CO2 Australia Limited

Bendena Human-Induced Regeneration Project

Project Scale

Environmental Account 2020

Account Summary & Information Statement

THIRD-PARTY VERIFIED

CERTIFIED environmental account

ACCOUNTING FOR NATURE

WHO IS ACCOUNTING FOR NATURE?

Accounting for Nature Ltd is a not-for-profit company with a vision to be a recognised global leader for measuring changes in the health of the environment. Our mission is to provide transparent, affordable and verifiable measures of change in environmental condition of sufficient quality to inform policy and investment decisions - both at an enterprise and at an ecosystem scale. To achieve this, the Accounting for Nature® Certification Framework sets the first globally consistent, scientifically credible Standard for measuring, certifying and communicating changes in the condition of any environmental asset (native vegetation, soil, water and wildlife).

PURPOSE OF THIS DOCUMENT

The Accounting for Nature® Certification Framework specifies that a set of tables and maps be produced, together with an Information Statement, to create an Environmental Account that describes the condition of a range of environmental assets – similar to a financial balance sheet for a company. The Information Statement provides full transparency on how an Environmental Account is developed. The Information Statement documents, in non-technical terms, the rationale for the selection of assets, choice of indicators, the origins of the data, the analysis and treatment of data and construction of the Econd®.

DISCLAIMER

Table of Contents

Figures

Tables

1 Overview

CO2 Australia – Bendena Human-Induced Regeneration Project

AfN Registered Account: **AfN-PROJECT-02**

Proponent	CO2 Australia Limited
Authors & Qualifications/experience	Dr Jarrad Cousin PhD (Ecology) *UNE*, MSc (EnvMan) *ECU*, BSc (Zool)(Bot) *UWA* Accredited Expert – Category 1 (Native Vegetation and Fauna)
Certification tier	Tier 1 – Certified
Linked Environmental Markets	ACCU – search "Bendena Human-Induced Regeneration Project" at http://www.cleanenergyregulator.gov.au/ERF/project-and-contracts-registers/project-register
Report citation	CO2 Australia (2022). *Bendena Human-Induced Regeneration Project Environmental Account – Information Statement*. CO2 Australia, Brisbane.
Acknowledgements	The accredited method used to generate the Native Vegetation Econd® was authored by Dr Jarrad Cousin and Mr Christopher Ewing of CO2 Australia and accredited by Accounting for Nature Limited (AfN) in September 2020. Field-based assessments undertaken in accordance with the Native Vegetation Method were undertaken by Dr Jarrad Cousin and Mr Dean Orrick of CO2 Australia in October 2020.

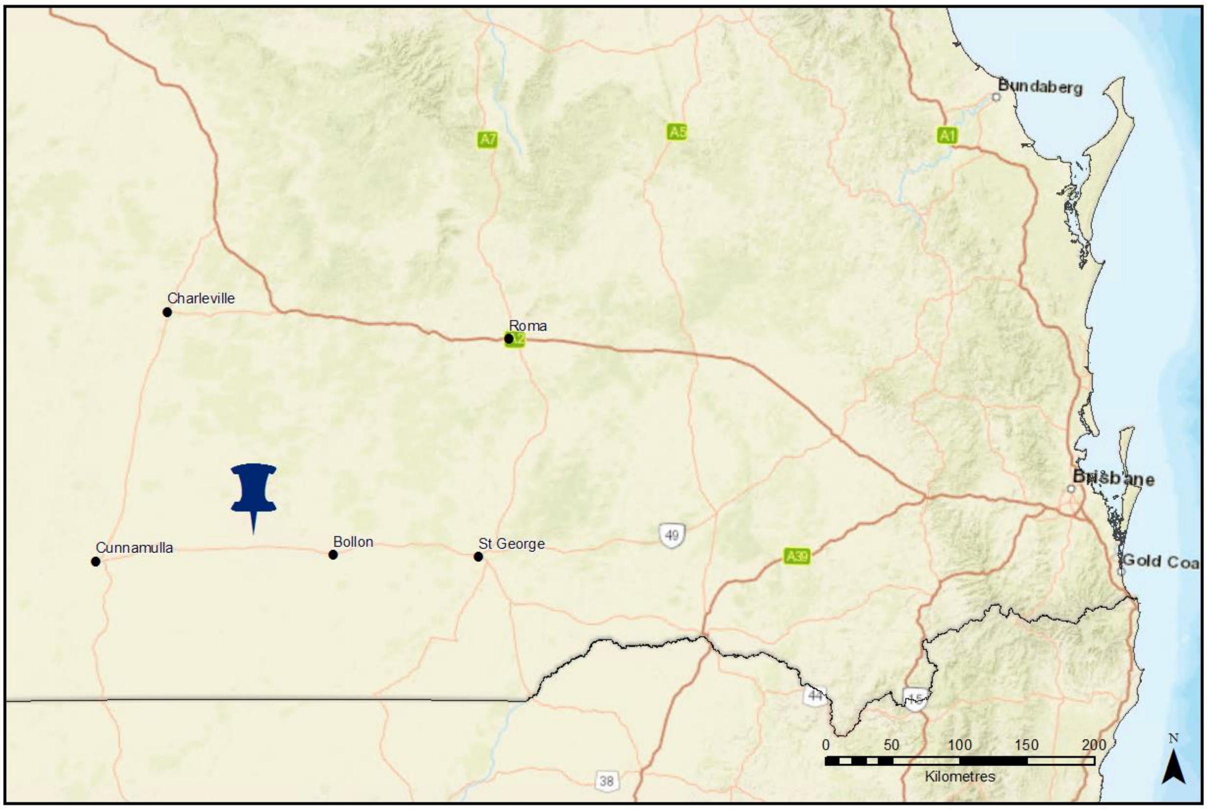


Figure 1. Location of Bendena

2 Environmental Account information

Purpose	In November 2017, the *Bendena Human-Induced Regeneration Project* was declared an eligible project under the *Carbon Credits (Carbon Farming Initiative) Act 2011* (Cth). The project has been generating Australian Carbon Credit Units (ACCUs) and will continue to supply them to the end of the project's Emissions Reduction Fund (ERF) crediting period. The goal of the project is to monitor and track improvement in biodiversity co-benefits associated with the carbon estimate areas of the Human-Induced Regeneration (HIR) ERF project through the calculation of a Native Vegetation Econd®. Once the project's Environmental Account is formally certified by AfN, the calculation of the project Native Vegetation Econd® will inform management by contributing to the assessment of weed threat and fuel loads in the project area. Further opportunities to improve biodiversity co-benefits of the project will continue to be explored for the life of the project, based on the outcomes of Econd® assessments.
Scope	The account aims to assess the change in condition of the native vegetation environmental asset over time, associated with the recovery of vegetation communities within the project accounting area.
Scale	Project-scale, within eligible project areas representing the project accounting area. The project environmental account area represents 32% of the property area (Figure 2).
Location	Nebine, Shire of Paroo, Queensland (Figure 1)
Bioregion	Mulga Lands bioregion (West Balonne Plains, Eastern Mulga Plains and Nebine Plains subregions)
Climate	BSh climate designation under the Köppen-Geiger climate classification. B – Arid, S – Steppe, h – hot (Beck et al. 2018)
Area (hectares [ha])	19,713
Site history	The site has historically been used for cattle crazing
Current land-uses	Cattle grazing

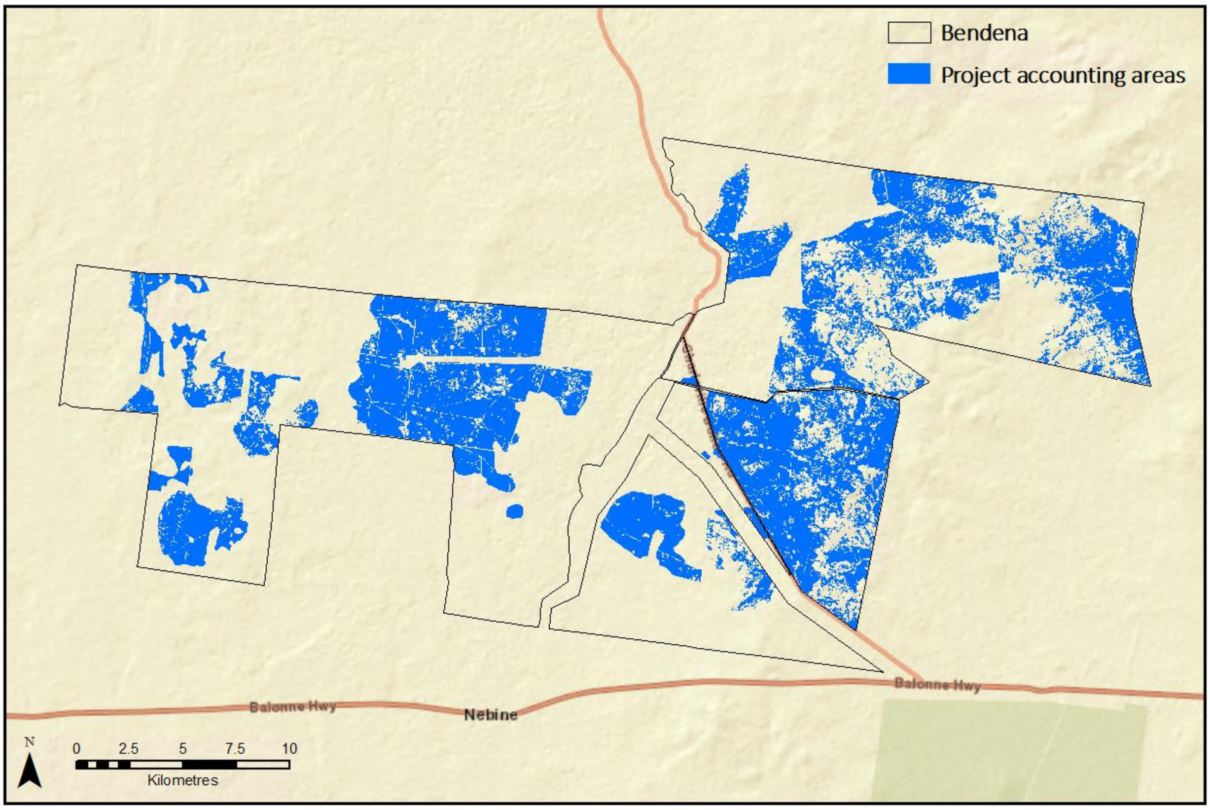
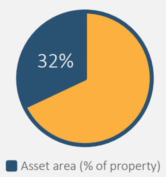


Figure 2. Bendena Human-Induced Regeneration Project – project accounting areas

Table 1. Environmental account summary table

Asset	Asset area	Baseline Econd® Base Year – 2020	Econd® Trend	Confidence Level and Method
NATIVE VEGETATION	19,713 ha 	Econd® 64.8 2020	TBC	LEVEL 1 VERY HIGH CONFIDENCE Econd™ accuracy of 95% AfN-METHOD-NV-02
SOIL	While these assets are not currently included in this project's environmental account, they may be considered for inclusion in future updates			
NATIVE FAUNA				
FRESH WATER	Not currently being considered			
MARINE	NA			

3 Environmental Account summary

3.1 Econd® Summary table

Table 2 presents the Econd® score for the Native Vegetation Asset of the *Bendena Human-Induced Regeneration Project*. The Native Vegetation Asset is represented by a single assessment unit, with no sub-assets. Figure 3 graphically illustrates the measurable attribute condition scores (scaled to be out of 100) contributing to species richness, structure, function and vegetation configuration condition indicators of the Native Vegetation Asset Econd®.

Table 2. 2020 Econd® summary table for the CO2 Australia – Bendena Human-Induced Regeneration Project

Asset	Assessment Unit	Area (ha)	2020
			Asset Econd®
Native Vegetation	Broad Vegetation Group (BVG) 23 – *Acacia aneura* (mulga) woodlands to tall open shrublands on red earth plains, sandplains or residuals	19,713	64.8

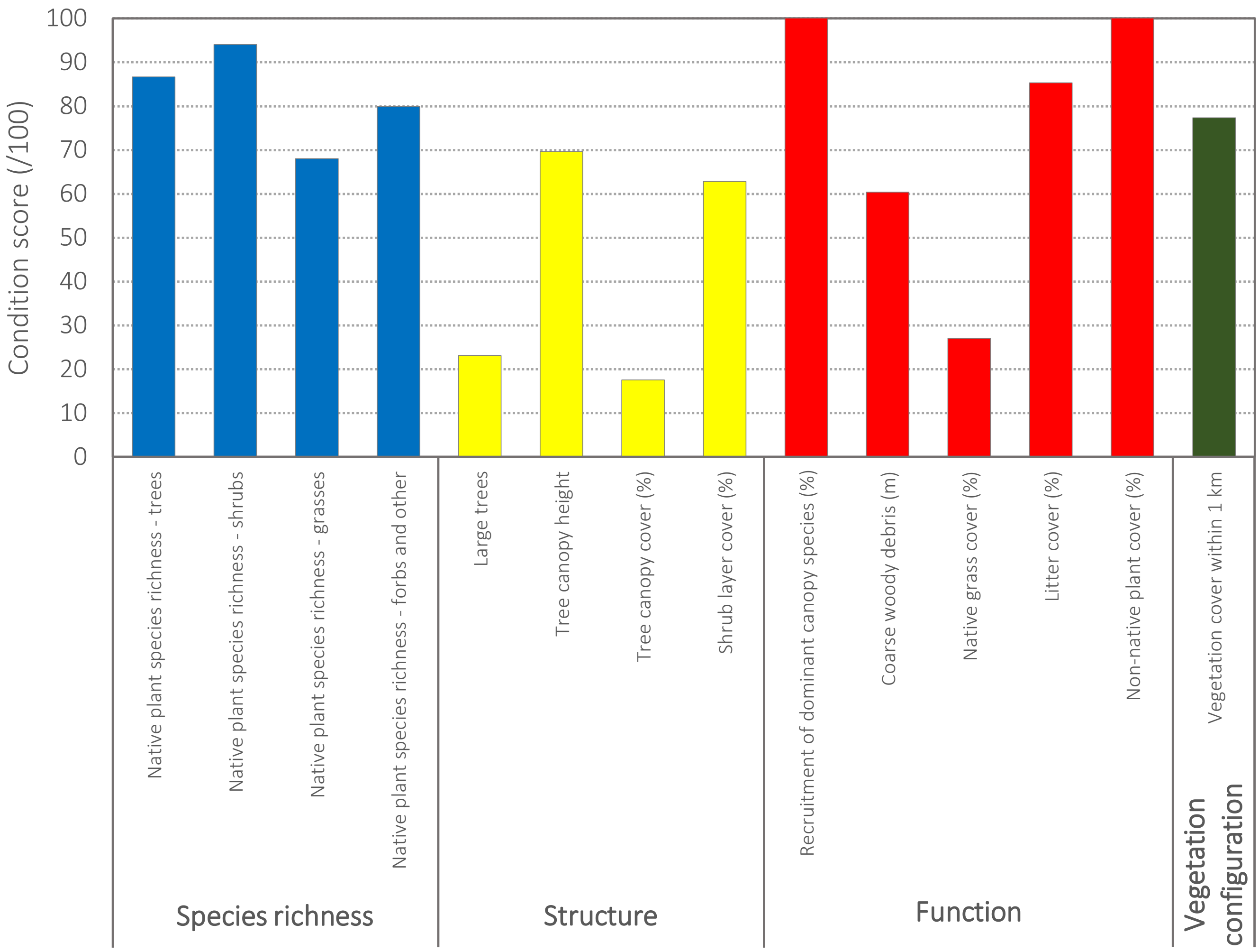


Figure 3. Summary of the measurable attribute condition scores contributing to species richness, structure, function and vegetation configuration condition indicators of the Native Vegetation Asset Econd®

3.2 Significant outcomes

At the time of preparing this information statement, there are no existing HIR projects anywhere in Australia established with an AfN Environmental Account, with only one other existing environmental account attached to an ERF project, also prepared by CO2 Australia for an environmental planting project in south-east Queensland (*Wivenhoe Land Restoration Pilot* – AfN-PROJECT-01). With unprecedented demand in the market (both private and public investment) for ACCU projects supporting verifiable, auditable biodiversity co-benefits, CO2 Australia are proud to continue their unwavering support for supplying and delivering such carbon credits into the Australian market.

This information statement represents the baseline environmental account for the *Bendena Human-Induced Regeneration Project*. At present, this environmental account only considers Native Vegetation assets, with the potential to incorporate additional assets (e.g. Fauna, Soils) in the future. The results of the baseline Native Vegetation Econd® assessment, summarised in Figure 3, demonstrate that species richness of most strata are approaching benchmark values. The species richness attribute the furthest from benchmark condition is grass species richness, however it is anticipated that in these mulga-dominated communities, this attribute will continue to increase with an increase in canopy cover.

Condition scores for structural indicator attributes of the Native Vegetation Asset were, on average, less than other indicators. In particular, the average score for number of large trees and tree canopy cover was less than 20. This was not unexpected given the land use history of Bendena, characterised by the 'pulling' of such country for fodder harvesting over many years. Consequently, with the cessation of such practices, it is anticipated that the tree canopy cover and tree canopy height will continue to increase, with the number of large trees likely to take much longer to recover. Likewise, shrub cover is likely to increase with canopy cover and easing of grazing pressure.

Condition scores for functional indicator attributes were variable, with maximum scores for recruitment and non-native plant cover. Conversely, native grass cover exhibited the lowest score of all functional indicator attributes. As with native grass richness, it is anticipated that this attribute will increase with an increase in canopy cover. Like the large trees attribute, the coarse woody debris attribute is one not anticipated to change in the short term; only likely to manifest with the senescence and death of the larger trees over the longer term.

The vegetation configuration indicator, represented by the measure of vegetation cover within 1 kilometre (km) of the Econd® sites, is only likely to increase in the long-term as areas of regrowth associated with project areas continue to mature and reach remnant status.

Future, ongoing assessments of the *Bendena Human-Induced Regeneration Project* will be undertaken to track the expected improvement of the Native Vegetation Econd®.

4 Asset 1: Native vegetation

This Native Vegetation Account was developed in accordance with the Accounting for Nature® *CO2 Australia Native Vegetation Condition Monitoring Method* (CO2 Australia 2020; AfN-PROP-NV-02, hereafter referred to as 'Native Vegetation Method'), accredited by the AfN Standards & Accreditation Committee (now Science Accreditation Committee) on 16 September 2020.

This Native Vegetation Account is developed at the *Level 1 (very high)* assurance, as defined in the Native Vegetation Method, over a project accounting area of 19,713 ha.

4.1 Data sources

To develop the Native Vegetation Account, the data sources listed in Table 3 were used.

Table 3. Datasets used for the Native Vegetation Asset

Data name	Source	Use
Sentinel-2 satellite imagery – 4-band (10 m resolution)	Copernicus Open Access Hub – Sentinel-2 (Level-1C product)	Sentinel-2 satellite imagery was classified into 20 clusters based on the spectral signature values of bands 2-8a and 11 ,12 (20201017_Kmean20) using the kmean algorithm. Resulting output was then reclassified into more meaningful high-regrowth, regrowth, forest-cover, bare/sand and non-regrowth classes based on visual inspection of the Sentinel-2 image; merging the 20 classes to create 5 classes to assist with: - stratification of vegetation into existing forest areas (for exclusion from project areas), high-regrowth, regrowth and bare/sand for purposes of subsequent field-based assessment and stratification refinement - delineating remnant, regrowth and non-remnant areas for use in the configuration analysis.
Biodiversity status of pre-clearing regional ecosystems – Queensland – version 12	Queensland Department of Environment and Science (DES) 2021	Interrogation of land zone and pre-clearing Regional Ecosystems (REs) for the purposes of stratifying the environmental accounting area and assigning monitoring sites.
Queensland Government's Regulated Vegetation Management Map (RVMM) – version 4.05	Department of Natural Resources, Mines and Energy (DNRME) 2020	Interrogation of the extent of Category B vegetation for the purpose of assessing remnant, regrowth and non-remnant areas for use in the configuration analysis

4.2 Stratification and sampling

4.2.1 Stratification

Initial human-induced regeneration project establishment

The HIR project was established during 2017 based on an initial desktop stratification identifying eligible project areas by first excluding forested areas (identified from analysis of Landsat and Sentinel-2 MSI remote sensing satellite data) and excluding other land not being used for project purposes. This initial stratification also involved the interrogation of Queensland digital mapping datasets including pre-clearing RE mapping; specifically selecting areas mapped as supporting mulga-dominated REs. This focus was largely borne in response to these mapped RE being those within which fodder harvesting was historically targeted, with eucalypt-dominated communities (where present) not typically supporting fodder species. Following the desktop stratification, remote sensing satellite imagery (Sentinel-2 imagery) was interrogated to further refine project areas based on a preliminary classification system delineating possible forest, high-regrowth, regrowth and bare/sand classes. Field-based assessments were then undertaken, comprising a combination of transect and point-based measurements. Following collection of field-based data, accuracy assessment of modelled project areas was undertaken whereby 70% was randomly selected as training data and the remaining 30% was used for accuracy assessment. Based on the combination of desktop assessments, field-based assessments and model refinement, a final project area was identified, representing 19,713 ha (Figure 2).

Stratification of project accounting area for establishing Econd® sites

The pre-clearing RE mapping (DES 2021) identifies a total of six BVG across the Bendena property (Figure 4). The desktop and field-based assessment undertaken as part of the original HIR project establishment focused on mulga-dominated REs consistent with just BVG 23. These represent the RE that are typically cleared as part of fodder harvesting, dominated by the primary fodder species (particularly *Acacia aneura*, but also *Acacia excelsa* and *Geijera parviflora*).

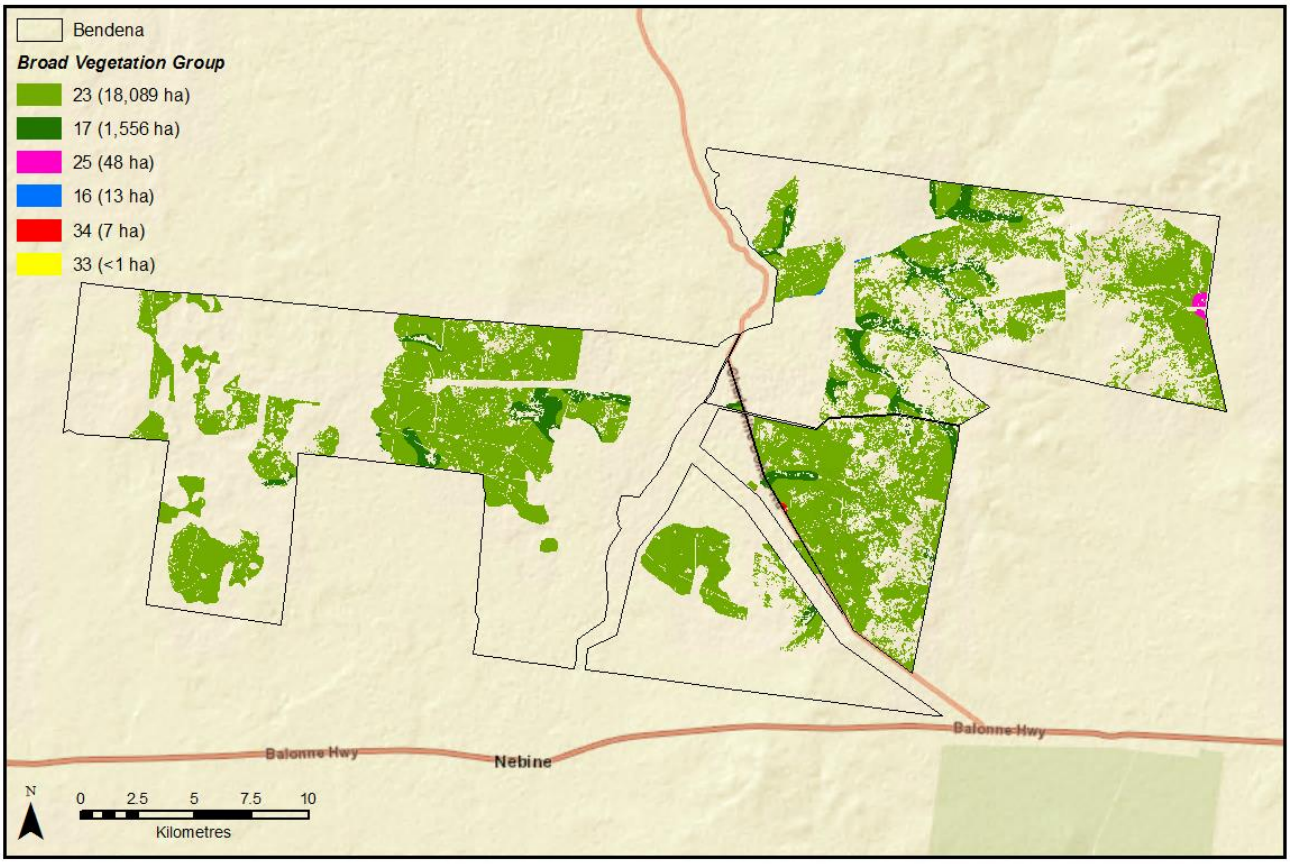


Figure 4. Queensland pre-clearing BVG (DES 2021) for the Bendena Human-Induced Regeneration Project

Thus, while the project accounting area intersects six mapped pre-clearing BVG (comprising a mix of 20 single RE and mixed RE polygons), 89.6% of the project accounting area intersected with seven REs within BVG 23. Of the remaining 10.4% of the project accounting area, two mapped pre-clearing REs (RE 6.3.18 and RE 6.5.3, both from BVG 17a) contributed 9.1%. However, field-based assessments identified that these areas were instead consistent with BVG 23 REs, with the discrepancy a consequence of pre-clearing RE mapping being generated at a broad spatial scale (1:100,000). For example, the predominantly ephemeral RE 6.3.18 is represented in pre-clearing RE mapping as polygons up to 500 metres (m) in width, whereas field-based assessments identified occasional areas of RE 6.3.18 as narrow bands of vegetation (<10 m) associated with ephemeral drainage lines. Much of these areas were already excluded from the project accounting area as part of the HIR project establishment stratification process.

Of the remaining 1.3% of the project area, pre-clearing mapping identified a mix of non-mulga REs of varying species compositions and land zones. By virtue of the project area specifically being associated with mulga-dominated vegetation communities, none of these areas were considered as accurately reflecting the likely and/or ground-truthed REs.

The project accounting areas were thus stratified into the seven (7) remaining pre-cleared REs, all grouped into the single BVG 23 (1:2,000,000 scale). In accordance with the Native Vegetation Method, the project accounting area assessment unit was thus taken to be represented by the single BVG 23 (Table 3), with the sampling design guided by the results of that stratification.

Table 4. The single Native Vegetation assessment unit and the contribution of REs across the Bendena Human-Induced Regeneration Project accounting area

Asset	Broad Vegetation Group (BVG)[A]	Regional Ecosystem (RE)[B]	Area (ha)	Weighting
Native vegetation	BVG 23	RE 6.5.1 *Acacia aneura +/- Eucalyptus populnea, E. melanophloia* open forest on undulating plains in the east	7,667.3	38.9%
		RE 6.5.2 *Eucalyptus populnea, Acacia aneura* and/or *E. melanophloia* woodland on Quaternary sediments	4,205.5	21.3%
		RE 6.5.11 *Acacia aneura +/- Eucalyptus populnea* low woodland on sand plains	3,874.5	19.7%
		RE 6.5.7 *Eucalyptus populnea +/- Acacia aneura, E. melanophloia, E. intertexta* woodland on sand sheets	3,529.8	17.9%
		RE 6.7.12 *Acacia aneura +/- Eucalyptus populnea* low woodland on lateritic residuals	240.2	1.2%
		RE 6.3.21 *Acacia aneura, A. excelsa and/or Geijera parviflora low woodland on low alluvial sand dunes*	196.2	1.0%
		TOTAL	**19,713.5**	**100%**

[A] Broad Vegetation Group defined at the 1:2,000,000 scale and represents the assessment unit for the purposes of calculating Indicator Condition Scores and final Econd® scores.

[B] RE codes and descriptions based on version 12 of the *Regional Ecosystem Description Database* (Queensland Herbarium 2021a).

4.2.2 Sample sites

Following stratification of the project accounting area, a sampling design was implemented in accordance with the Native Vegetation Method. The number of Econd® monitoring sites established across the project accounting area was assigned to ensure survey effort was sufficient to ensure *Level 1 (very high)* assurance, as defined in the Native Vegetation Method.

A total of 15 Econd® monitoring sites were established across the project accounting area (Table 5, Table 6 and Figure 5), six more than the minimum required to ensure *Level 1 (very high)* assurance under the Native Vegetation Method. The location of each of the 15 Econd® monitoring sites was established by assigning a number of sites to each of the six RE contributing to the BVG 23 assessment unit, proportional to the contribution of the area of each of the given RE to the project area and ensuring at least one monitoring site at each RE. Figure 6 shows vegetation at a representative site (BEND_12), with Figure 7 showing the details of what was installed to establish the permanent monitoring sites.

Table 5. Regional Ecosystems contributing to the BVG 23 assessment unit and summary of survey effort

Assessment unit	Regional Ecosystem (RE)	Area (ha)	Minimum survey effort[A]	Econd® monitoring sites established
BVG 23	RE 6.5.1	7,667.3	3	5
	RE 6.5.2	4,205.5	2	3
	RE 6.5.11	3,874.5	2	2
	RE 6.5.7	3,529.8	2	3
	RE 6.7.12	240.2	1	1
	RE 6.3.21	196.2	1	1
	TOTAL	19,713.5	9	15

[A] Required in order to achieve *Level 1 (very high)* assurance in accordance with the Native Vegetation Method. Minimum survey effort calculated as approximate proportional contribution of REs to the total assessment unit area.

Table 6. Overview of sample site selection method and timing

Sample	Implementation
Site selection	Approximately 103 sites were originally assigned across the Bendena property for assessment of canopy cover using an unmanned aerial vehicle for the purposes of determining eligibility for registration of an HIR project. The 103 sites were assigned by a combination of HIR model (gridded) point sites (refer to Figure 5) and visual interrogation of Sentinel-2 satellite classification imagery. Of those 103 sites, all those within 500 m of known access tracks were shortlisted, reducing the number to 37 sites. To assign each of the minimum number of Econd® sites to each of the RE, representative sites for each RE were selected from the shortlisted sites, ensuring they were spread across the project accounting area as much as possible. While the minimum number of sites to achieve *Level 1 (very high)* assurance was 9 sites, additional sites were assigned to three of the REs in order to increase spatial representativeness of those sites across the project accounting area.
Timing	Assessment of vegetation condition at the finalised Econd® monitoring sites was undertaken during October 2020. The project is considered to be located in the arid zone for the purpose of the Native Vegetation Method on account of the Köppen-Geiger Climate Classification (BSh – Arid, steppe, hot). The Native Vegetation Method identifies that the recommended surveying timing in the arid zone is the months following major rainfall event/s. Rainfall records from Heather Station (weather station 44143), approximately 45 km to the south-east of Bendena, confirmed 49.5 millimetres of rain in the two months preceding the vegetation condition assessments (August and September 2020), representing 142% of the long-term average for these months (Bureau of Meteorology 2022). During the vegetation condition assessment, many of the understorey species were present and identifiable, reflecting the appropriate timing of the survey.

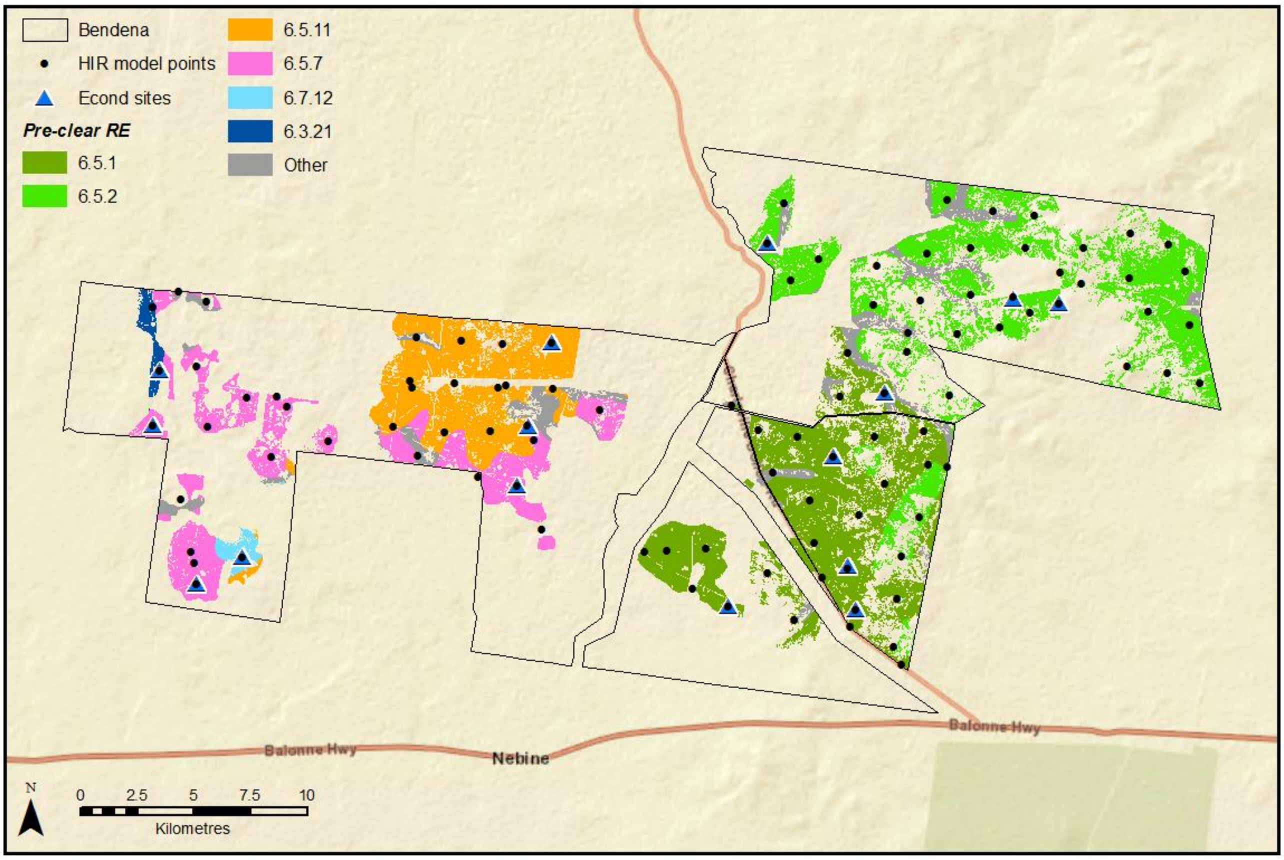


Figure 5. Native Vegetation mapped pre-clearing Regional Ecosystems and Econd® sites in the Bendena Human-Induced Regeneration Project

Figure 6. Econd® monitoring site (BEND_12) showing vegetation characteristic of regenerating RE 6.5.11, including retained coarse woody debris in the ground layer

Figure 7. Econd® monitoring site (BEND_08) showing permanent marker installed at the 0 m point – represented by steel pickets covered with orange PVC conduit. Permanent markers were installed at the 0 m and 50 m point at all the 15 project Econd® sites

4.3 Indicators and Reference Benchmarks

4.3.1 Indicators

Measurable attributes contributing to the indicators used to calculate the Native Vegetation Econd® are listed in Table 7, consistent with the Native Vegetation Method.

The composition indicator comprises a mix of 13 measurable attributes, combined into three sub-indicators represented by species richness, structure and function. Vegetation configuration is represented by a single measurable attribute reflecting extent of remnant (intact) and regrowth vegetation within 1 km of a given monitoring site.

Table 7. Measurable attributes contributing to Indicators Condition Scores and final Native Vegetation Econd®

<table>
<tr><th colspan="2">Indicators</th><th>Measurable attributes</th><th>Attribute score</th><th>Indicator Condition Score</th></tr>
<tr><td colspan="2">Extent</td><td colspan="2">Extent measured as the percentage contribution of the area of a given assessment unit to the project accounting area.</td><td>-</td></tr>
<tr><td rowspan="13">Composition</td><td rowspan="4">Species richness</td><td>Species richness (count) – trees</td><td>5</td><td rowspan="4">20</td></tr>
<tr><td>Species richness (count) – shrubs</td><td>5</td></tr>
<tr><td>Species richness (count) – grasses</td><td>5</td></tr>
<tr><td>Species richness (count) – forbs/other</td><td>5</td></tr>
<tr><td rowspan="4">Structure</td><td>Large trees (count)</td><td>15</td><td rowspan="4">30</td></tr>
<tr><td>Canopy tree height (m)</td><td>5</td></tr>
<tr><td>Canopy cover (%) – trees</td><td>5</td></tr>
<tr><td>Canopy cover (%) – shrubs</td><td>5</td></tr>
<tr><td rowspan="5">Function</td><td>Recruitment of dominant canopy species (%)</td><td>5</td><td rowspan="5">30</td></tr>
<tr><td>Coarse woody debris (total length of logs)</td><td>5</td></tr>
<tr><td>Organic litter cover (%)</td><td>5</td></tr>
<tr><td>Native grass cover (%)</td><td>5</td></tr>
<tr><td>Non-native plant cover (%)</td><td>10</td></tr>
<tr><td colspan="2">Vegetation configuration</td><td>Remnant (intact) vegetation and native regrowth within 1 km of site</td><td>20</td><td>20</td></tr>
<tr><td colspan="4">Final Native Vegetation Econd®</td><td>100</td></tr>
</table>

4.3.2 Reference Benchmarks

Reference conditions for the measurable attributes contributing to the composition indicators were sourced from BioCondition benchmark documentation developed by the Queensland Herbarium (2021b) (refer to Appendix A).

BioCondition benchmarks have been compiled by the Queensland Herbarium from quantitative site data from reference sites, data from the Queensland Herbarium's CORVEG database and other relevant data and expert opinion. The benchmark documents are specific to each RE and aim to reflect the natural variability in structure and floristic composition under a range of climatic and natural disturbance regimes throughout the geographic extent of a given RE.

While BioCondition benchmarks were developed specifically to support the BioCondition vegetation condition assessment framework, the survey design outlined in the Native Vegetation Method was developed specifically in order to be able to use BioCondition benchmarks as the reference condition data source. Where deviations in attribute scores from the published benchmarks were used, they are explained in Appendix A.

4.4 Data collection

4.4.1 GIS analyses – extent and configuration

Analysis of Data

The spatial configuration of native vegetation for the project was mapped in accordance with the Native Vegetation Method. Specifically, it considered the extent of remnant (intact) and native regrowth vegetation within a 1 km radius of each of the 15 Econd® monitoring sites using ArcGIS (Figure 8). The extent of remnant vegetation was derived from a combination of interrogation of the extent identified as Category B vegetation under the Queensland Government's RVMM (DNRME 2020), interrogation of Sentinel-2 satellite imagery classification, field-based observations and aerial photo interpretation. Category C (high value regrowth) areas under the RVMM are not considered an accurate surrogate of the extent of native regrowth vegetation within the landscape, as implied under the Native Vegetation Method, given the restrictive definition of Category C vegetation under the *Vegetation Management Act 1999* (Qld; VMA) (see assessment of data quality below). Instead, the extent of native regrowth vegetation was assessed and mapped in ArcGIS using a combination of the latest available aerial imagery, interrogation of Sentinel-2 satellite imagery classification and results of field-based assessments to ensure it included areas showing native vegetation regrowth, while excluding non-native regrowth vegetation and cleared areas.

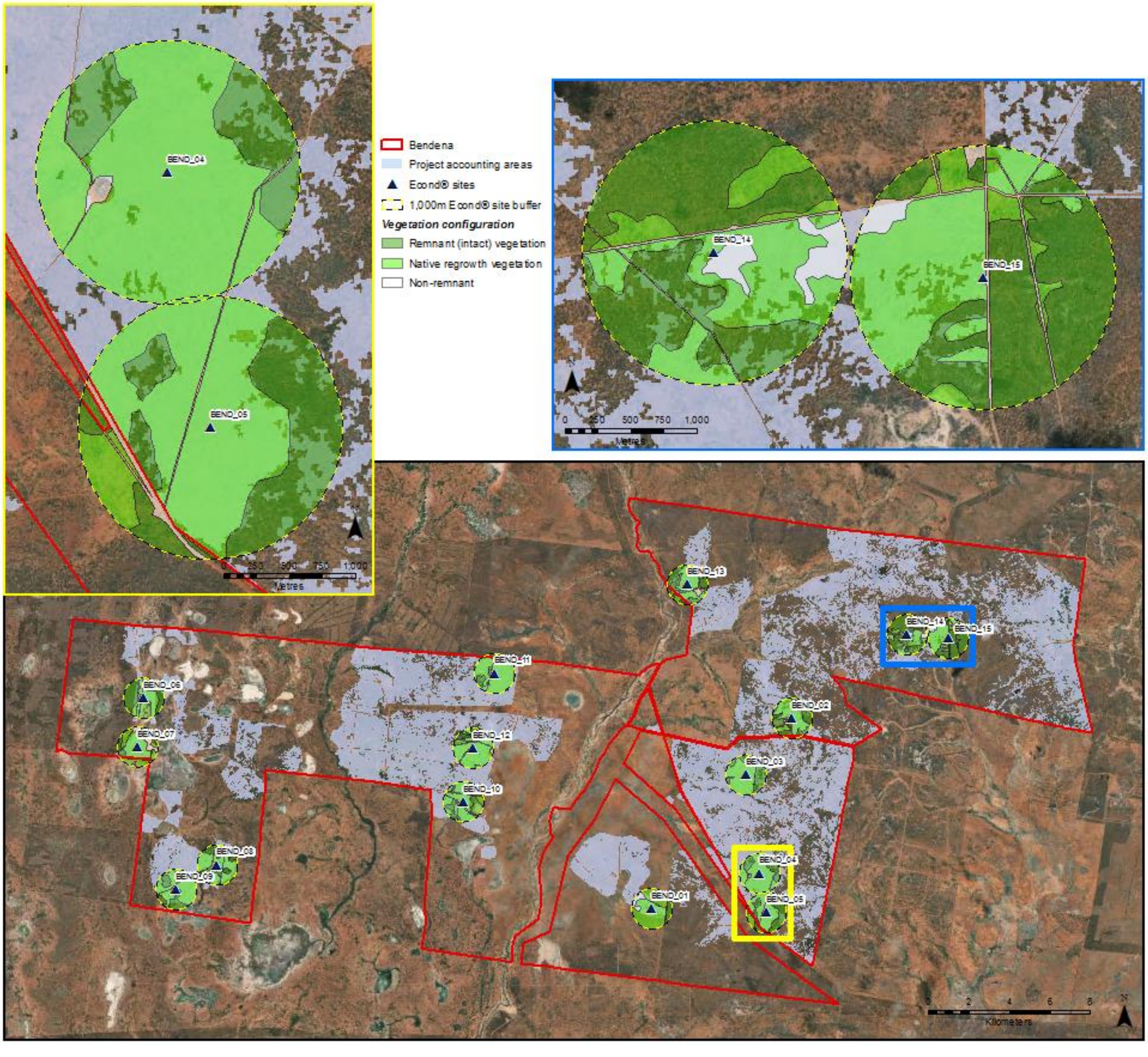


Figure 8. Remnant (intact) and native regrowth vegetation within 1 km of Econd® sites in the Bendena Human-Induced Regeneration Project, showing close-up site examples demonstrating scale of vegetation configuration assessed

Assessment of data quality

There is high confidence in the quality of the composition data as it is derived from a combination of Queensland Government RVMM, detailed interrogation of 10 m resolution Sentinel-2 satellite imagery, latest aerial imagery and results of field-based assessments. While Section 20AN of the VMA defines Category C vegetation mapped on the RVMM as areas supporting 'high value regrowth', this mapping is restricted to land of certain tenures, and only refers to areas that have not been cleared for at least 15 years. Referring to just Category C mapped areas would exclude regrowth vegetation <15 years old from consideration as part of the vegetation configuration indicator, as would mapped areas legally cleared for relevant clearing activities. Instead, the use of RVMM mapping in combination with Sentinel-2 satellite imagery, latest aerial imagery and results of field-based assessments afford the greatest confidence in the quality of the composition data.

4.4.2 Field assessment – composition indicators

Data collection methodology

Composition data was collected from established Econd® monitoring sites by tertiary-qualified ecologists sufficiently familiar with the flora of the region. All field-based assessments were undertaken in accordance with the Native Vegetation Method. In addition to visual identification of the species richness attributes, a number of the structural and functional attributes contributing to the composition indicator were collected using manual and electronic tools (refer to Native Vegetation Method), including GPS, tape measures, clinometers etc. Additional/supporting information was also collected as part of the field-based assessment (not contributing to the Econd® scoring), including monitoring site photos as per the Native Vegetation Method.

All composition data were recorded in the field on a combination of paper and electronic proformas.

Assessment of data quality

There is a high confidence in the quality of the composition data as it is derived from field-based assessments, with the number of survey sites exceeding the minimum survey effort required to ensure *Level 1 (very high)* assurance, as defined in the Native Vegetation Method. All data was collected by tertiary-qualified ecologists sufficiently familiar with the flora of the region.

4.5 Indicator Condition Score and Econd® calculation

Indicator Condition Score calculation

The Indicator Condition Score for composition indicators were calculated in accordance with the Native Vegetation Method. Specifically, all data collected from field-based assessments were collated in a scoring workbook developed by CO2 Australia, which includes prompted inputs and automatic calculations. This includes dynamic weightings for the four species richness attributes and accounts for naturally missing attributes, where relevant.

Econd® calculation

All Native Vegetation Econd® calculations were undertaken in accordance with the Native Vegetation Method (refer to CO2 Australia 2020). The results of the Econd® assessments, including all the raw data (and corresponding scoring) for each of the 15 Econd® sites are presented in Table 8, Table 9 and Table 10. The Native Vegetation Econd® was calculated for the single assessment unit, which represented the final project-wide Econd® (Table 11).

4.6 Native Vegetation Asset tables

Table 8, Table 9 and Table 10 present the raw data and measurable attribute score for each of the 15 sites (BEND_01 to BEND_15). Table 11 collates the results of each of the sites and presents the final Native Vegetation Econd® score.

Table 8. Raw data and measurable attribute scores for sites BEND_01 to BEND_06 – Refer to Table 7 for measurable attribute scores and their contribution to the final Native Vegetation Econd®

NATIVE VEGETATION ASSET TABLE														
		SITE	BEND_01		BEND_02		BEND_03		BEND_04		BEND_05		BEND_06	
Indicator		Measurable attribute	RE 6.5.1	Benchmark RE 6.5.1	RE 6.5.1	Benchmark RE 6.5.1	RE 6.5.1	Benchmark RE 6.5.1	RE 6.5.1	Benchmark RE 6.5.1	RE 6.5.1	Benchmark RE 6.5.1	RE 6.3.21	Benchmark RE 6.3.21
RAW DATA														
Composition	Species richness	Native plant species richness - trees	4	2	2	2	2	2	4	2	2	2	1	6
		Native plant species richness - shrubs	5	2	2	2	3	2	5	2	4	2	4	2
		Native plant species richness - grasses	9	11	6	11	2	11	5	11	10	11	7	7
		Native plant species richness - forbs and other	10	18	17	18	12	18	11	18	15	18	16	6
	Structure	Large trees	16	44	0	44	2	44	0	44	4	44	4	44
		Tree canopy height	10.4	10	3.3	10	8.6	10	3.5	10	3.6	10	4.8	6
		Tree canopy cover (%)	18.6	40	6.2	40	10.8	40	0	40	1.3	40	0	23
		Shrub layer cover (%)	24.1	2.5	14.2	2.5	10.7	2.5	6	2.5	21.8	2.5	6.9	0
	Function	Recruitment of dominant canopy species (%)	100	100	100	100	100	100	100	100	100	100	100	100
		Coarse woody debris (m)	378	300	420	300	59	300	290	300	154	300	20	11
		Native grass cover (%)	4	5	0	5	0.4	5	0.8	5	3.4	5	1.6	13
		Litter cover (%)	24	30	25.6	30	19.6	30	14.8	30	26.6	30	14	30
		Non-native plant cover (%)	0	0	0	0	0	0	0	0	0	0	0.05	0
Vegetation configuration		Vegetation cover within 1 km – Remnant (%)	7.9	-	41.4	-	35.4	-	21.5	-	36.0	-	52.8	-
		– Native regrowth (%)	82.1	-	57.6	-	63.9	-	76.6	-	60.7	-	45.2	-
MEASURABLE ATTRIBUTE SCORE														
Composition	Species richness	Native plant species richness - trees	5		5		5		5		5		0	
		Native plant species richness - shrubs	5		5		5		5		5		5	
		Native plant species richness - grasses	4.83		2.33		0		1.11		5		5	
		Native plant species richness - forbs and other	2.47		5		3.87		3.23		4.87		5	
	Structure	Large trees	4.97		0		0.03		0		0.19		0.19	
		Tree canopy height	5		0.29		5		0.50		0.62		5	
		Tree canopy cover (%)	4.86		0.15		2.04		0		0		0	
		Shrub layer cover (%)	3		3		3		3		3		-	
	Function	Recruitment of dominant canopy species (%)	5		5		5		5		5		5	
		Coarse woody debris (m)	5		5		0.6		5		5		5	
		Native grass cover (%)	4.83		0		0		0.03		4.35		0.00	
		Litter cover (%)	5		5		5.00		5.00		5		4.86	
		Non-native plant cover (%)	10		10		10		10		10		10	
Vegetation configuration		Vegetation cover within 1 km	8		16		16		16		16		16	

Table 9. Raw data and measurable attribute scores for sites BEND_07 to BEND_12 – Refer to Table 7 for measurable attribute scores and their contribution to the final Native Vegetation Econd®

NATIVE VEGETATION ASSET TABLE														
		SITE	BEND_07		BEND_08		BEND_09		BEND_10		BEND_11		BEND_12	
Indicator		Measurable attribute	RE 6.5.7	Benchmark RE 6.5.7	RE 6.7.12	Benchmark RE 6.7.12	RE 6.5.7	Benchmark RE 6.5.7	RE 6.5.7	Benchmark RE 6.5.7	RE 6.5.11	Benchmark RE 6.5.11	RE 6.5.11	Benchmark RE 6.5.11
RAW DATA														
Composition	Species richness	Native plant species richness - trees	2	2	1	4	3	2	3	2	3	2	2	2
		Native plant species richness - shrubs	5	1	2	5	3	1	2	1	5	2	3	2
		Native plant species richness - grasses	8	7	2	11	10	7	6	7	7	13	7	13
		Native plant species richness - forbs and other	7	13	2	24	16	13	13	13	8	8	6	8
	Structure	Large trees	4	17	24	44	36	17	24	17	12	44	2	44
		Tree canopy height	4.4	9	8.4	7	11.8	9	15.2	9	8	11	4.2	11
		Tree canopy cover (%)	7.5	48	7.1	21	10.2	48	11.7	48	5.7	38	3.9	38
		Shrub layer cover (%)	15.6	1	7.1	5	4	1	13	1	28.2	1	13.9	1
	Function	Recruitment of dominant canopy species (%)	100	100	100	100	100	100	100	100	100	100	100	100
		Coarse woody debris (m)	17	453	10	20	100	453	52	453	620	300	353	300
		Native grass cover (%)	1.8	5	0	18	31.4	5	0	5	0	33	1	33
		Litter cover (%)	8.4	55	17.6	30	23	55	34.6	55	26	30	43.6	30
		Non-native plant cover (%)	0	0	0	0	0	0	0	0	0	0	0	0
Vegetation configuration		Vegetation cover within 1 km – Remnant (%)	10.1	-	20.0	-	24.2	-	27.6	-	14.2	-	14.4	-
		– Native regrowth (%)	69.4	-	78.4	-	74.8	-	67.9	-	84.3	-	80.9	-
MEASURABLE ATTRIBUTE SCORE														
Composition	Species richness	Native plant species richness - trees	5		0		5		5		5		5	
		Native plant species richness - shrubs	5		0.54		5		5		5		5	
		Native plant species richness - grasses	5		0		5		4.92		2.23		2.23	
		Native plant species richness - forbs and other	2.23		0		5		5		5		4.54	
	Structure	Large trees	1.90		10.07		15		15		2.67		0.03	
		Tree canopy height	3.03		5		5		5		5		0.95	
		Tree canopy cover (%)	0.16		3.52		0.85		1.46		0.12		<0.01	
		Shrub layer cover (%)	3		5		3		3		3		3	
	Function	Recruitment of dominant canopy species (%)	5		5		5		5		5		5	
		Coarse woody debris (m)	0		4.94		1.00		0.01		4.98		5	
		Native grass cover (%)	1.19		0		5		0		0		0	
		Litter cover (%)	0.14		5.00		4.59		5.00		5		5	
		Non-native plant cover (%)	10		10		10		10		10		10	
Vegetation configuration		Vegetation cover within 1 km	16		16		16		16		16		16	

Table 10. Raw data and measurable attribute scores for sites BEND_13 to BEND_15 – Refer to Table 7 for measurable attribute scores and their contribution to the final Native Vegetation Econd®

NATIVE VEGETATION ASSET TABLE								
		SITE	BEND_13		BEND_14		BEND_15	
Indicator		Measurable attribute	RE 6.5.2	Benchmark RE 6.5.2	RE 6.5.2	Benchmark RE 6.5.2	RE 6.5.2	Benchmark RE 6.5.2
RAW DATA								
Composition	Species richness	Native plant species richness - trees	2	2	3	2	2	2
		Native plant species richness - shrubs	2	2	5	2	2	2
		Native plant species richness - grasses	9	8	12	8	5	8
		Native plant species richness - forbs and other	10	12	13	12	8	12
	Structure	Large trees	4	80	8	80	10	80
		Tree canopy height	8.5	15	11.6	15	7	15
		Tree canopy cover (%)	4.2	35	4.2	35	4	35
		Shrub layer cover (%)	13.3	3	9.4	3	14.1	3
	Function	Recruitment of dominant canopy species (%)	100	100	100	100	100	100
		Coarse woody debris (m)	221	965	284	965	83	965
		Native grass cover (%)	5.4	11	5	11	0.2	11
		Litter cover (%)	26	63	30	63	8.8	63
		Non-native plant cover (%)	0	0	0	0	0	0
Vegetation configuration		Vegetation cover within 1 km – Remnant (%)	33.3	-	55.8	-	49.0	-
		– Native regrowth (%)	60.2	-	35.3	-	44.7	-
MEASURABLE ATTRIBUTE SCORE								
Composition	Species richness	Native plant species richness - trees	5		5		5	
		Native plant species richness - shrubs	5		5		5	
		Native plant species richness - grasses	5		5		3.40	
		Native plant species richness - forbs and other	4.87		5		3.87	
	Structure	Large trees	0.04		0.24		0.41	
		Tree canopy height	4.25		5		2.59	
		Tree canopy cover (%)	0.01		0.01		0.01	
		Shrub layer cover (%)	3		3		3	
	Function	Recruitment of dominant canopy species (%)	5		5		5	
		Coarse woody debris (m)	1.16		2.60		0	
		Native grass cover (%)	2.64		2.23		0	
		Litter cover (%)	4.55		4.89		0.07	
		Non-native plant cover (%)	10		10		10	
Vegetation configuration		Vegetation cover within 1 km	16		16		16	

Table 11. Summary of site Econd® scores contributing to final project accounting area Native Vegetation Econd® score. Refer to Table 7 for measurable attribute scores and their relative contribution to the Native Vegetation Econd® score

Assessment Unit (AU)	Site	RE	Indicator scores (/100)					Site Econd® score	Native Vegetation Econd® score
			Extent	Composition			Vegetation configuration		
				Species richness	*Structure*	*Function*			
AU 1: BVG 23	BEND_01	6.5.1	19,713 ha	71.28	59.40	99.43	40	69.91	64.8
	BEND_02	6.5.1		82.20	11.49	83.33	80	60.89	
	BEND_03	6.5.1		54.39	33.58	68.67	80	57.55	
	BEND_04	6.5.1		54.73	11.66	83.22	80	55.41	
	BEND_05	6.5.1		98.55	12.70	97.84	80	68.87	
	BEND_06	6.3.21		71.43	20.75	82.88	80	61.37	
	BEND_07	6.5.7		68.70	26.96	54.42	80	54.15	
	BEND_08	6.7.12		1.23	78.63	83.13	80	64.77	
	BEND_09	6.5.7		100	79.51	85.31	80	85.45	
	BEND_10	6.5.7		99.50	81.53	66.68	80	80.36	
	BEND_11	6.5.11		71.20	35.96	83.26	80	66.01	
	BEND_12	6.5.11		68.24	13.26	83.33	80	58.63	
	BEND_13	6.5.2		98.67	24.63	77.83	80	66.39	
	BEND_14	6.5.2		100	27.50	82.37	80	68.96	
	BEND_15	6.5.2		78.11	20.01	50.23	80	52.69	

4.7 Native Vegetation balance sheet

The Native Vegetation Balance Sheet for the *Bendena Human-Induced Regeneration Project* environmental account is shown in Table 12. The environmental account does not have any sub-assets and is instead shown as the single assessment unit (BVG 23). As this information statement represents the baseline assessment, all future assessments will be compared to this baseline.

Table 12. Native Vegetation Balance Sheet

Asset	Area	2020 Econd®	2025 Econd®	Net Econd® Change	Percent Econd® Change
Native Vegetation BVG 23 – *Acacia aneura* (mulga) woodlands to tall open shrublands on red earth plains, sandplains or residuals	19,713	64.8	TBC	TBC	TBC

4.8 Discussion

The 2020 Econd® assessment of the environmental accounting area was the baseline assessment, with a follow-up assessment to be repeated in (or prior to) 2025.

4.9 Limitations

Limitations associated with the calculation of the Econd® for the environmental account are outlined below in Table 13, with justifications for how they were minimised/addressed incorporated therein.

Table 13. Identified limitations and controls to minimise them

Indicator	Identified limitation	Control
Composition (Species richness)	Potential for false negatives in species richness assessments, referring to the potential for missing species (often cryptic) that were actually present but not encountered. Implication is to underrepresent the species richness attributes contributing to the Species Richness (composition) indicator.	The Native Vegetation Method outlines the recommended survey time to maximise opportunities to identify/differentiate flowering plants. Field-based assessments were undertaken during October 2020, consistent with the Native Vegetation Method, with greater-than-average rainfall in the preceding two months likely to represent favourable conditions for field-based measurements.
Vegetation configuration	Potential subjectivity afforded by the manual designation of areas as remnant (intact) vegetation and native regrowth vegetation.	The mapping of vegetation configuration categories (remnant and regrowth vegetation) was undertaken combining the interrogation of Sentinel-2 satellite imagery, Queensland Government RVMM, aerial imagery and field-based assessment to confirm the composition of vegetated areas within 1 km of each of the Econd® sites.

5 Linked Environmental Markets

5.1 Carbon

The *Bendena Human-Induced Regeneration Project* is an ERF Project with the Australian Government (ERF118301), registered under the *Carbon Credits (Carbon Farming Initiative) (Human-Induced Regeneration of a Permanent Even-Aged Native Forest - 1.1) Methodology Determination 2013*. Details of that project, to which the current environmental account is linked to, are provided in Table 14.

Table 14. Linked Carbon Market

Carbon Scheme	Australian Government Carbon Farming Initiative (CFI)
Project	Bendena Human-Induced Regeneration Project (ERF118301)
Issuance Date	29 November 2017
Label	AfN Certified Environmental Account. NATIVE VEGETATION, Confidence Level 1 (Very High). AfN-PROJECT-02, https://www.accountingfornature.org/afn-proj-co2-02

6 References

Beck, H. E., Zimmermann, N. E., McVicar, T. R., Vergopolan, N., Berg, A. and Wood, E. F. (2018). Present and future Köppen-Geiger climate classification maps at 1-km resolution. *Nature Scientific Data* **5:** 180214 (doi:10.1038/sdata.2018.214)

Bureau of Meteorology (2022). *Monthly rainfall – Heather Station (Station Number 44143)*. Retrieved from Climate Data Online available at http://www.bom.gov.au

CO2 Australia Limited (CO2 Australia) (2020). *Native Vegetation Econd Method: A methodology for assessing condition of terrestrial wooded ecosystems of Australia*. CO2 Australia, Brisbane.

Department of Environment and Science (DES) (2021). *Biodiversity status of pre-clearing regional ecosystems – Queensland – version 12 [GIS dataset]*. State of Queensland (Department of Environment and Science), Brisbane. Available at http://qldspatial.information.qld.gov.au/catalogue/

Department of Natural Resources, Mines and Energy (DNRME) (2020). *Vegetation management regulated vegetation management map – version 4.05 [GIS dataset].* State of Queensland (Department of Natural Resources, Mines and Energy), Brisbane. Available at http://qldspatial.information.qld.gov.au/catalogue/

Queensland Herbarium (2021a). *Regional Ecosystem Description Database (REDD). Version 12.1 (December 2021)* Stage of Queensland (Department of Environment and Science), Brisbane. Available at https://www.qld.gov.au/environment/plants-animals/plants/ecosystems/descriptions/download

Queensland Herbarium (2021b). *BioCondition Benchmarks.* Available at https://www.qld.gov.au/environment/plants-animals/biodiversity/benchmarks (Note: BioCondition benchmarks used to prepare Information Statement and inform the Econd® scoring based on superseded version, provided in Appendix A).

Appendix A Regional Ecosystem BioCondition Benchmarks

The RE BioCondition Benchmark documents (Queensland Herbarium 2021b) were used as the basis of the reference benchmark for each RE contributing to the project accounting area. While the BioCondition benchmarks used in the current environmental account (see attached) are not assigned a version by the Queensland Herbarium, each identifies a date on which they were released. In the case of the six BioCondition benchmark documents attached, RE 6.5.2 was released on 14 March 2014, with the remaining five all released 30 November 2012.

The following table outlines the final values used based on interrogation of the BioCondition Benchmark documents which are attached on the following pages. For those attributes in which a range is given as to the benchmark condition, a mid-point for those ranges was assigned. For example, the benchmark native tree species richness for RE 6.3.21 is given in the published BioCondition Benchmark document as 5-7, so a mid-point value of six was assigned for that attribute.

Furthermore, a number of published RE benchmarks (RE 6.3.21, RE 6.7.12, and RE 6.5.11) denoted a number of the benchmark values for attributes as 'no data'. In those circumstances, the benchmark values for those attributes for those REs was assigned as the corresponding benchmark attribute value from RE 6.5.1. It was considered that in the absence of data, the values for those 'no data' attributes was best approximated by those reported for RE 6.5.1. Accordingly, the seven values in italics in Table A-1 below represent those derived from the benchmark values for attributes in RE 6.5.1.

The intent is that the BioCondition benchmark values provided in Table A-1 below will be used for all subsequent environmental accounts for this project.

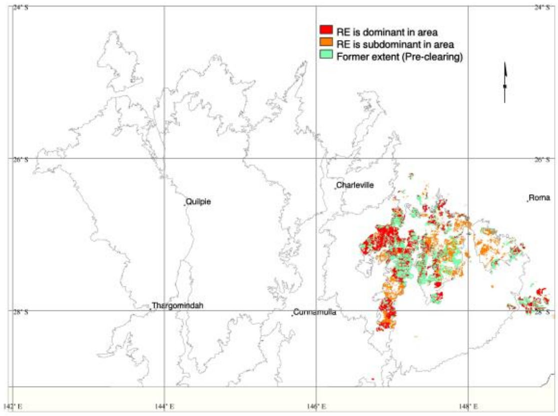
Table A-1. BioCondition benchmark values derived from the Queensland Herbarium BioCondition Benchmark documents (attached)

Indicator	Measurable attribute	RE 6.5.1	RE 6.3.21	RE 6.5.7	RE 6.7.12	RE 6.5.11	RE 6.5.2
Species richness	Native plant species richness - trees	2	6	2	4	2	2
	Native plant species richness - shrubs	2	2	1	5	2	2
	Native plant species richness - grasses	11	7	7	11	13	8
	Native plant species richness - forbs and other	18	6	13	24	8	12
Structure	Large trees	44	*44*	17	*44*	*44*	80
	Tree canopy height	10	6	9	7	11	15
	Tree canopy cover (%)	40	23	48	21	38	35
	Shrub layer cover (%)	3	0	1	5	1	3
Function	Recruitment of dominant canopy species	100	100	100	100	100	100
	Coarse woody debris	300	11	453	20	*300*	965
	Native grass cover (%)	5	13	5	18	33	11
	Litter cover	30	*30*	55	*30*	*30*	63
	Non-native plant cover	0	0	0	0	0	0

BioCondition benchmark for regional ecosystem condition assessment

Mulga Lands Regional ecosystem: 6.5.1

Acacia aneura, Eucalyptus populnea, E. melanophloia open-forest on undulating lowlands



Tony Bean

BioCondition attribute			Benchmark
Recruitment of dominant canopy species (%):			100
Native plant species richness:		Tree:	2
		Shrub:	2
		Grass:	11
		Forbs and other:	18
Trees:	Tree canopy	Tree canopy median height (m):	10
		Tree canopy cover (%):	40
	Tree sub-canopy	Tree sub-canopy median height (m):	na
		Tree sub-canopy cover (%):	na
	Large trees	Large eucalypt tree dbh threshold (cm):	40
		Number of large eucalypt trees per hectare:	4
		Large non-eucalypt tree dbh threshold (cm):	25
		Number of large non-eucalypt trees per hectare:	40

Typical tree species: Acacia aneura (mulga), Eucalyptus populnea (poplar box), Eucalyptus melanophloia (silver-leaved ironbark)

Shrubs:	Native shrub cover (%):	2.5

Typical shrub species: Eremophila gilesii (Charleville turkeybush), Eremophila glabra

Ground cover (%):	Native perennial grass cover (%):	5
	Organic litter cover (%):	30

Typical ground cover species: Thyridolepis mitchelliana (mulga mitchell grass), Monachather paradoxus (bandicoot grass), Amphipogon caricinus, Eragrostis eriopoda (woollybutt), Eragrostis lacunaria (purple lovegrass)

Coarse woody debris:	Total length (m) of debris ≥ 10cm diameter and ≥0.5m in length per hectare:	300
Non-native plant cover		0

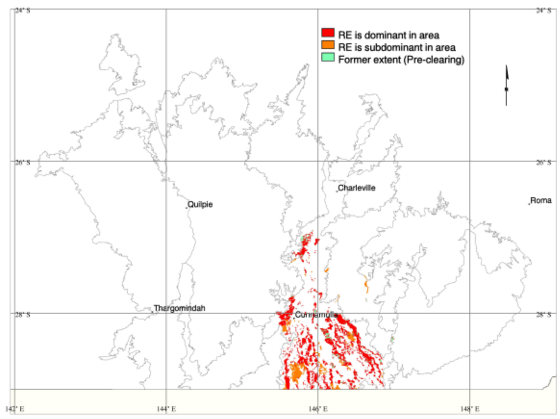
Typical non-native species: Gomphrena celosioides (gomphrena weed)

Selected typical species are those that characterize the ecosystem, community or stratum at reference sites. Up to five frequently occurring species for each stratum are selected. Users should refer to the regional ecosystem description database (REDD) and/or the technical description for more complete lists of characteristic species. Only the most frequently used common name is given. Other common names may be used in other regions. Declared pest species in Queensland are designated (^).

BioCondition benchmark for regional ecosystem condition assessment

Mulga Lands — Regional ecosystem: 6.3.21

Acacia aneura, A. excelsa and/or Geijera parviflora low woodland on low alluvial sand dunes



Rosemary Purdie

BioCondition attribute			Benchmark
Recruitment of dominant canopy species (%):			100
Native plant species richness:		Tree:	5-7
		Shrub:	0-4
		Grass:	6-8
		Forbs and other:	4-7
Trees:	Tree canopy	Tree canopy median height (m):	2-9
		Tree canopy cover (%):	15-30
	Tree sub-canopy	Tree sub-canopy median height (m):	na
		Tree sub-canopy cover (%):	na
	Large trees	Large eucalypt tree dbh threshold (cm):	30
		Number of large eucalypt trees per hectare:	no data
		Large non-eucalypt tree dbh threshold (cm):	20
		Number of large non-eucalypt trees per hectare:	no data

Typical tree species: Acacia aneura (mulga), Geijera parviflora (wilga), Acacia excelsa (ironwood)

Shrubs:	Native shrub cover (%):	0

Typical shrub species: Alectryon oleifolius (boonaree), Eremophila deserti (Ellangowan poison bush), Hakea leucoptera (water tree)

Ground cover (%):	Native perennial grass cover (%):	10-15
	Organic litter cover (%):	no data

Typical ground cover species: Thyridolepis mitchelliana (mulga mitchell grass), Aristida calycina var. praealta, Eragrostis eriopoda (woollybutt), Abutilon otocarpum, Calotis cuneata

Coarse woody debris:	Total length (m) of debris ≥ 10cm diameter and ≥0.5m in length per hectare:	2-20
Non-native plant cover		0

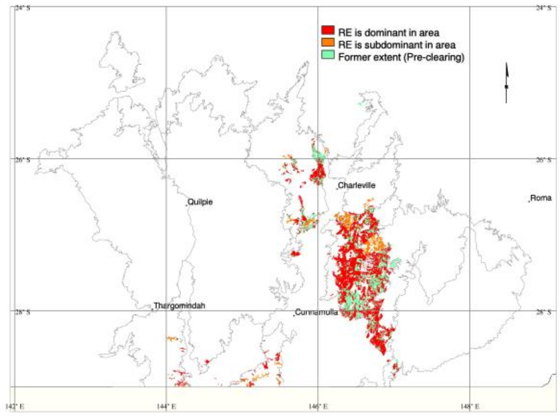
None listed

Selected typical species are those that characterize the ecosystem, community or stratum at reference sites. Up to five frequently occurring species for each stratum are selected. Users should refer to the regional ecosystem description database (REDD) and/or the technical description for more complete lists of characteristic species. Only the most frequently used common name is given. Other common names may be used in other regions. Declared pest species in Queensland are designated (^).

BioCondition benchmark for regional ecosystem condition assessment

Mulga Lands — Regional ecosystem: 6.5.7

Acacia aneura, Eucalyptus populnea +/- E. intertexta low woodland on run-on areas



Russell Fairfax

BioCondition attribute			Benchmark
Recruitment of dominant canopy species (%):			100
Native plant species richness:		Tree:	2
		Shrub:	1
		Grass:	7
		Forbs and other:	13
Trees:	Tree canopy	Tree canopy median height (m):	9
		Tree canopy cover (%):	48
	Tree sub-canopy	Tree sub-canopy median height (m):	na
		Tree sub-canopy cover (%):	na
	Large trees	Large eucalypt tree dbh threshold (cm):	30
		Number of large eucalypt trees per hectare:	3
		Large non-eucalypt tree dbh threshold (cm):	20
		Number of large non-eucalypt trees per hectare:	14

Typical tree species: Acacia aneura (mulga), Eucalyptus populnea (poplar box)

Shrubs:	Native shrub cover (%):	1

Typical shrub species: Eremophila gilesii (Charleville turkeybush), Eremophila longifolia (berrigan), Eremophila glabra

Ground cover (%):	Native perennial grass cover (%):	5
	Organic litter cover (%):	55

Typical ground cover species: Thyridolepis mitchelliana (mulga mitchell grass), Eragrostis eriopoda (woollybutt), Themeda triandra (kangaroo grass), Digitaria ammophila (silky umbrella grass), Calotis cuneata

Coarse woody debris: Total length (m) of debris ≥ 10cm diameter and ≥0.5m in length per hectare: 453

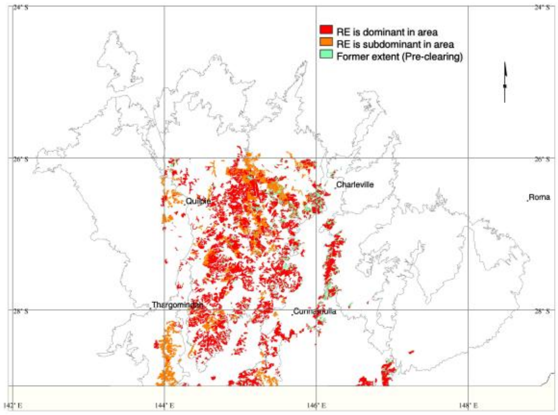
Non-native plant cover 0

None listed

Selected typical species are those that characterize the ecosystem, community or stratum at reference sites. Up to five frequently occurring species for each stratum are selected. Users should refer to the regional ecosystem description database (REDD) and/or the technical description for more complete lists of characteristic species. Only the most frequently used common name is given. Other common names may be used in other regions. Declared pest species in Queensland are designated (^).

Mulga Lands Regional ecosystem: 6.7.12

Acacia aneura +/- Eucalyptus populnea +/- E. melanophloia +/- Eremophila gilesii tall shrubland on residuals



Russell Fairfax

BioCondition attribute			Benchmark
Recruitment of dominant canopy species (%):			100
Native plant species richness:		Tree:	1-6
		Shrub:	2-7
		Grass:	3-19
		Forbs and other:	7-41
Trees:	Tree canopy	Tree canopy median height (m):	3-11
		Tree canopy cover (%):	1-40
	Tree sub-canopy	Tree sub-canopy median height (m):	na
		Tree sub-canopy cover (%):	na
	Large trees	Large eucalypt tree dbh threshold (cm):	30
		Number of large eucalypt trees per hectare:	no data
		Large non-eucalypt tree dbh threshold (cm):	20
		Number of large non-eucalypt trees per hectare:	no data

Typical tree species: Acacia aneura (mulga), Eucalyptus populnea (poplar box), Eremophila mitchellii (false sandalwood)

Shrubs:	Native shrub cover (%):	0-10

Typical shrub species: Eremophila gilesii (Charleville turkeybush), Acacia aneura (mulga), Prostanthera suborbicularis

Ground cover (%):	Native perennial grass cover (%):	5-30
	Organic litter cover (%):	no data

Typical ground cover species: Amphipogon caricinus, Eriachne mucronata (mountain wanderie grass), Thyridolepis mitchelliana (mulga mitchell grass), Dysphania glomulifera, Evolvulus alsinoides (tropical speedwell)

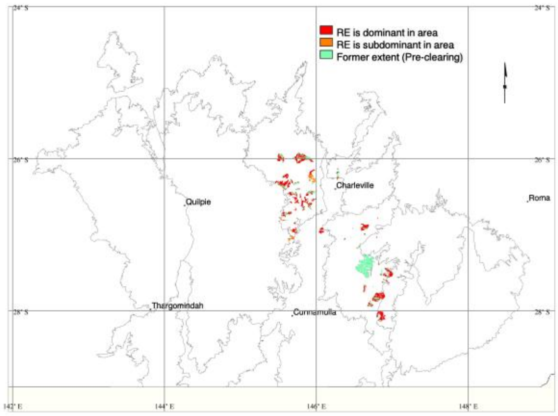
Coarse woody debris:	Total length (m) of debris ≥ 10cm diameter and ≥0.5m in length per hectare:	20
Non-native plant cover		0

None listed

Selected typical species are those that characterize the ecosystem, community or stratum at reference sites. Up to five frequently occurring species for each stratum are selected. Users should refer to the regional ecosystem description database (REDD) and/or the technical description for more complete lists of characteristic species. Only the most frequently used common name is given. Other common names may be used in other regions. Declared pest species in Queensland are designated (^).

Mulga Lands — Regional ecosystem: 6.5.11

Acacia aneura +/- Eucalyptus populnea low woodland on sand plains



V.J.Neldner

BioCondition attribute			Benchmark
Recruitment of dominant canopy species (%):			100
Native plant species richness:		Tree:	1-2
		Shrub:	1-3
		Grass:	11-15
		Forbs and other:	6-9
Trees:	Tree canopy	Tree canopy median height (m):	10-11
		Tree canopy cover (%):	20-55
	Tree sub-canopy	Tree sub-canopy median height (m):	2-11
		Tree sub-canopy cover (%):	20-55
	Large trees	Large eucalypt tree dbh threshold (cm):	30
		Number of large eucalypt trees per hectare:	no data
		Large non-eucalypt tree dbh threshold (cm):	20
		Number of large non-eucalypt trees per hectare:	no data

Typical tree species: Acacia aneura (mulga), Eucalyptus populnea (poplar box)

Shrubs:	Native shrub cover (%):	0-1

Typical shrub species: Eremophila mitchellii (false sandalwood), Eremophila longifolia (berrigan), Psydrax oleifolia (wild lemon)

Ground cover (%):	Native perennial grass cover (%):	5-60
	Organic litter cover (%):	no data

Typical ground cover species: Thyridolepis mitchelliana (mulga mitchell grass), Aristida calycina var. praealta, Digitaria brownii (cotton panic), Abutilon fraseri (dwarf lantern flower), Evolvulus alsinoides (tropical speedwell)

Coarse woody debris:	Total length (m) of debris ≥ 10cm diameter and ≥0.5m in length per hectare:	no data
Non-native plant cover		0

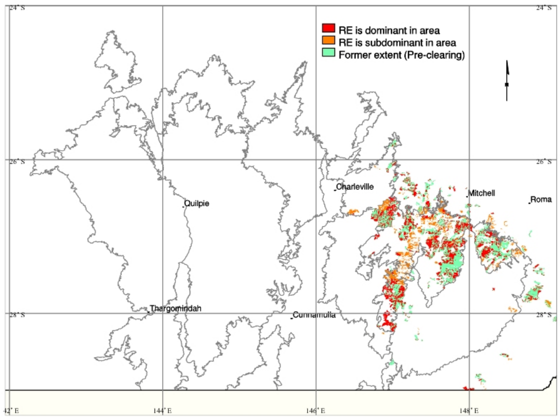
None listed

Selected typical species are those that characterize the ecosystem, community or stratum at reference sites. Up to five frequently occurring species for each stratum are selected. Users should refer to the regional ecosystem description database (REDD) and/or the technical description for more complete lists of characteristic species. Only the most frequently used common name is given. Other common names may be used in other regions. Declared pest species in Queensland are designated (^).

BioCondition benchmark for regional ecosystem condition assessment

Mulga Lands — Regional ecosystem: 6.5.2

Eucalyptus populnea, Acacia aneura and/or E. melanophloia woodland on Quaternary sediments



Teresa Eyre

BioCondition attribute			Benchmark
Recruitment of dominant canopy species (%):			100
Native plant species richness:		Tree:	2
		Shrub:	2
		Grass:	8
		Forbs and other:	12
Trees:	Emergent canopy	Tree emergent canopy median height (m):	na
		Tree emergent canopy cover (%):	na
	Tree canopy	Tree canopy median height (m):	15
		Tree canopy cover (%):	35
	Tree sub-canopy	Tree sub-canopy median height (m):	10
		Tree sub-canopy cover (%):	19
	Large trees	Large eucalypt tree dbh threshold (cm):	40
		Number of large eucalypt trees per hectare:	20
		Large non-eucalypt tree dbh threshold (cm):	22
		Number of large non-eucalypt trees per hectare:	60

Typical tree species: Acacia aneura, Eucalyptus melanophloia, Eucalyptus populnea (poplar box)

Shrubs:	Native shrub cover (%):	3

Typical shrub species: Eremophila maculata ssp. maculata, Senna artemisioides ssp. coriacea, Eremophila mitchellii, Geijera parviflora (wilga)

Ground cover (%):	Native perennial grass cover (%):	11
	Organic litter cover (%):	63

Typical ground cover species: Aristida jerichoensis var. subspinulifera, Dinebra decipiens ssp. asthenes, Digitaria brownii, Eragrostis lacunaria (purple lovegrass), Brunoniella australis (blue trumpet)

Coarse woody debris: Total length (m) of debris ≥ 10cm diameter and ≥0.5m in length per hectare: 965

Non-native plant cover 0

None listed

Benchmark based on: 2 reference sites, 1 Corveg site and expert opinion **Benchmark reliability ranking:** moderate

Selected typical species are those that characterize the ecosystem, community or stratum at reference sites. Up to five frequently occurring species for each stratum are selected. Shrub and ground strata may contain recruiting canopy species. 'Eucalypt' refers to species belonging to the genera Eucalyptus, Corymbia, Angophora, Lophostemon and Syncarpia. Users should refer to regional ecosystem technical descriptions for more complete lists of characteristic species. Common names can differ between regions. Declared pest species in Queensland are designated (^).