



BioCondition Report

Prepared for Toohey Forest Environmental Education Centre

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Introduction

Balance Environmental was engaged by Toohey Forest Environmental Education Centre (TFEEC) to establish and measure two permanent BioCondition plots in the forest area used by TFEEC for educational purposes.

The aim of the task was to obtain baseline ecological condition data to support student learning activities, in particular as a reference data-set for senior Biology curriculum studies in Ecology. The longer-term objective of the project is to acquire regular monitoring data from the BioCondition sites that can be used by students to support their own measurements made in the same forest area.

Methods

The BioCondition method (Eyre *et al.* 2015) was chosen for this project because it has become a State-wide standard for monitoring ecological condition of natural areas for a variety of applications (e.g. development impact assessment, land restoration monitoring, conservation values assessment). The approach incorporates a relatively simple plot layout (**Figure 1**), within which a range of vegetation structural and floristic measures are made that are indicative of key aspects of ecological function (**Table 1**). These measures may then be compared with benchmark measurements made at “best-on-offer” sites in the same ecosystem type. Alternatively, the initial measurements may simply be used as a baseline against which future changes in condition may be compared.

Table 1 Summary of the functional role of vegetation for biodiversity and indicators of those functions (after Eyre *et al.* 2015)

Vegetation functions	Attributes that act as indicators of the functions
Structural aspects	
Provision of reliable foraging resources for wildlife (e.g. nectar, leaves, seeds)	Large trees, Shrub cover, Tree canopy cover, Native perennial grass, Coarse woody debris, Organic leaf litter, Ground cover
Provision of reliable sheltering resources and or breeding sites for wildlife	Large trees and/or hollow-bearing trees, Coarse woody debris, Tree canopy cover, Shrub cover, Organic litter, Perennial grass cover
Functional aspects	
Nutrient and water cycling	Tree canopy cover, Organic litter cover, Coarse woody debris
Maintenance of soil condition	Organic litter cover, Native perennial ‘decreaser’ grass species basal area, Native perennial non-grass cover, Coarse woody debris
Retention of plant propagules	Organic litter, Coarse woody debris
Compositional aspects	
Maintenance of plant species diversity	Native plant species richness, Recruitment of canopy species, Native perennial ‘decreaser’ grass species basal area, Non-native plant species cover (lack of)

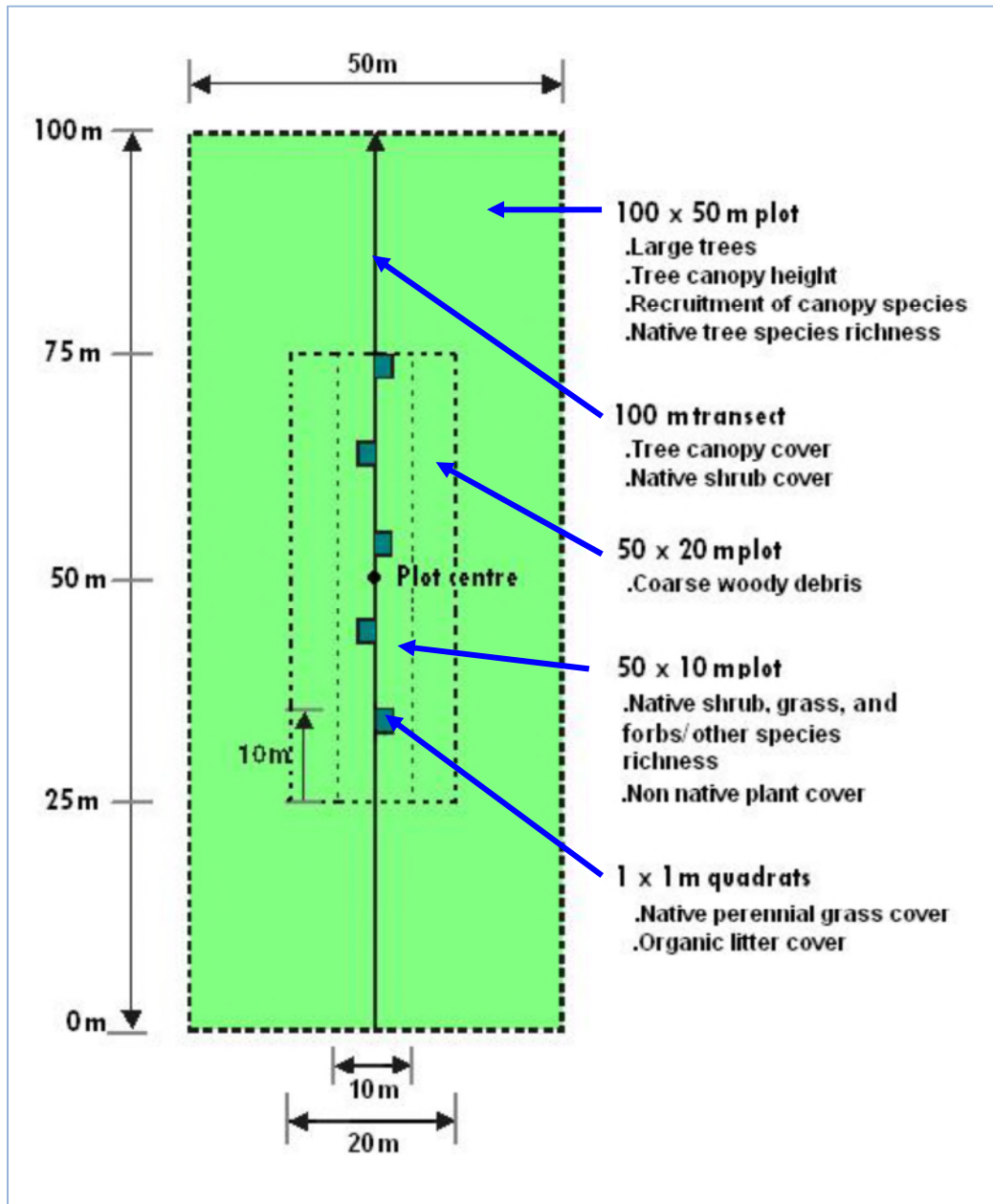


Figure 1 BioCondition plot layout (after Eyre *et al.* 2015)

Results & Discussion

Site selection

Two BioCondition transects were chosen to represent distinctive landscape positions across a moisture gradient from a wet gully to dry ridge-top (see **Figure 2**). Site TOO1 was placed along a mid-slope contour to represent the drier forest type, while Site TOO2 was placed along the creek-flat to represent the moist riparian forest type. These two transects cut approximately perpendicularly across a moisture-gradient transect established by TFEEC for their teaching activities.



Figure 2 BioCondition transect points for two sites in Toohy Forest. University Road runs along the bottom of the frame.

Site assessment

The assessment of both sites was conducted on 5th August 2018, in the late winter/mid-dry-season. Sites were assessed by Mr Greg Ford (Balance Environmental) and Mr Brad Lambert (TFEEC), with measurement tasks split between operators to expedite the assessment process.

Regional Ecosystem (RE) types

The BioCondition transects lie in a transitional zone between several Regional Ecosystems (see RE map at **Appendix A**), so the vegetation along each transect does not fit neatly within any of the RE descriptions (**Table 2**). Site TOO1 approximately follows the mapped boundary of RE 12.9-10.26 and RE 12.11.24 and has floristic and structural elements of both of those REs as well as RE 12.9-10.4. Site TOO2 was selected as representative of RE 12.3.6, but also contains elements of RE 12.9-10.26 and RE 12.11.24.

Table 2 Regional Ecosystem descriptions for mapped REs surrounding Toohy Forest BioCondition sites (refer also to RE map at **Appendix A**).

RE number	RE description
12.3.6	<i>Melaleuca quinquenervia</i> +/- <i>Eucalyptus tereticornis</i> , <i>Lophostemon suaveolens</i> , <i>Corymbia intermedia</i> open forest on coastal alluvial plains
12.9-10.4	<i>Eucalyptus racemosa</i> subsp. <i>racemosa</i> woodland on sedimentary rocks
12.9-10.26	<i>Eucalyptus baileyana</i> and/or <i>E. planchoniana</i> and/or <i>E. psammitica</i> woodland to open forest on quartzose sandstone
12.11.24	<i>Eucalyptus carnea</i> , <i>E. tindaliae</i> , <i>Corymbia intermedia</i> +/- <i>E. siderophloia</i> or <i>E. crebra</i> woodland on metamorphics +/- interbedded volcanics

RE Benchmarks

At the time of the initial field assessment, RE benchmark documentation was available only for RE 12.9-10.4 and RE 12.11.24 (under previous code of RE 12.11.5a). The latter benchmark, therefore, was chosen for Site TOO1. Since no RE benchmark existed at the time for RE 12.3.6 and given the floristic and structural divergence of this riparian site from RE 12.11.24, it was decided that the best benchmark for comparison with Site TOO2 was a mean of RE 12.11.24 and RE 12.3.5 (the nearest similar community to RE 12.3.6 that had a benchmark at the time of assessment). Consequently, the benchmark sizes (DBH) for large trees used in the field-assessment, especially for Site TOO2, are not adequately comparable to the true RE benchmark for the site.

The current version of the southeast Queensland BioCondition benchmarks document (Queensland Herbarium 2019) includes a benchmark for RE 12.3.6 and this should be used as the comparison-point for data collected at Site TOO2. Indeed, benchmarks are now available for all REs present in the study area (see **Appendix B**), so these should be referred to when undertaking future assessments at the TFEEC BioCondition sites.

Site BioCondition summaries

BioCondition Summary data for Sites TOO1 and TOO2 are shown below in **Table 3** and **Table 4**, respectively. The raw field data for each site are presented in **Appendix C** and in the Microsoft Excel files (*BioCondition_2018_TOO1.xlsx* and *BioCondition_2018_TOO2.xlsx*) that are bundled with the electronic copy of this report.

The ecological condition of a site, relative to benchmark condition, is expressed as a BioCondition Score. This Score is calculated by adding a series of weighted scores applied to the key BioCondition indicators (see **Appendix D**) and dividing the sum by the maximum possible Score for the ecosystem type (80 in the case of woodland/forest ecosystems). The Scores for each indicator are weighted according to their relative contribution to overall ecosystem function (see Eyre *et al.* (2015) for detailed explanations).

Site TOO1 has a relatively high BioCondition Score of 0.92 (i.e. 92% of Benchmark Condition), so is considered to be in very good ecological condition. The main functional indicator contributing to a reduced score at this site is low cover of native perennial grasses; however, this was probably a result of survey timing in late winter when grass cover is often scant.

The TOO2 Score is much lower (0.73), but this is unreliable due to the wrong choice of large-tree benchmark at the time of assessment and confusion over whether to place the abundant vine cover in the “shrub cover” indicator category. The subsequent low count of large trees and high shrub cover has probably negatively skewed the result away from the Site’s true BioCondition Score.

Table 3 BioCondition Summary for August 2018 assessment at Site TOO1, Toohey Forest.

BIOCONDITION ATTRIBUTE			Measurement		Weighted score
			Site	Benchmark*	
Recruitment of dominant canopy species %			100	100	5
Native plant species richness	Tree		13	10	5
	Shrub		10	8	5
	Grass		4	9	2.5
	Forbs etc.		18	17	5
Trees - Emergent	Median height (m)		n/a	n/a	
	Cover (%)		n/a	n/a	
Canopy	Median height (m)		23	26	5
	Cover (%)		68.6	72	5
Sub-canopy	Median height (m)		12	10	
	Cover (%)		30.4	43	
Large trees	Eucalypt threshold DBH (cm)		46	46	
	Number large eucalypts per hectare		58	33	
	Non-eucalypt threshold DBH (cm)		n/a	n/a	
	Number large non-eucalypts per hectare		n/a	n/a	
	Total large trees per hectare		58	33	15
Shrubs	Native shrub cover (%)		6	7	5
Ground cover	Native perennial grass cover (%)		9.5	39	1
	Organic litter cover (%)		55.4	45	5
Coarse woody debris	Total length per hectare (m)		560	546	5
Non-native plant cover (%)			1	0	10
Total weighted score					73.5
BioCondition Score (=Total score /80)					0.92

* Benchmark shown = RE 12.11.24

Table 4 BioCondition Summary for August 2018 assessment at Site TOO2, Toohey Forest.

BIOCONDITION ATTRIBUTE		Measure		Weighted score
		Site	Benchmark*	
Recruitment of dominant canopy species %		70	100	3
Native plant species richness	Tree	1	8	5
	Shrub	9	7	5
	Grass	1	6	0
	Forbs etc.	15	15	5
Trees - Emergent	Median height (m)	n/a	n/a	
	Cover (%)	n/a	n/a	
Canopy	Median height (m)	28	18	5
	Cover (%)	64.8	55	5
Sub-canopy	Median height (m)	15	8	
	Cover (%)	66.3	6	
Large trees	Eucalypt threshold DBH (cm) †	40	44	
	Number large eucalypts per hectare	66	25	
	Non-eucalypt threshold DBH (cm)	n/a	26	
	Number large non-eucalypts per hectare	0	78	
	Total large trees per hectare	66	103	10
Shrubs	Native shrub cover (%)	11.3	6	5
Ground cover	Native perennial grass cover (%)	0.4	30	0
	Organic litter cover (%)	38.6	43	5
Coarse woody debris	Total length per hectare (m)	530	617	5
Non-native plant cover (%)		1	0	5
Total weighted score				58
BioCondition Score (=Total score/80)				0.73

* Benchmark shown = RE 12.3.6

† **NOTE:** benchmark DBH for large trees was not derived from the listed benchmark as it was not available at the time of field work; consequently, the large tree count for Site TOO2 used smaller threshold DBH and did not include a count of non-eucalypts.

Conclusions

At the time of conducting this first round of site assessments, the available BioCondition Benchmarks were not entirely suitable for the vegetation types being surveyed for TFEEC. Consequently, the comparison of data collected in August 2018 with 'assumed' benchmarks (which were based on combination available Benchmarks for nearest similar REs) is somewhat less than satisfactory for the long-term monitoring of the sites. Despite this, we collected suitable baseline data on key ecological indicators for the two transects and these data will be useful for TFEEC students wishing to evaluate their own data collected from the sites.

References

- Queensland Herbarium (2019). *Biocondition Benchmarks for Regional Ecosystem Condition Assessment: Southeast Queensland Bioregion*. Department of Environment and Science; Brisbane. URL: <https://www.qld.gov.au/environment/plants-animals/biodiversity/benchmarks>; Accessed 30/01/2019.
- Eyre, T.J., Kelly, A.L, Neldner, V.J., Wilson, B.A., Ferguson, D.J., Laidlaw, M.J. and Franks, A.J. (2015). *BioCondition: A Condition Assessment Framework for Terrestrial Biodiversity in Queensland. Assessment Manual. Version 2.2*. Queensland Herbarium; Department of Science, Information Technology, Innovation and the Arts; Brisbane.
- Department of Environment and Science (2019). Copy of the Remnant Regional Ecosystem Map - Version 11. Online RE Map, The Department of Environment and Science, Brisbane. URL: <https://apps.des.qld.gov.au/map-request/re-broad-veg-group/> Accessed on 30/01/2019.

Appendix A Remnant Regional Ecosystem map for the Toohey Forest project area

Appendix B Biocondition benchmarks relevant to TFEEC BioCondition sites

Appendix C BioCondition Data Sheets for two transects at Toohey Forest

Appendix D Weighted scoring system for BioCondition indicators (after Eyre *et al.* 2015)

Indicator	Description	Score
Number of large trees	No large trees present	0
	0 to 50% of benchmark number of large trees	5
	≥50% to 100% of benchmark number of large trees	10
	≥ benchmark number of large trees	15
Tree canopy height	<25% of benchmark height	0
	≥25% to 70% of benchmark height	3
	≥70% of benchmark height	5
Recruitment of canopy species	<20% of dominant canopy* species present as regeneration	0
	≥20 – 75% of dominant canopy* species present as regeneration	3
	≥75% of dominant canopy* species present as regeneration	5
Tree canopy cover	Percentage of Tree Canopy (EDL) Cover relative to Benchmark	
	<10% of benchmark	0
	≥10% and <50%	2
	≥50% or ≤200%	5
	>200%	3
Shrub cover	<10% of benchmark shrub cover	0
	≥10 to <50% or >200% of benchmark shrub cover	3
	≥50% or ≤200% of benchmark shrub cover	5
Coarse woody debris	<10% of benchmark number or total length of CWD	0
	≥10 to <50% or >200% of benchmark number or total length of CWD	2
	≥50% or ≤200% of benchmark number or total length of CWD	5
Plant species richness for each life form	<25% of benchmark number of species within each life-form	0
	≥25% to 90% of benchmark number of species within each life-form	2.5
	≥90% of benchmark number of species within each life-form	5
Non-native plant cover	>50% of vegetation cover are non-native plants	0
	≥25 – 50% of vegetation cover are non-native plants	3
	≥5 – 25% of vegetation cover are non-native plants	5
	<5% of vegetation cover are non-native plants	10
Native perennial grass species cover	<10% of benchmark native perennial (or preferred and intermediate) grass cover	0
	≥10 to 50% of benchmark native perennial (or preferred and intermediate) grass cover	1
	≥50 – 90% of benchmark native perennial (or preferred and intermediate) grass cover	3
	≥90% of benchmark native perennial (or preferred and intermediate) grass cover	5
Organic litter	<10% of benchmark organic litter	0
	≥ 10 to <50% or >200% of benchmark organic litter	3
	≥50% or ≤200% of benchmark organic litter	5