Native Vegetation Integrity Benchmarks

An information sheet

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Contents

List of figures

Introduction

This document describes major changes to Bionet Vegetation Classification data collection. The focus of this document is the new Vegetation Integrity Benchmarks.

Background

Benchmarks describe the reference state to which sites are compared to score their site-scale biodiversity values. The three primary attributes of biodiversity; composition, structure and function[1] can be described by benchmarks. When scores for composition, structure and function are combined into a vegetation integrity score, they provide the rigour and transparency needed to make site-scaled comparisons and inform natural resource management decision making tools such as the Biodiversity Assessment Method (BAM). The BAM improves on past approaches in six core areas.

Improvements

From expert opinion to data-driven benchmarks

A vegetation integrity score represents the degree to which the composition, structure and function of the vegetation at a site differs from the best-on-offer[2,3] condition for the same vegetation type in the contemporary landscape. The focus on best-on-offer is a departure from previous approaches based on long-undisturbed or pre-European conditions. The primary reason for this departure is that long-undisturbed benchmarks cannot be reliably estimated because long-term disturbance histories are often unknown and difficult to quantify. This intractable problem explains why expert opinion has been prominent in the derivation of previous vegetation benchmarks.

Best-on-offer sites are those sites within the contemporary landscape with higher numbers of native plant species, greater structural complexity and replete with functional components, relative to other sites of the same vegetation type. By progressing to the best-on-offer paradigm, the vast repository of vegetation data stored in the NSW BioNet system can become the basis for data-driven vegetation integrity benchmarks.

Composition (native plant species richness) and structure (native plant foliage cover) benchmarks have been created for more than 650 bioregional vegetation classes. Bioregional vegetation classes are an amalgamation of IBRA regions (version 7) and Keith Vegetation Classes[4]. Floristic inventories from more than 36,000 full-floristic 0.04 ha plots (approximately 1.25 million records) were used to model composition and structure benchmarks. Modelling enabled prediction of benchmarks for bioregional vegetation classes with few or no plot data by drawing on information from the same vegetation class in different regions, and different vegetation classes in the same region. Modelled composition and structure benchmarks approximate the likely 75th percentile of each attribute's raw data distributions. Function benchmarks were generated from approximately 14,000 records from 0.1 ha plots, and were created at a variety of classification levels (up to Formation), and represent the 75th percentile of each attribute's raw data distributions.

From vegetation strata to vegetation growth forms

In previous approaches, cover of vegetation strata dominated assessments. Within the BAM, vegetation growth forms have replaced vegetation strata because they:

- Avoid the confusion sometimes associated with inconsistently identifying vegetation strata,
- Can be consistently allocated to all native plant species in NSW via look-up[5],
- Allow for the creation of composition and structure benchmarks for each different growth form,
- Have a long history of use in Australia[6], and are currently used in Queensland's *BioCondition* and Victoria's *Habitat Hectares* biodiversity assessment methods.

In the BAM, the composition (native plant species richness) and structure (native plant foliage cover) of trees, shrubs, grasses and grass-like, forbs, ferns, and other growth forms are now separately assessed against their data-derived bioregional vegetation class benchmarks.

From static attribute weights to dynamic attribute weights

In previous approaches, assessment attributes received the same weight across all vegetation types. For example, native ground cover was weighted at 7.5% of the total score regardless of whether the site was an open woodland or a rainforest. In contrast, dynamic weighting has been implemented in the BAM so that the importance (weight) of any composition or structure attribute is proportional to its contribution to the total number of native plant species or total plant foliage cover in the benchmark.

From number of trees with hollows to number of large trees

The number of large trees, along with the length of logs, cover of leaf litter, presence of tree regeneration, and stem size diversity, are assessed for woody bioregional vegetation classes as part of the function assessment. The attribute 'number of large trees' has replaced the former attribute 'number of trees with hollows' to recognise the importance of large trees for the provision of food, habitat and other resources (in addition to hollows), and because counts of trees with hollows can be highly variable among operators[7]. The large tree threshold size has however been guided by models that predict the probability of trees containing hollows[8]. Dynamic weights do not apply to function attributes.

Aggregation of composition, structure and function scores using the geometric mean

A new approach to creating a vegetation integrity score has been implemented in the BAM. Firstly, the three primary attributes of biodiversity; composition, structure and function[1], are each scored from 0–100. The vegetation integrity score is then calculated as the geometric mean (cubed root) of these three scores (or the square root of the composition and structure scores in non-woody vegetation). This approach has two benefits. Firstly, the three sub-indices clearly communicate whether a site is lacking compositional, structural or functional components, which provides a clear focus for restoration management actions. Secondly, the geometric mean reduces the problem of attribute substitution, that is, a low scoring attribute being compensated for by a high scoring attribute. Use of the geometric mean penalises a site by generating a lower vegetation integrity score when one or more primary biodiversity attributes score low.

Scoring attribute condition using a continuous non-linear function

The final change implemented in the BAM is a move from a semi-quantitative approach that scores attribute condition as 0, 1, 2, or 3 (for 0–10%, 10–50%, 50–100%, >100% of benchmark respectively), to a continuous non-linear approach based on the Weibull function (Figure 1). This approach avoids the steep thresholds of the prior approaches. It is also more biologically meaningful with: (i) a curvilinear base representing a gradual accumulation in habitat suitability (food, habitat and other resources) for plants and animals at very low attribute levels, (ii) a curvilinear top accommodating the expected range of natural variability around the single benchmark value and (iii) a steep linear central section which represents rapid accumulation of important habitat resources.

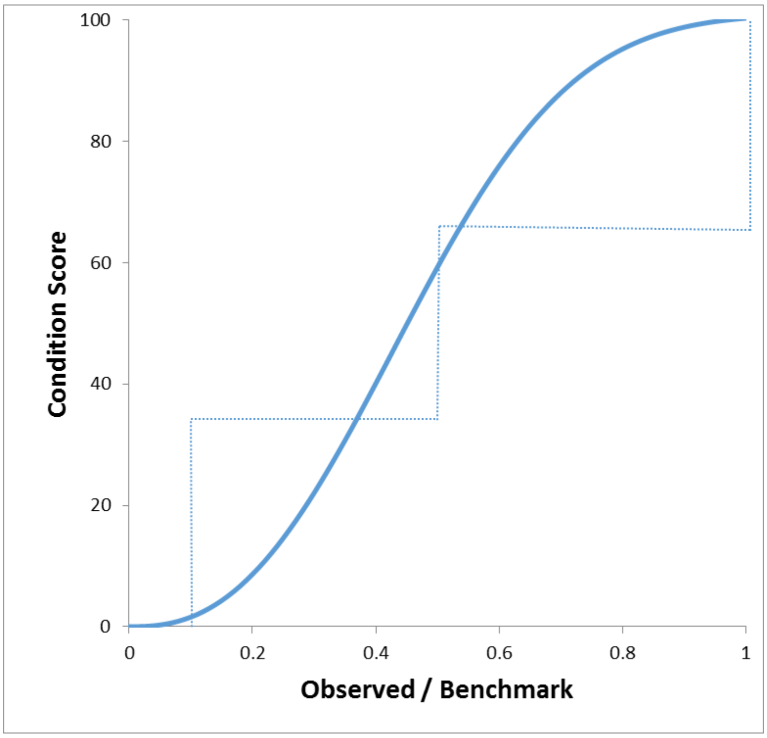

Figure 1 **Weibull function used to calculate individual attribute condition scores (light-blue dashed line shows the previous semi-quantitative four score approach)**

Future work

Where bioregional vegetation class benchmarks are represented by few plots, confidence in benchmark values may be low. Gap-filling vegetation survey work currently underway will provide new data to improve models and confidence ratings. Modelled bioregional vegetation class function benchmarks will be explored, as will the potential to deliver composition and structure benchmarks at a finer level of classification. Modelling will also continue to explore the potential of dynamic benchmarks that take account of seasonal (month) and climatic (rainfall) variation. Previous approaches accommodated such variation using broad benchmark ranges (e.g. grass cover benchmark of 10-50%) but such broad ranges compromise the ability to discriminate among sites. Currently available composition and structure benchmarks are predicted as the annual average for an average rainfall year. Future work will explore the benefits of dynamic benchmarks. As new vegetation data become available, and new analyses are undertaken to deliver improved benchmarks, periodic benchmark uploads will be undertaken and communicated.

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