.

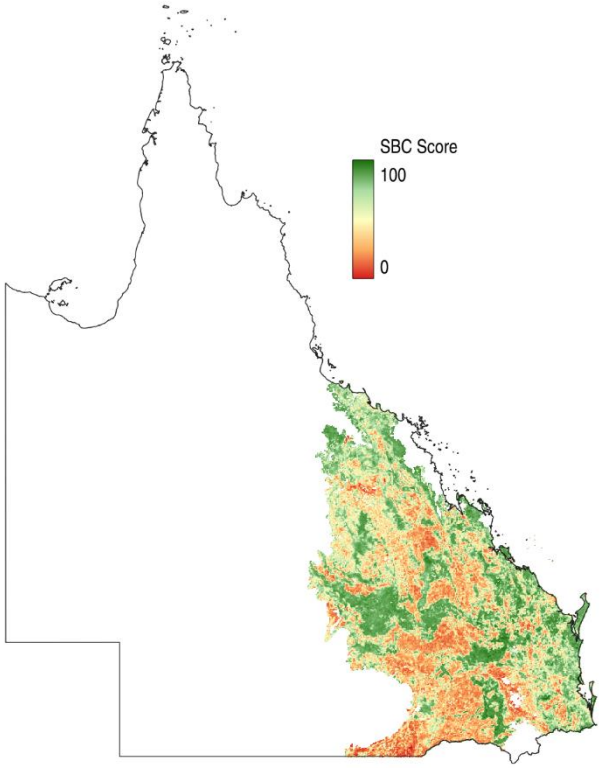

Figure 1: SBC version v1.0 for the Brigalow Belt and South-east Queensland Bioregions

Background:

SBC was developed to support reforms to the Queensland Vegetation Management Act 1999 that aim to provide more holistic reporting on vegetation extent and condition in Queensland. It is a collaboration between the Queensland Herbarium and Biodiversity Science business unit and Remote Sensing Sciences in the Queensland Department of Environment and Science.

Condition of vegetation for biodiversity may be influenced by agricultural practices, grazing land management, inappropriate fire regimes, urban development, incursion of non-native species, industrial logging, and mining. There is an increasing need to measure vegetation condition at scale to inform the biodiversity protection and conservation goals of the state.

The BioCondition framework measures the relative capacity of an ecosystem to support the suite of species expected to occur in its undisturbed (reference) state. The greater the difference from the reference state the worse the condition. At the site level this is measured using a suite of vegetation attributes which are compared against a benchmark. The benchmark or reference characteristics are derived from a set of sites in the same RE that are known to be in the best available condition. To move beyond a site-based approach, SBC uses a model based on a series of vegetation specific remote sensing data to map condition across the state.

Method

In brief, the difference in RS values between training site locations and reference locations are used to train a machine learning model which is applied to predict BioCondition for all locations.

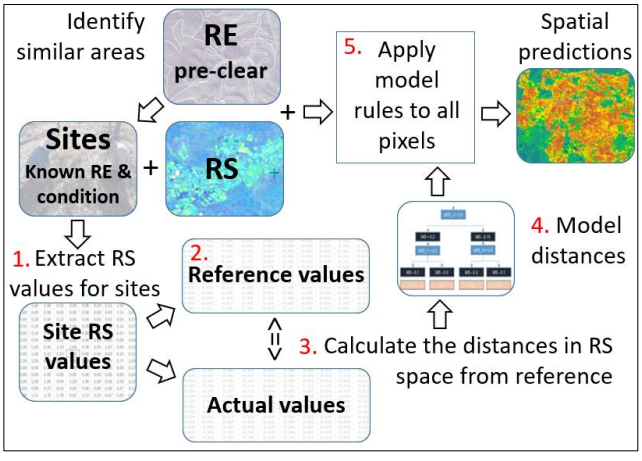

Figure 2: Modelling workflow for SBC

There are three critical inputs for the modelling approach: RE pre-clear mapping; verified georeferenced training sites with known RE and condition state; and a suite of RS predictor variables

(Figure 2). The steps involved in the modelling are:

1. RS values for all predictor variables are extracted for all training sites.
2. For each RE a reference dataset of RS values is derived using a set of sites known to be in best available condition state.
3. The distance (in RS space) from the reference dataset for each RE is calculated for every training site (all condition states).
4. The derived distances are used to train a Gradient Boosting Decision Tree Regression model to fit a set of decision rules that relate the target variables (BioCondition score) to the predictor variables.
5. The model rules are applied across the full geographic extent of that RE to predict Spatial BioCondition for every pixel.

The SBC score assigned to each pixel is the result of the comparison against a RE specific reference.

Accuracy:

An independent field validation was undertaken with field data collected from 231 sites in the Brigalow Belt and Southeast Queensland bioregions. The sites were selected using a stratified random sampling approach aimed to maximise both condition range and geographic spread. Comparison of BioCondition scores for independent field sites with model predictions yielded a R^2 value of ~0.7 (Figure 3), lowest accuracy was found at intermediate condition scores where we have fewer training sites.

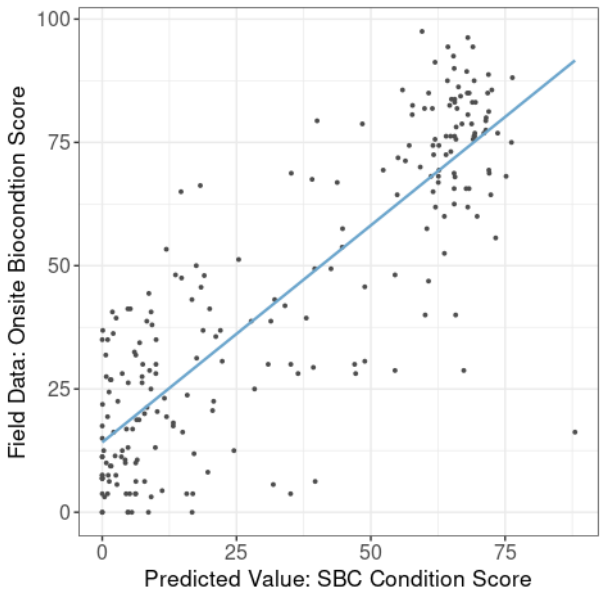

Figure 3: BioCondition site scores from independent field data plotted against SBC predicted condition scores.

Product constraints:

SBC shares limitations of the input datasets, these include: resolution, detectability and currency for RS inputs; scale and heterogeneity for RE mapping; volume, quality and currency for training site data. Some important BioCondition attributes (such as species diversity, large trees or fallen woody debris) are either currently not measurable or are difficult to detect using RS at the scale required.

SBC is not suitable for the measurement of changes in condition over time below the regional scale and does not identify the underlying causes or drivers of reduced condition for biodiversity.

Applications:

Potential uses of the SBC product is inclusive of but not limited to: biodiversity monitoring; natural capital accounting; State of Environment reporting; ecosystem services; and environmental offsets.

Product description:

SBC predictions should be interpreted in conjunction with and at a similar scale to the RE mapping.

The product covers most vegetated terrestrial ecosystems in Queensland, except the following exclusions for which no predictions are provided.

- Intertidal ecosystems
- urban, suburban, and industrial areas
- predominantly unvegetated areas such as open water, bare sands, and rock pavements
- Natural grasslands
- Regional Ecosystems with insufficient reference site data.

The SBC product is a raster dataset with a spatial resolution of 30m. It comprises three bands. Band 2 is the predicted BioCondition score 0-100, with higher values representing better BioCondition. Bands 1 and 3 are the 5th and 95th percentile for the prediction interval (i.e. the true value will be found within this range with a likelihood of 90%). The condition score is predicted for the year 2019. Access to Geographic Information System (GIS) software is required to obtain full functionality of the product.

Data availability:

Spatial data for version 1.0 – 2019 condition for the Brigalow Belt and Southeast Queensland bioregions is expected to be available on Qspatial, TERN and the code used to generate the model will be available from GitLab from the middle of 2023.

Next steps:

The project team are currently working on expanding SBC to include other bioregions. We are also investigating ways to incorporate habitat context and connectivity into the SBC framework.

Contact:

For more information about accessing Spatial BioCondition products, email: queensland.herbarium@qld.gov.au