



Assessing Change in Ecological Communities in K'gari (Fraser Island) using time series monitoring datasets



Queensland
Government

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Summary

K'gari (Fraser Island) was inscribed on the World Heritage Area (WHA) List in 1992. The Butchulla Aboriginal people have since been recognised by the High Court of Australia as holding Native Title rights to K'gari (Fraser Island). Hence, the National Park tenure and World Heritage Area on Fraser Island is now officially known as K'gari, the traditional Butchulla name for the island. Vegetation associations represented on K'gari display an unusual level of complexity, with major changes in floristic and structural composition occurring over very short distances. The key threats requiring ongoing attention include degradation due to visitor numbers, inappropriate fire regimes, invasive plants and animals, and climate change.

Understanding how threats, and their associated management strategies, affect species diversity over time is important for biodiversity conservation of World Heritage Areas. This study investigated patterns of vegetation change using time series data from vegetation monitoring sites established in 1995 by the University of Queensland (UQ) and Queensland Parks and Wildlife Service (QPWS). The number of observed plant species (species richness) and the abundance of each plant species (composition) recorded from the historical monitoring sites were compared with monitoring data collected from the same sites in 2021.

Although the species richness observed during each site revisit were different, when the species richness for sites located in the same regional ecosystem were statistically compared, the overall differences were not statistically significant at $P < 0.05$. There were significant differences in species richness among regional ecosystems which is consistent with species differences that underpin regional ecosystem mapping. Species canopy cover was adversely affected by the 2021 fire event and resulted in statistically significant differences between the burnt sites and sites with unburnt history of 2 to 25 years.

On average, approximately 28% of plant species observed in 1999 were not observed in 2021 and a similar proportion of plant species observed in 2021 were not observed in 1999. These differences suggest the need for further analyses of the data to carefully identify the species involved, to study their autecology and to examine whether this discrepancy was associated with fire events. Only six invasive plant species that are known environmental weeds were recorded in the 22 sampled sites, and among these it was the extent of *Lantana camara* that was of most concern. It is also recommended that more of the UQ/QPWS sites be revisited

and resampled using the Queensland Herbarium QBEIS field assessment methodology to build on the information already obtained from this valuable long-term vegetation monitoring program.

Background

Fraser Island was inscribed on the World Heritage Area (WHA) List in 1992 (UNESCO, 1992). Since then, the Butchulla Aboriginal people have been recognised by the High Court of Australia as holding Native Title rights to K'gari (Fraser Island). Hence, the National Park and World Heritage tenure on Fraser Island is now officially known as K'gari, the traditional Butchulla name for the island (IUCN, 2020). At 122 km long and 181,851 hectares it is the largest sand island in the world. K'gari offers an outstanding example of ongoing biological, hydrological and geomorphological processes. These include the combination of shifting sand-dunes, development of rainforest vegetation on coastal dune systems at large scale and the world's largest unconfined aquifer on a sand island (UNESCO, 1992). These natural values and the history of human-use on K'gari is comprehensively documented in Walker *et al.* (2022).

The process of soil formation on the island is also unique. As a result of successive overlaying of dune systems, there is a chronosequence of podzol development from the younger dune systems on the east to the oldest systems on the west and changing from rudimentary profiles less than 0.5 metres thick to giant forms more than 25 metres thick. These deep profiles far exceed known depths of podzols anywhere else in the world and have a direct influence on plant succession, with the older dune systems causing retrogressive succession when the soil horizon becomes too deep to provide nutrition for tall forest species (UNESCO, 1992).

Vegetation associations represented on K'gari display an unusual level of complexity, with major changes in floristic and structural composition occurring over very short distances (IUCN, 2020). These reflect the long successional process related to dune development. For example, there are abrupt transitions from rainforest and wet sclerophyll vegetation communities, with trees up to 50 metres tall, on younger coastal dune systems to dry sclerophyll vegetation such as heathlands on older dunes (Applegate, 2020). Both heathland and closed forest communities provide refugia for relict and disjunct populations, which are

important to ongoing speciation and radiation. The vegetation associations also depict differences in specialised adaptation to low fertility, fire, waterlogging and aridity as evident among most of the vegetation communities and the associated vertebrate and invertebrate fauna (UNESCO, 1992).

In 2020, the World Heritage Conservation Outlook Assessment for K’gari (Fraser Island) was reported as “Good with some concerns” but the current threats were rated as “High” (IUCN, 2020). The report highlighted that increased visitation, biosecurity concerns and impacts of climate change were major threats. Increased tourism was noted to drive threats including pollution, erosion and siltation, disturbance, and the introduction of invasive species (IUCN, 2020). The United Nations Educational, Scientific and Cultural Organization (UNESCO) had identified that key threats to the conservation values requiring ongoing attention in K’gari include degradation due to high visitor numbers, inappropriate fire, invasive plants and animals, and climate change impacts (UNESCO, 2022). Fire is a significant driver of vegetation change and hence appropriate fire regimes, and management of bushfires is required to maintain the integrity of the World Heritage values (Neldner and Ngugi, 2021; UNESCO, 2022).

Significant human and financial resources have been directed towards the management of these threats as well as to the protection and monitoring of biodiversity values in K’gari (Behrendorff et al., 2019; Hockings and Hobson, 2000; Neldner and Ngugi, 2021). Among these is a long-term monitoring program consisting of 56 permanently marked biodiversity monitoring sites that were set up by the University of Queensland (UQ) and Queensland Parks and Wildlife Service (QPWS) in 1995 (Hockings and Hobson, 2000) and re-measured annually, with some sites re-measured until 2003. In 2021, Queensland Herbarium revisited 22 of these sites to capture vegetation recovery following a bushfire in the southern area of the Island in 2019 and a bushfire in the northern part of the island in 2020. Full floristic assessment using Queensland Herbarium survey methodology (Neldner et al., 2022) was conducted to assess vegetation recovery following these fire events (Neldner and Ngugi, 2021).

Temporal species turnover is a well-recognised ecological phenomenon for vegetation communities (Chen et al., 2016). One of the biggest challenges is distinguishing change due to anthropogenic activities from underlying natural dynamics (Chen et al., 2016). Time series data can provide an opportunity to examine incremental changes and causation. In the context of the identified key threats to biodiversity in the K’gari WHA, and the availability of

historical monitoring datasets, it is timely to undertake a time series assessment of vegetation dynamics and the likely impacts of these threats on the species richness (number of species) and species composition (measure of the number of species and a measure of abundance of each species, usually described by an index (Pyron, 2010)) of the vegetation communities.

Objectives and scope of analysis

The overarching objective of this study is to support the management of K’gari World Heritage Area by assessing the likely impacts of ongoing management of floristic biodiversity of the area since the National Park was listed as a World Heritage Area in 1992. This analysis is important in both enabling and promoting improved resource management and in meeting accountability and reporting requirements.

K’gari vegetation is composed of a broad range of regional ecosystems (Neldner and Ngugi, 2021) that can be impacted differently by the threatening processes. In this study the data collected between 1995 and 2003 were used as the baseline and were compared to data collected in 2021 to assess changes in vegetation communities. Hence, the specific objectives are:

- To determine changes in plant species richness and species composition at the regional ecosystem level over the monitoring period;
- Determine the likely cumulative impacts of fire events on plant communities in terms of species richness and composition and;
- To examine the changes in the status and infestation risk of invasive non-native plant species over the monitoring period.

Methods

Distribution of Pre-2003 monitoring sites

The UQ and QPWS biodiversity monitoring program was established in 1995 to examine change in habitat composition and structure in K’gari WHA for the purpose of ensuring that fire management was maintaining “biodiversity through continued natural processes”

(Hockings and Hobson, 2000). The vegetation of Fraser Island was mapped at 1:25 000 scale by Peter Stanton in 1975. This high-quality vegetation mapping was converted into regional ecosystems and has been part of the state-wide regional ecosystem coverage since 2000.

The long-term monitoring sites were distributed across the island and were located to achieve a representative sampling of vegetation types and fire management regimes as shown in Figure 1 (Hockings and Hobson, 2000). The location of sites within fire management zones was based on the fire management strategy prepared for the island (Twyford, 1995). This strategy used the system of zoning shown in Table 1 to define the objectives and fire management prescriptions for different areas. Each site was located within a relatively large and uniform patch of the relevant vegetation type, at least 100 m from a boundary with another vegetation type and 50 to 100m from an accessible road or track (Hockings and Hobson, 2000).

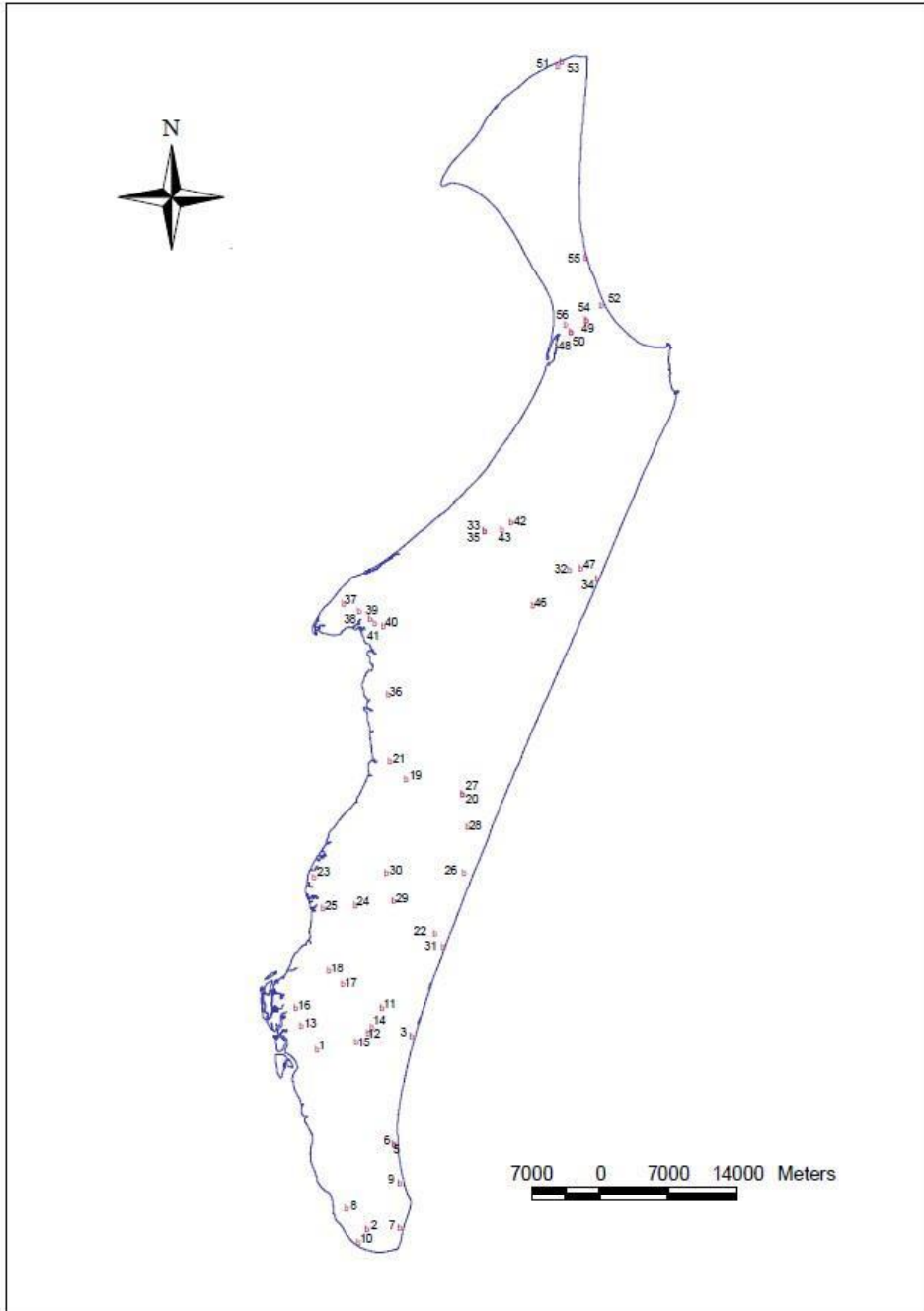


Figure 1. Distribution of University of Queensland /Queensland Parks and Wildlife Service sites established in 1995.

Table 1. Fire management zones on Fraser Island as defined in the fire strategy at the time the plots were established in 1995 (information extracted from Twyford, 1995).

Zone	Zone Name and Objectives	Guidelines and Prescriptions for Fire Management	Site
1	<p>Property and asset protection Protection of life, property and infrastructure, fire sensitive natural and cultural resources</p>	Frequent, low intensity fires designed to maintain low fuel loads and maximise protection from bushfire.	No site
2	<p>Strategic corridor Reduce potential for extensive areas to be burnt by wildfire and provide strategic basis for bushfire suppression.</p>	Corridors, aligned approximately east-west, divide the island into five large blocks. In combination with natural fire breaks such as vine forest, lakes and sandblows, they are designed to limit bushfire spread. Prescribed burning is undertaken to maintain fuel loads at low to moderate levels.	32, 48, 33, 3, 34, 21, 35
3	<p>Nature conservation Maintain range and extent of vegetation communities and associated fauna.</p>	Prescribed burns aim to produce a mosaic of burnt/unburnt areas. Fire regimes will vary depending on ecological requirements of vegetation and faunal communities.	22, 36, 37, 23, 38, 24, 56
4	<p>Fire reference areas Provide a basis on which to monitor long-term effects of prescribed burning, bushfire, and fire exclusion on nature conservation values.</p>	Fire is to be excluded apart from designated prescribed burns introduced as part of approved ecological research programs.	11, 42, 13, 15, 43
5	<p>Not planned to be burnt Exclude prescribed fire from vegetation communities requiring infrequent or no fire for regeneration and from fire-sensitive communities.</p>	Fire is to be excluded.	18, 30, 47

Historical long-term vegetation monitoring plots

There were 56 permanently marked vegetation monitoring sites that were established by UQ/QPWS in 1995. The size of the plots varied according to the site and ranged from 25 m² to 400 m² in increments of 25 m². Species/area curves for each site were calculated and plot sizes selected to contain at least 90% of the total estimated number of species present (Hockings and Hobson, 2000).

Most surveys were undertaken between August and November, with most measured in October when flowering facilitates accurate species identification. Species that could not be positively identified in the field were collected and specimens sent to the Queensland Herbarium for identification. In a few cases, in the absence of flowers or fruit, identification to species level was not possible.

Plots were resurveyed in 1996, 1997, 1999 and in some cases 2001 and 2003. Measurements involved collection of data on species composition and vegetation structure. The outer crown envelope of shrubs and trees (equivalent to canopy cover) was used to estimate cover based on Braun-Blanquet cover abundance ranking scale shown in Table 2 (Wikum and Shanholtzer, 1978), rather than the actual projected cover of individual leaves and branches. The scale consists of a plus (+) and a series of numbers from 1 to 5 denoting the proportion of the plot area covered by that species. The scale ranges from + (sparse and covering a small area) to 5 (covering 75% or more of the area). Some species were missed or mis-identified in some plots pre 1997 when the field herbarium was incomplete, and an experienced botanist was not available to assist in field work. Only data collected after 1997 is used in this analysis.

Table 2. Braun-Blanquet cover scale and corresponding cover percentage values.

Braun-Blanquet ranking	Cover range (%)	Mid-point cover range (%)
+	< 2%	1
1	2% to <5	3.5
2a	5 to <15	10
2b	15 to <25	20
3	25 to <50	37.5
4	50 to <75	62.5
5	75 to 100	87.5

Resampling long-term sites using Queensland Herbarium vegetation survey methodology in 2021

The 2021 vegetation monitoring dataset was collected to assess post fire recovery from the November 2019 and October to December 2020 bushfires in K'gari WHA (Neldner and Ngugi, 2021). To understand the condition of the vegetation before the recent bushfires, information on past vegetation monitoring sites on Great Sandy National Park were sourced. Among the 56 permanently marked vegetation monitoring sites established by UQ/QPWS in 1995 (Hockings and Hobson, 2000), some had been re-sampled up to four times on a yearly basis since establishment.

Due to the logistical difficulty of locating these historical sites in the field, only 22 of the original 56 sites were reliably located in April 2021 (Neldner and Ngugi, 2021). These sites were overlaid with a 50 x 10 m vegetation assessment plots and permanently marked with steel star pickets at the origin and end of the line transect.

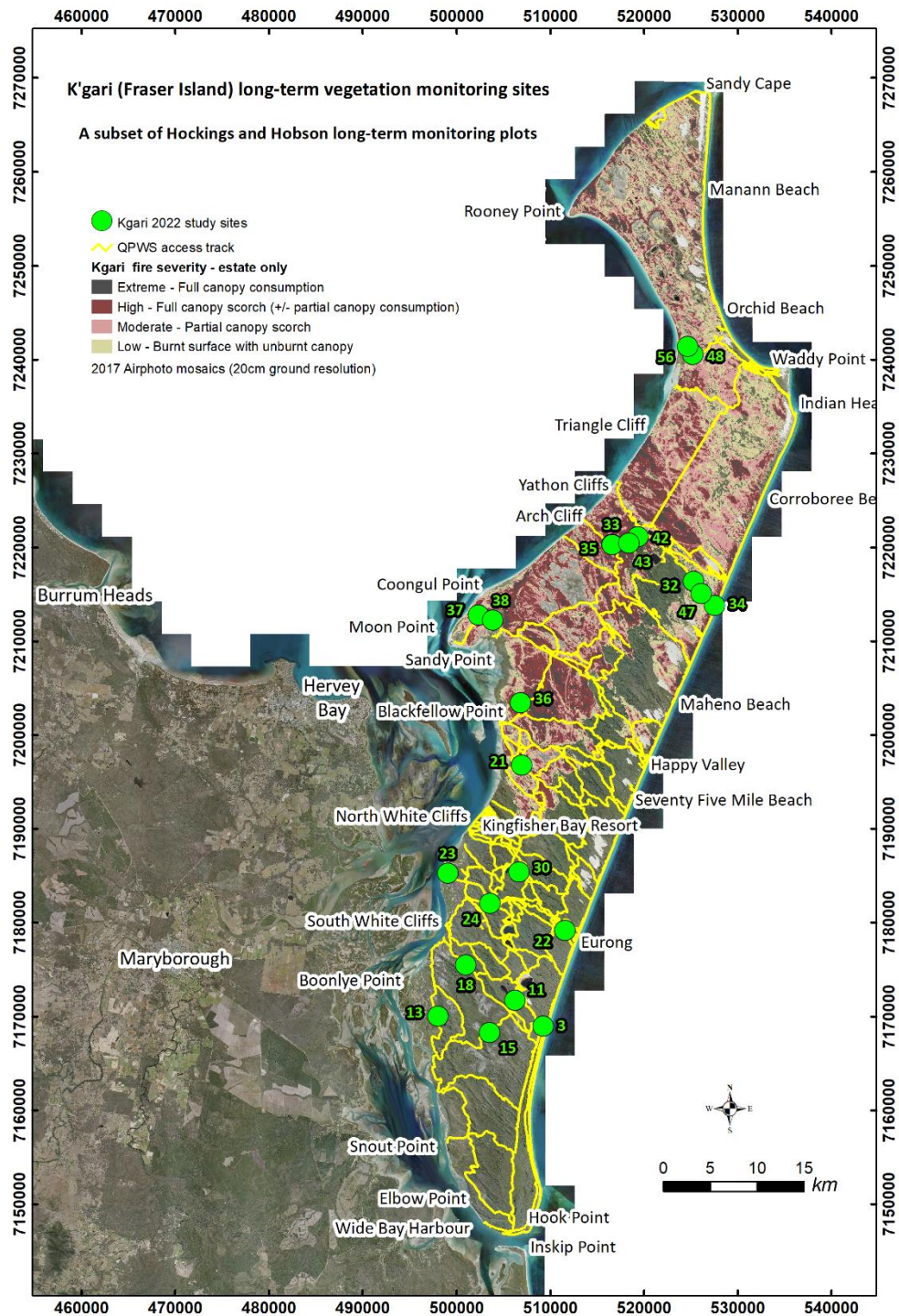


Figure 2. Location of permanently marked vegetation monitoring sites established by UQ/ QPWS in 1995 and resampled in 2021 by Queensland Herbarium and the 2020 bushfire extent and severity mapping (Meiklejohn et al., 2021).

The standard Queensland Herbarium vegetation survey methodology (Neldner et al., 2022) used for collecting data for the Queensland Biodiversity and Ecology Information System

(QBEIS) was followed at each site, which included stratifying the vegetation into layers, recording canopy cover, tree density and diameter of tree species. The collected data were stored in the QBEIS database. Where the UQ/QPWS site location post could not be located, a new survey site was established at the location and in the same vegetation indicated in the UQ/QPWS past measurement data. Where plants could not be identified in the field (many heath shrubs were not fertile at the time), a specimen was collected, dried, and later identified at the Queensland Herbarium.

Fire management history

Fire management is an important part of QPWS&P management of the Great Sandy National Park. QPWS&P uses the principles contained in the Planned Burn Guidelines – Southeast Queensland Bioregion of Queensland (QPWS, 2013; Srivastava et al., 2021) in conjunction with the regional ecosystem fire guidelines (Herbarium, 2021) to plan fire management activities. The ability to implement these plans is dependent on suitable weather and other management issues. Historical fire data from 1960 to 2021 for each site was obtained from QPWS fire database FLAME (QPWS, 2021) and is presented in Table 3. In November 2019, a bushfire burnt the southern part of K’gari, and on 14 October 2020, another bushfire was reported in the northern part following an illegal campfire near Orange Creek, and led to a major bushfire covering 75 110ha (or 46%) of K’gari section of the Great Sandy National Park (Inspector-General Emergency Management, 2020; Meiklejohn et al., 2021)

Rainfall

Historical rainfall data (Figure 3) was obtained from the SILO database - the Australian climate database hosted by the Queensland Department of Environment and Science (DES). Annual rainfall data from 1994 to 2020 was used to assess the rainfall pattern over the data collection period.

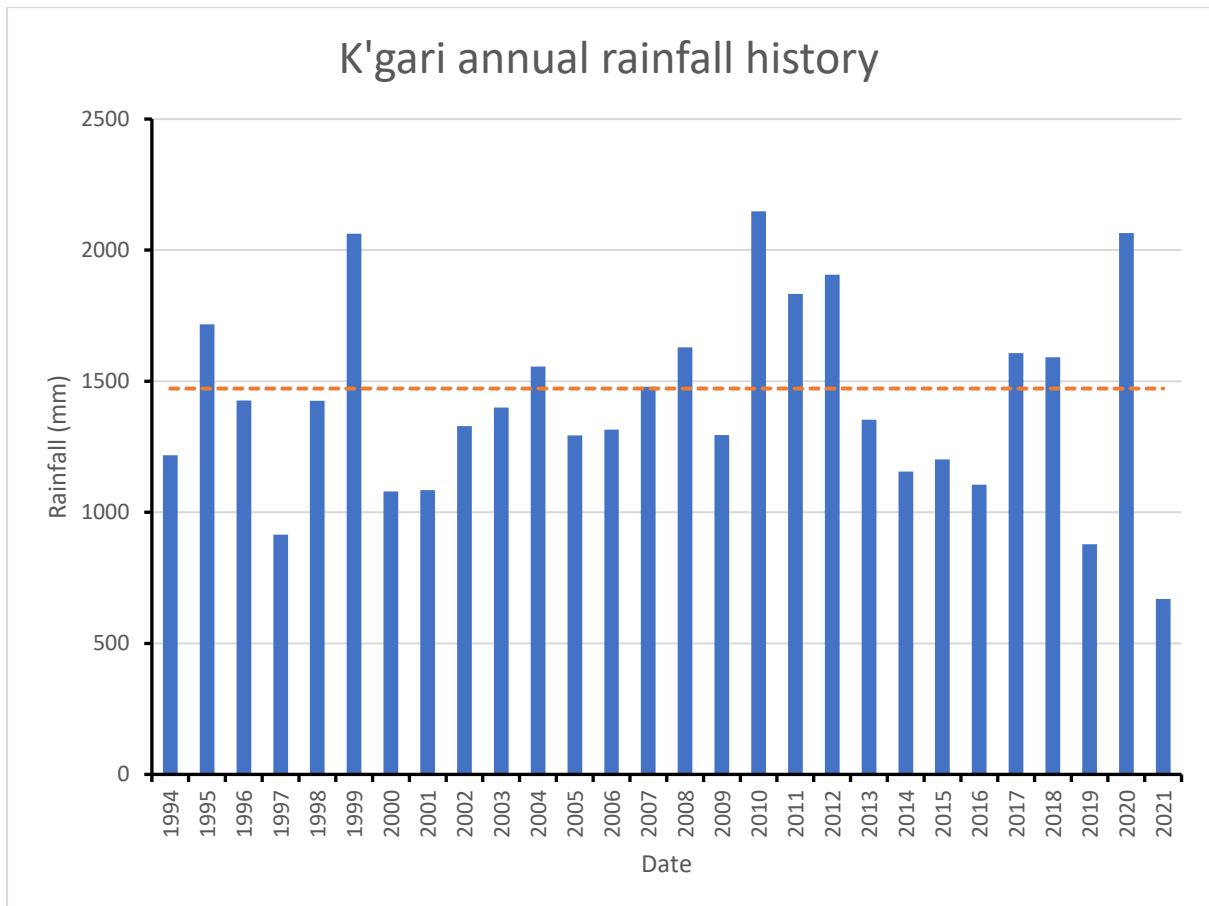


Figure 3. Historical annual rainfall totals and mean annual rainfall (dotted line) for K'gari.

Data analysis

Data from the 22 UQ/QPWS sites that were revisited in 2021 for post-fire monitoring was used for this analysis. Graphical charts were plotted for each site to determine the trends in species richness over the monitoring period in relation to the timing of fire events. Changes in species composition were examined using several indices.

The Jaccard similarity index (sometimes called the Jaccard similarity coefficient) compares members from two datasets using presence/absence information of species to determine which members are shared between sets and which are unique. It is a measure of similarity between the two sets of data, with a range from 0% to 100%. The more species both sets have in common, the higher the percentage, and the greater the similarity between the two populations. The Jaccard similarity index was calculated to assess similarity in species composition observed for each site using data collected in 1999 and 2021. The 1999 dataset

was used mainly because the handwritten field data were more legible compared to those for 1997. The formula to find the Index is:

Jaccard Index = (number of species common in both sets) / (total number of species in both sets) * 100

The same formula in notation is:

$$J(X,Y) = |X \cap Y| / |X \cup Y|$$

Where:

- J is Jaccard index
- X and Y are species richness of the two data sets
- $|X \cap Y|$ only number of species occurring in both sets
- $|X \cup Y|$ total number of all the species recorded in both sets

The Bray Curtis dissimilarity index is a measure of dissimilarity between two sets of data, with a range from 0% to 100%. The higher the percentage, the greater the dissimilarity between the two populations. This dissimilarity index was used to quantify the differences in species composition between the 1999 and 2021 observations using species cover data as measures of species abundance. The index was calculated with the following formula:

$$BC = \sum abs(S1i - S2j) / \sum(S1i + S2j) * 100$$

Where:

- BC is Bray-Curtis dissimilarity index,
- S1 & S2 are the two measure dates (S1 =1999 and S2 = 2021),
- S1_i is the cover of species in set S1,
- S2_j is the cover of the same species in set S2,
- Abs is the absolute difference between S1_i – S2_j.

For the crown cover data collected during the 1999 time-point using the Braun-Blanquet cover class, the midpoint of the class range was used as the estimated cover for each species

(Table 2). In contrast, for the data collected using the Herbarium survey methodology in 2021 the actual crown cover for each species was estimated and stored in QBEIS. These data were further aggregated by regional ecosystem and presented as box plots.

To examine changes in species richness among sites that were in the same regional ecosystem, One-way ANOVA was conducted using Microsoft Excel. This was only done for regional ecosystems that had at least three monitoring sites located and remeasured.

Computed values of Jaccard and Bray-Curtis indices were used to compare differences among sites within each regional ecosystem and between burnt and unburnt sites.

To assess the invasion threat of non-native species in the study sites, the Queensland Herbarium specimen database (HERBRECS) (Queensland Herbarium, 2021) was utilised to determine naturalised species recorded in the sites.

Results

Fire history

Fire records for each of the 22 sites that had past monitoring data are presented in Table 3. All the sites had experienced at least one fire event (planned burn or bushfire). Eighty-three percent of the sites had more than one bushfire within the last 26 years (between 1994 and 2020) (Table 3). Images showing the condition of each of these sites in 2021, species richness and the date when fire events happened are shown in Appendix 1. Based on available fire history data since 1961 (QPWS, 2021), the average duration between two consecutive bushfires (bushfire return interval) between 1961 and 1991 for the study sites was approximately seven years and for the period of 1994 to 2020 was approximately 13 years.

Species richness between 1997 and 2021

The highest species richness (count of number of species) was recorded in RE 12.2.9, ranging from 23 to 42 species and a mean of 32 species. This mean is comparable to the average species richness of 30.1 (ranging from 9 to 47 species) recorded by Pearl et al. (2022) over nine sites with an area of 1000 m² on the Sunshine Coast. An additional site

established in RE 12.2.9 near Deep Creek in 2021 (QBEIS 18286) had a species richness of 26. RE 12.2.15g had the lowest species richness ranging from eight to 22 species, and a mean of 12 species (Table 4).

Using a boxplot, the distribution of species richness values among sites within each RE, and among all the sampled REs is presented in Figure 4. Generally, there was great variability in the number of species observed during consecutive remeasurements within each RE (Figure 4). The median richness for all the REs except RE 12.2.15g and RE 12.2.9 was relatively close. The highest variability in observed richness over time was obtained in RE 12.2.9, which was represented by only a single site.

Table 3. History of fire events showing the year when a planned burn and/or bushfire occurred at each of the monitored sites.

Regional Ecosystem	Regional Ecosystem Description	Site Number	Planned Burn Year	Bushfire Year
12.2.5	<i>Corymbia intermedia</i> +/- <i>Lophostemon confertus</i> +/- <i>Banksia</i> spp. +/- <i>Callitris columellaris</i> open forest on beach ridges usually in southern half of bioregion	38	-	1994, 2020
12.2.6	<i>Eucalyptus racemosa</i> subsp. <i>racemosa</i> open forest on dunes and sand plains. Usually deeply leached soils	11	2008	-
		22	2009, 2013	2000, 2017
		24	1989	-
		33	1998	2005, 2020
		36	-	1994, 2006, 2020
		42	-	2005, 2020
		43	-	2005, 2020
47	-	2020		
12.2.7	<i>Melaleuca quinquenervia</i> or rarely <i>M. dealbata</i> open forest on sand plains	23	1994, 2017	-
12.2.8	<i>Eucalyptus pilularis</i> open forest on parabolic high dunes	18	-	2009, 2019
		30	2002	2011
		32	2007	2020
12.2.9	<i>Banksia aemula</i> low open woodland on dunes and sand plains. Usually deeply leached soils	15	-	2009, 2016
12.2.11	<i>Corymbia tessellaris</i> +/- <i>Eucalyptus tereticornis</i> , <i>C. intermedia</i> and <i>Livistona decora</i> woodland on beach ridges in northern half of bioregion	13	2015	2001, 2009, 2019
		37	-	1994, 2020
		48	2000, 2016, 2017	2013, 2020
12.2.14	Fore dune complex comprising <i>Corymbia tessellaris</i> , <i>C. intermedia</i> with <i>Acacia leiocalyx</i> , <i>A. disparrima</i> low open forest	3	1996	-
12.2.14a	<i>Casuarina equisetifolia</i> subsp. <i>incana</i> woodland to low open forest on exposed frontal areas	34	2007, 2015	2020
12.2.15g	Swamps dominated by <i>Empodisma minus</i> , <i>Gahnia sieberiana</i> , other sedges and forbs and shrubs such as <i>Leptospermum liversidgei</i> .	21	2017	2004, 2020
		35	1999	2020
		56	2000, 2016, 2017	2013, 2020

Table 4. Species richness recorded during each site monitoring event between 1997 and 2021.

Regional Ecosystem	Site number	Monitoring year					Mean richness	
		1997	1999	2001	2003	2021		
12.2.5	<i>Corymbia intermedia</i> +/- <i>Lophostemon confertus</i> +/- <i>Banksia</i> spp. +/- <i>Callitris columellaris</i> open forest on beach ridges usually in southern half of bioregion	38	22	26		33	27	
12.2.6	<i>Eucalyptus racemosa</i> subsp. <i>racemosa</i> open forest on dunes and sand plains. Usually deeply leached soils	11	33	37	-	-	28	33
		22	27	24	17	-	23	23
		24	36	36	-	-	31	34
		33	25	22	-	-	18	22
		36	27	25	-	-	23	25
		42	27	24	-	-	18	23
		43	35	35	-	-	20	30
47	21	22	-	-	23	22		
12.2.7	<i>Melaleuca quinquenervia</i> or rarely <i>M. dealbata</i> open forest on sand plains	23	27	25		30	27	
12.2.8	<i>Eucalyptus pilularis</i> open forest on parabolic high dunes	18	25	22	-	-	24	24
		30	28	28	-	-	30	29
		32	33	32	-	-	26	30
12.2.9	<i>Banksia aemula</i> low open woodland on dunes and sand plains. Usually deeply leached soils	15	42	32	-	23	32	32
12.2.11	<i>Corymbia tessellaris</i> +/- <i>Eucalyptus tereticornis</i> , <i>C. intermedia</i> and <i>Livistona decora</i> woodland on beach ridges in northern half of bioregion	13	38	35	-	-	40	38
		37	17	18	-	-	21	19
		48	26	26	18	-	29	25
12.2.14	Foredune complex comprising <i>Corymbia tessellaris</i> , <i>C. intermedia</i> with <i>Acacia leiocalyx</i> , <i>A. disparrima</i> low open forest	3	32	25	-	-	27	28
12.2.14a	<i>Casuarina equisetifolia</i> subsp. <i>incana</i> woodland to low open forest on exposed frontal areas	34	26	24	-	-	18	23
12.2.15g	Swamps dominated by <i>Empodisma minus</i> , <i>Gahnia sieberiana</i> , other sedges and forbs and shrubs such as <i>Leptospermum liversidgei</i> .	21	13	14	-	-	22	16
		35	8	9	-	-	11	9
		56	14	12	9	-	11	12

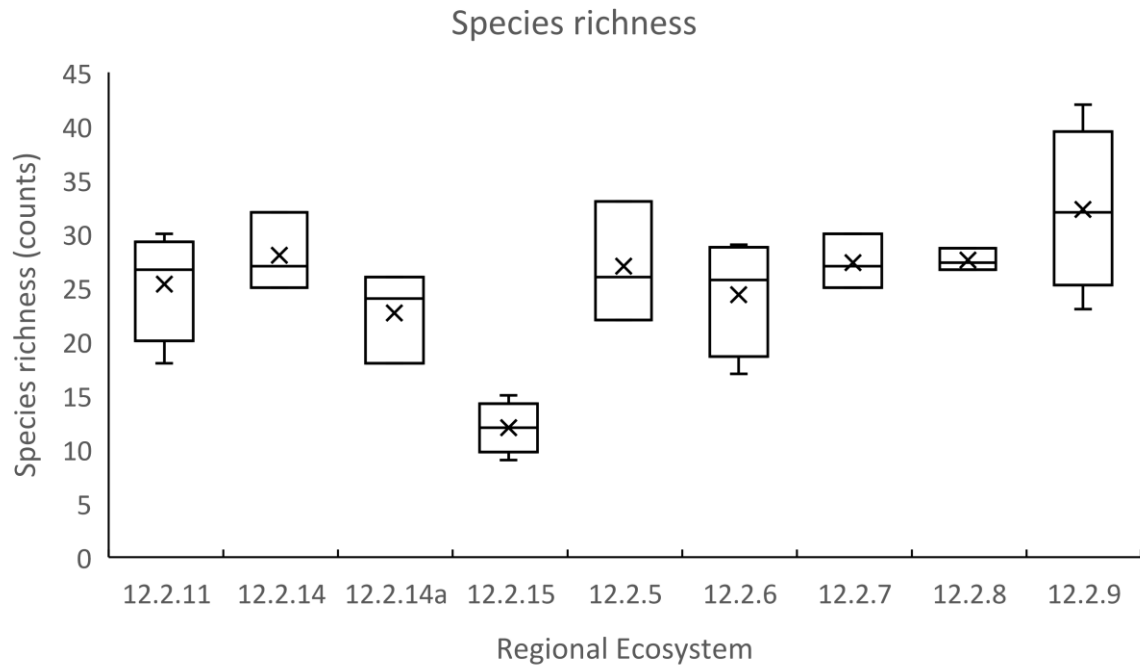


Figure 4. Boxplot of total species richness recorded between 1997 and 2021 in each of the sampled regional ecosystems. Error bars show minimum and maximum values, X is the mean, and the middle bar is the median of richness values.

Summary statistics for species richness within each regional ecosystem are presented in Table 5 showing that the average richness of the regional ecosystem ranged from 12 to 32 species and the variance ranged from six to 73. Further analysis of this data using Analysis of Variance (ANOVA), shown in Table 6, demonstrated that species richness among the eight regional ecosystems represented in our dataset differed significantly ($p < 0.0001$) (Table 6).

Table 5. Summary statistics of species richness within each regional ecosystem based on the remeasured sites.

Anova: Single Factor				
SUMMARY				
Groups	No. of measures	Sum	Average species richness	Variance
12.2.11	10	268	27	73
12.2.14	6	152	25	21
12.2.15g	10	123	12	16
12.2.5	3	81	27	31
12.2.6	25	657	26	38
12.2.7	3	82	27	6
12.2.8	9	248	28	14
12.2.9	4	129	32	60

Table 6. Analysis of variance results comparing species richness among the eight regional ecosystems.

ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	1982.8592	7	283.26560	8.09437	5.77634 E-07	2.16131
Within Groups	2169.71222	62	34.99535			
Total	4152.571429	69				

Species richness among sites within each regional ecosystem

The results of the analysis of variance of species richness within each of the four regional ecosystems that had more than three sites are shown in Table 7. The differences in species richness within each of the regional ecosystems were not significantly different as shown by P-values that were greater than *the test value of $P < 0.05$* .

Table 7. Analysis of variance for species richness measured in 1997, 1999 and 2021 within each of the regional ecosystems (RE) that had at least three monitoring sites.

RE12.2.11	ANOVA						
	Source of Variation	SS	df	MS	F	P-value	F crit
	Between Groups	22.88889	2	11.44444	0.125152	0.884607	5.14325
	Within Groups	548.6667	6	91.44444			
	Total	571.5556	8				
RE12.2.15g	ANOVA						
	Source of Variation	SS	df	MS	F	P-value	F crit
	Between Groups	18	2	9	0.47368	0.64416	5.14325
	Within Groups	114	6	19			
	Total						
RE12.2.6	ANOVA						
	Source of Variation	SS	df	MS	F	P-value	F crit
	Between Groups	163.58333	2	81.79166	2.65167	0.09401	3.4668
	Within Groups	647.75	21	30.84523			
	Total						
RE12.2.8	ANOVA						
	Source of Variation	SS	df	MS	F	P-value	F crit
	Between Groups	6.22222	2	3.111111	0.183007	0.83724	5.14325
	Within Groups	102	6	17			
	Total	108.2222	8				

Assessment of species composition using the Jaccard Similarity Index

Similarity in species composition between data collected in 1999 and those collected in 2021 were analysed using the Jaccard similarity index and the results are presented in Table 8. Similarity was highly variable and ranged from 27.9 to 66.7% with a mean of 42.2%. In the calculation of the Jaccard indices, it was noted that on average, 29% of species recorded in the 1999 surveys were not recorded in the 2021 surveys, and 28% of species recorded in the 2021 surveys were not recorded in the 1999 surveys. However, on average, 42% of the species were commonly recorded in the 1999 and 2021 surveys (Table 8).

Table 8. Jaccard Similarity Index comparing floristic composition in 2021 against floristic composition recorded in 1999, number of species present and absent at each site, whether the site was burnt or unburnt by 2020 bushfire and years since last fire event at 2021 measure date.

Regional Ecosystem (RE)	Site number	Jaccard Similarity Index (%)	Species found only in 1999	Species found only in 2021	Species found in 1999 and 2021	2020 Fire Status	Years since last fire
12.2.5	38	47.5	7	14	19	Burnt	1
12.2.6	11	44.4	17	8	20	Unburnt	13
	22	51.6	8	7	16	Unburnt	4
	24	36.7	18	13	18	Unburnt	32
	33	42.9	10	6	12	Burnt	1
	36	45.5	10	8	15	Burnt	1
	42	44.8	11	5	13	Burnt	1
	43	31.0	22	7	13	Burnt	1
	47	28.6	12	13	10	Burnt	1
12.2.7	23	27.9	13	18	12	Unburnt	4
12.2.8	18	39.4	9	11	13	Unburnt	2
	30	52.6	8	10	20	Unburnt	10
	32	48.7	13	7	19	Burnt	1
12.2.9	15	42.2	13	13	19	Unburnt	5
12.2.11	13	41.5	13	18	22	Unburnt	2
	37	39.3	7	10	11	Burnt	1
	48	48.6	8	11	18	Burnt	1
12.2.14	3	44.4	9	11	16	Unburnt	25
12.2.14a	34	31.3	14	8	10	Burnt	1
12.2.15g	21	38.5	4	12	10	Unburnt	1
	35	66.7	1	3	8	Burnt	1
	56	35.3	6	5	6	Burnt	1

The list of species found only in 1999 and those found only in 2021 grouped by regional ecosystem are presented in Appendix 2. It is noted that while a species may not have been present at one site during the measure date, it could have been present at another site in the same RE during the same measure.

The distribution of the similarity indices plotted using a boxplot to compare the variability within and among regional ecosystems is presented (Figure 5).

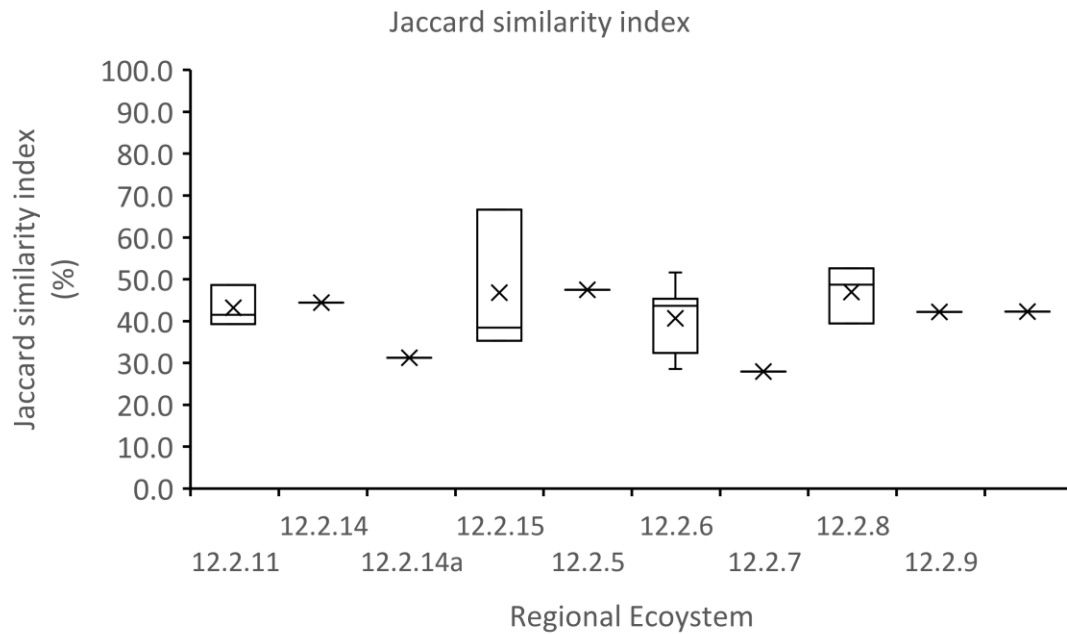


Figure 5. Boxplot of Jaccard similarity indices comparing species in sites measured in 1999 and 2021 within each of the sampled regional ecosystem. Error bars show minimum and maximum values, X is the mean and middle bar is the median value.

The greatest variability in the Jaccard similarity index was in RE 12.2.6 (9.5 to 51.6%) and in RE 12.2.15g (Figure 5). However, when the Jaccard indices obtained for the four regional ecosystems that had at least three monitoring sites (RE 12.2.11, RE 12.2.15g, RE 12.2.6 and RE 12.2.8) were analysed using ANOVA, the differences in average indices for these regional ecosystems were not statistically different ($P = 0.7919$,) (Table 9).

Table 9. Summary statistics and analysis of variance for the Jaccard similarity indices among regional ecosystems that had at least three monitoring sites.

ANOVA: Single Factor
SUMMARY

RE (Groups)	Count	Sum	Average	Variance
12.2.11	3	129.4438	43.14793	23.92964
12.2.15g	3	140.4223	46.80744	298.2998
12.2.6	9	334.9789	37.21988	162.2755
12.2.8	3	140.7435	46.91449	46.24813

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	345.3679	3	115.1226	0.791937	0.518375	3.343889
Within Groups	2035.159	14	145.3685			
Total	2380.527	17				

Potential impacts of fire on the Jaccard similarity indices

Since all the regional ecosystems had undergone a fire disturbance at different times during the monitoring period, we assumed that the impacts of the past fires on species composition would be cumulative and reflected in the sites sampled in 2021. During the 2021 field assessment, many of the sites were recovering from the 2020 bushfire event but there were several sites that had remained unburnt. These unburnt sites provided the opportunity to conduct an exploratory analysis using all the sites (regardless of regional ecosystem) to assess whether there were statistically significant differences among the similarity indices obtained for burnt and unburnt sites. The ANOVA results provided in Table 10 showed that the similarity indices for the burnt and unburnt sites were not statistically different ($P = 0.8867$). In addition, correlation analysis between the Jaccard indices and “years since the last fire” returned a very weak negative correlation coefficient of -0.0128.

Table 10. Analysis of variance results comparing the Jaccard similarity indices obtained from burnt and unburnt sites.

ANOVA: Single Factor
SUMMARY

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>
Burnt	12	510.0262	42.50218	110.5402
Unburnt	10	419.3622	41.93622	51.47637

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	1.747175	1	1.74717	0.02080	0.88674	4.35124
Within Groups	1679.23	20	83.96149			
Total	1680.977	21				

The large variance obtained for burnt sites (Table 10) may reflect the effect of differences in bushfire intensity at local sites, but it could also have been accentuated by species composition differences among the regional ecosystems.

Bray-Curtis species composition change between 1999 and 2021

The Bray-Curtis dissimilarity index was used to investigate differences in species composition over time on a scale of 0 to 100%. The dissimilarity indices obtained for each of the sites are provided in Table 11 and ranged from 38.3 to 93.5% with a mean dissimilarity index of 65.9%.

Table 11. Bray-Curtis Dissimilarity Index comparing floristic composition measured in 2021 with that measured in 1999 and whether the site was burnt or unburnt by the 2020 bushfire.

Regional Ecosystem (RE)	Site number	Bray-Curtis Index (%)	2020 fire Status
12.2.5: <i>Corymbia intermedia</i> +/- <i>Lophostemon confertus</i> +/- <i>Banksia</i> spp. +/- <i>Callitris columellaris</i> open forest on beach ridges usually in southern half of bioregion	38	77.6	Burnt
12.2.6: <i>Eucalyptus racemosa</i> subsp. <i>racemosa</i> open forest on dunes and sand plains. Usually deeply leached soils	36	75.3	Burnt
	43	93.5	Burnt
	47	85.5	Burnt
	24	46.0	Unburnt
	33	74.2	Burnt
	22	58.3	Unburnt
	42	71.6	Burnt
11	47.8	Unburnt	
12.2.7: <i>Melaleuca quinquenervia</i> or rarely <i>M. dealbata</i> open forest on sand plains	23	63.8	Unburnt
12.2.8: <i>Eucalyptus pilularis</i> open forest on parabolic high dunes	30	38.3	Unburnt
	18	83.9	Unburnt
	32	40.4	Burnt
12.2.9: <i>Banksia aemula</i> low open woodland on dunes and sand plains. Usually deeply leached soils	15	66.4	Unburnt
12.2.11: <i>Corymbia tessellaris</i> +/- <i>Eucalyptus tereticornis</i> , <i>C. intermedia</i> and <i>Livistona decora</i> woodland on beach ridges in northern half of bioregion	37	77.2	Burnt
	48	89.1	Burnt
	13	72.7	Unburnt
12.2.14: Fore dune complex comprising <i>Corymbia tessellaris</i> , <i>C. intermedia</i> with <i>Acacia leiocalyx</i> , <i>A. disparrima</i> low open forest	3	46.9	Unburnt
12.2.14a: <i>Casuarina equisetifolia</i> subsp. <i>incana</i> woodland to low open forest on exposed frontal areas	34	61.1	Burnt
12.2.15g: Swamps dominated by <i>Empodisma minus</i> , <i>Gahnia sieberiana</i> , other sedges and forbs and shrubs such as <i>Leptospermum liversidgei</i> .	56	50.0	Burnt
	21	58.1	Unburnt
	35	50.7	Burnt

The distribution of the indices within and among regional ecosystems is presented using a boxplot (Figure 6) showing large variability among sites measured in RE 12.2.6 and RE 12.2.8. However, when dissimilarity indices for the different regional ecosystems were compared using analysis of variance, the differences were not statistically significant with $P= 0.416194$ (Table 12).

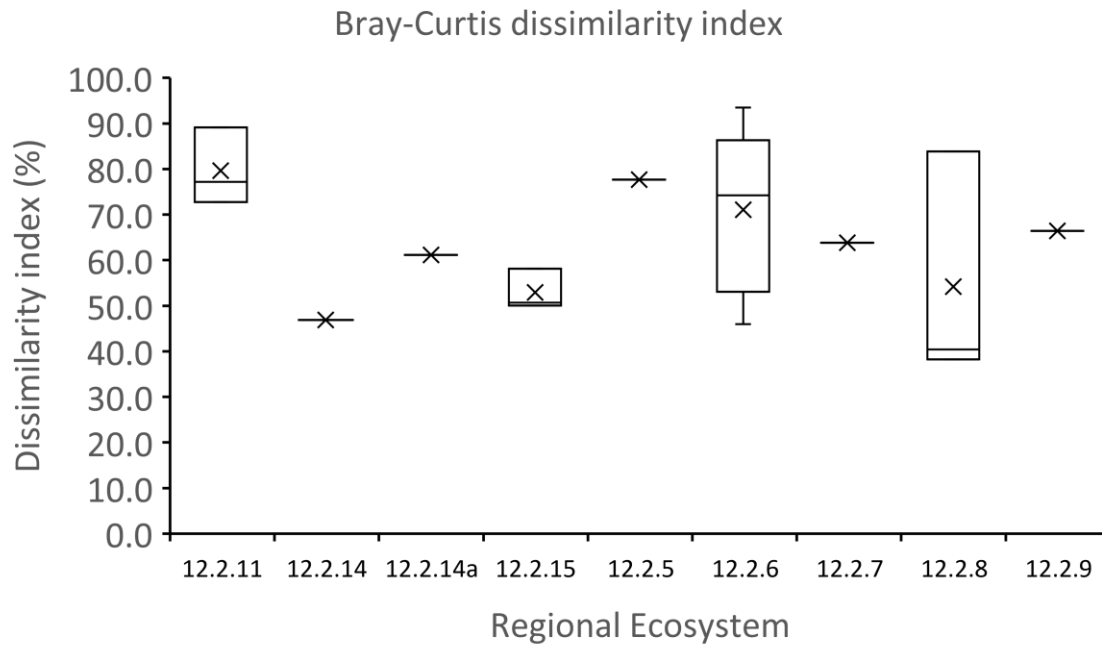


Figure 6. Boxplot of Bray-Curtis dissimilarity indices comparing species composition of sites measured in 1999 and 2021 within each of the sampled regional ecosystems. Error bars show minimum and maximum values, X is the mean and the middle bar is the median value.

Table 12. Analysis of variance for Bray-Curtis dissimilarity indices among regional ecosystems that had at least three monitoring sites.

SUMMARY						
RE Groups	Count	Sum	Average	Variance		
12.2.11	3	238.98	79.66	71.89589		
12.2.15g	4	258.5971	64.64927	561.1031		
12.2.6	9	639.3321	71.03689	291.263		
12.2.8	3	162.5356	54.17854	662.3174		
ANOVA: Single Factor						
Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	1105.962	3	368.6542	1.008751	0.416194	3.287382
Within Groups	5481.84	15	365.456			
Total	6587.803	18				

Bray-Curtis dissimilarity indices and potential impacts of fire

The variability of dissimilarity indices for sites that were recorded as burnt and unburnt in the 2021 field monitoring sites (Table 11) was assessed using analysis of variance (Table 13). A statistically significant difference was obtained ($P= 0.0297$) between dissimilarity indices of burnt and unburnt sites, with recently burnt sites showing greater dissimilarity (Table 13). Unburnt sites ranged from 2 to 25 years since the last fire event.

Table 13. Analysis of variance results comparing Bray-Curtis dissimilarity indices obtained from burnt and unburnt sites.

Anova: Single Factor
SUMMARY

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>
Burnt	14	1033.17	73.79785	308.9913
Unburnt	10	582.1048	58.21048	194.5999

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	1417.301	1	1417.301	5.405525	0.029695	4.30095
Within Groups	5768.286	22	262.1948			
Total	7185.586	23				

Comparison of K’gari sites species richness to regional ecosystem description

The Technical Descriptions (TD) for the regional ecosystems that were sampled on K’gari are provided in Appendix 3. This allows a comparison of the species richness and composition of K’gari sites with the full list of species compiled from a larger pool of sites covering the whole spatial distribution of a regional ecosystem. A summary comparison is provided in Table 14.

Table 14. Comparison between mean species richness and number of naturalised species recorded in each regional ecosystem in 2021 on K’gari and those from all sites in the same regional ecosystem as recorded in the regional ecosystems Technical Descriptions.

RE	2021 sampling			RE Technical Description		
	No. sites	Mean species richness	No. of naturalised species	No. sites	Mean species richness	No. of naturalised species
12.2.5	1	33	1	18	25.8	7
12.2.6	7	26.3	0	49	29.8	2
12.2.7	1	30	4	46	20.3	7
12.2.8	3	26.7	0	31	31.9	2
12.2.9	1	32	0	26	28.2	1
12.2.11	3	30	1	19	37.5	5
12.2.14a	2	22.5	2	22	13.5	12
12.2.15g	3	14.7	0	15	9.4	7

The 2021 sampling of the K’gari sites, which included the recently burnt sites, recorded a higher mean species richness than those of the Technical Descriptions for RE 12.2.5, 12.2.7, 12.2.9, 12.2.14a and 12.2.15g. However, these estimates are based on either a single site or a maximum of three sites compared to at least 15 sites used for the Technical Description estimates (Table 14). For the K’gari sites with a lower mean species richness compared to the corresponding Technical Description (RE 12.2.6, 12.2.8, and 12.2.11) the difference ranged from 3.5 to 7.5 species.

A chart showing mean species richness of native species derived from sites sampled in 2021 compared with that from the Technical Description of each of the regional ecosystems is provided in Figure 7. The mean species richness of sites observed in 2021 was 29 species and was very similar to 25 species obtained from the Technical Description. While there are differences in some regional ecosystems, analysis of variance results that compared the differences between the two mean estimates of species richness showed that the differences were not statistically significant $P = 0.7251$ (Table 15).

Table 15. Analysis of variance results comparing native species richness observed in 2021 with that derived from technical description of each of the regional ecosystem.

Anova: Single Factor

SUMMARY

Groups	Count	Sum	Average	Varianc e
Observed species 2021	8	207.7	25.9625	33.4655
Species from Tech. desc.	8	196.4	24.55	90.5514

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	7.9806	1	7.9806	0.1287	0.7251	4.6001
Within Groups	868.1188	14	62.0084			1
Total	876.0994	15				

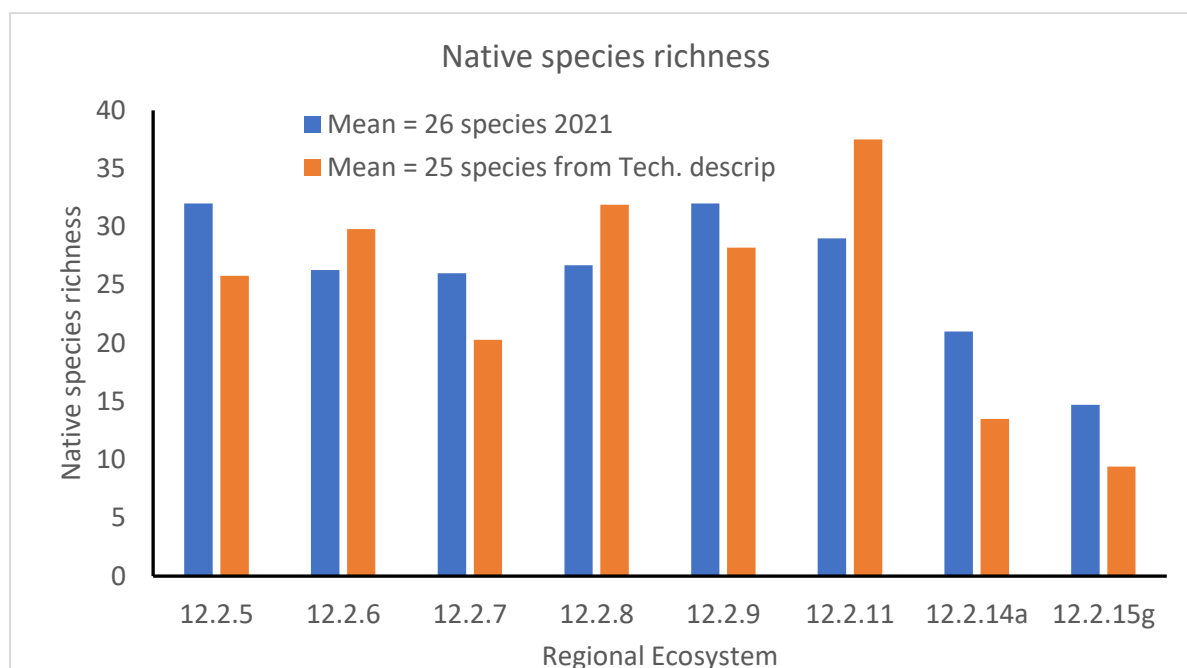


Figure 7. A comparison between native species richness derived from sites sampled in 2021 and from technical descriptions of each regional ecosystem.

Threat of invasive plant species

The list of naturalised invasive plants recorded in the sampled sites is presented in Table 16. All the species are recognised as environmental weeds in Queensland and *Lantana camara* is listed as a Weed of National Significance in Australia. The invasive species were only recorded at five sites in 2021. At three sites the invasive species cover was greater than 7%. These species and cover were: *Passiflora pallida* – 9.4% in site 34 (RE 12.2.14a) and 7.3% in site 23

(RE 12.2.7), and *Lantana camara* – 38% cover in site 23. The sampled K’gari sites had a much lower number of naturalised species recorded compared to the broader RE as shown by the technical descriptions (Table 14).

Table 16. List of naturalised species identified at K’gari sites in 2021 and historically.

RE	Site_ID	Species name in QBEIS	Cover (%)	Pest status
12.2.5	38	<i>Passiflora pallida</i> (corky stem passionflower)	0.1	Environmental Weed
12.2.7	23	<i>Passiflora pallida</i> (corky stem passionflower)	7.3	Environmental Weed
	23	<i>Digitaria ciliaris</i> (couch grass)	1.6	Environmental Weed
	23	<i>Sonchus oleraceus</i> (common sowthistle)	0.1	Environmental Weed
	23	<i>Lantana camara</i> (lantana)	38	Weed of National Significance
12.2.11	37	<i>Passiflora pallida</i> (corky stem passionflower)	0.2	Environmental Weed
12.2.14	3	<i>Passiflora pallida</i> (corky stem passionflower)	0.4	Environmental Weed
12.2.14a	34	<i>Passiflora pallida</i> (corky stem passionflower)	9.4	Environmental Weed
	34	<i>Solanum americanum</i> (glossy nightshade)	0.1	Environmental Weed

Discussion

Understanding how threats, and the management actions used to mitigate them, affect species composition and diversity over time is important for the management of World Heritage Areas. In the K’gari World Heritage Area, visitor impacts, inappropriate fire regimes, invasive plants and animals, and climate change are known key threats (UNESCO, 2022). In this study, two primary components of species diversity were investigated: 1) species richness (number of species) and 2) species composition (species and abundance). These were examined using data collected over 24 years (between 1997 and 2021) within the K’gari World Heritage Area, Queensland. Despite observed fluctuations in species richness during site revisits, the overall differences within regional ecosystems were not statistically significant. There were, however, significant differences in species richness among regional ecosystems which is consistent with the attribute of “species differences” that characterise regional

ecosystem communities. This finding provided support for the use of regional ecosystem mapping as a stratification criterion when assessing changes in the vegetation communities.

Fire is a major 'tool' in the management of biodiversity values of K'gari WHA. While fire regimes that are not appropriate to the ecosystems are recognised as a "High Threat" to the conservation values of the heritage listed area (IUCN, 2020), fire is a critical and natural component of the ecology of eucalypt forests in Australia (Gill, 1997) and most regional ecosystems on K'gari. All the sites in this study had experienced planned burn and/or bushfire events within the timeframe of this study with most of the sites having had at least two bushfire events. Intense bushfires tend to cause the greatest impact on biodiversity and this impact is exacerbated when they become too frequent. Forest and woodland bushfires in south-eastern Australia have been relatively infrequent in the past and characterised by fire return intervals of > 20 years (Wang et al., 2022; Williams and Gill, 2012). In this study, the average time between bushfires (bushfire return interval) in our plots (Table 3) since 1994 was estimated at 13 years, suggesting that bushfire occurrence in the last two decades appear to be more frequent than broader averages reported in the past in south-eastern Australia (Canadell et al., 2021).

Bushfire severity has direct impact on species richness and composition and can range from whole stand death or whole stand survival (Gill, 1997). In the 2021 K'gari post fire recovery study (Neldner and Ngugi, 2021), the negative effects of low severity fires appeared to be short lived. Much of the vegetation was recovering by vegetative resprouting of whole of plant, or from the base of the stem for those that had been severely burnt, except for fire intolerant, facultative-seeding species such as *Casuarina equisetifolia* subsp. *incana* in the foredune communities (Meiklejohn et al., 2021; Neldner and Ngugi, 2021). This response may partly explain why the species richness reported in this study, on sites within the same regional ecosystem that had several bushfires in the last 26 years, were not statistically different.

The Jaccard similarity indices enabled more detailed examination of the species composition. While the differences in the Jaccard similarity indices within and among regional ecosystems were not significant, on a 100% scale, the values were generally low and the average value of the indices for all the sites was 42%. A detailed examination of the species data used for the Jaccard analysis revealed that there were large differences in the list of unique species

recorded at the two different primary sampling occasions (1999 and 2021). About 28% of the species observed during the 1999 visit were not recorded in the 2021 visit and vice versa (Table 8). Although misidentification of species may have contributed to the discrepancy, differences due to bushfire exposure cannot be excluded as a possible cause for the differences in observed species - especially as 57% of the sites compared in this study were burnt in the 2020 bushfire. These 2020 burnt sites were in different stages of ecosystem recovery depending on fire severity and type of vegetation (Neldner and Ngugi, 2021). Some were characterised by massive regeneration of species from the soil seedbank, such as *Acacia* species. Further investigation into the likely cause/s of the differences in species composition for sites not burnt in 2020 compared to sites burnt in 2020 is recommended once sufficient time has passed to allow natural regeneration to occur on the burnt sites. This recommendation is supported by the results of the Bray-Curtis dissimilarity indices.

Species composition results obtained using Bray-Curtis dissimilarity indices indicated high dissimilarity between 1999 and 2021 (average 65.9%). The index was directly and negatively impacted by the severity of the 2020 fire event in the K'gari WHA. This is partly because plant cover was used as a surrogate for species abundance for this study and vegetation cover was adversely affected by fire severity. In addition, species differ from one another in their environmental tolerances, resource use, and interactions with other species, and hence their abundance has a major influence on ecosystem functioning and stability (Cleland, 2011). In K'gari, the differences in species responses to fire were evident in the recovery of different regional ecosystems following the 2020 fires (Meiklejohn et al., 2021; Neldner and Ngugi, 2021).

Species richness across the eight regional ecosystems sampled in 2021 on K'gari was very similar to the overall species richness recorded for a larger pool of sites upon which the regional ecosystem Technical Descriptions (TD) were based. The TDs are detailed descriptions of the normal range in structure and floristic composition of remnant regional ecosystems and their component vegetation communities (Queensland Herbarium 2022). Mean native species richness observed in 2021 (26 species) was also very similar to (25 species) obtained from the Technical Description. For five regional ecosystems, the sites on K'gari had a greater species richness than the TD, and for the remaining three regional ecosystems the average species richness was lower by about eight species. The species richness recorded in RE 12.2.9

was 32 species and an additional site established in RE 12.2.9 near Deep Creek in 2021 (QBEIS 18286) had 26 species. This richness is close to the average species richness of 30.1 recorded by Pearl et al. (2022) over nine sites with an area of 1000 m² on the Sunshine Coast. For all regional ecosystems, the number of naturalised species was lower than that recorded in the TD. This confirms that despite the 2020 fires which affected 12 of the 22 sites sampled, the K'gari sites are in generally good condition for the attributes of native species richness and species richness of non-native species specifically (Neldner and Ngugi 2021).

Constraints on vegetation data

The use of historical monitoring data to assess vegetation change over time provided a unique opportunity in this study but it was not without its challenges. There were three major potential data differences between the sampling conducted by UQ/QPWS and the Queensland Herbarium: 1) the different sized sample areas, 2) different precision on recording cover and 3) potential differences in the identification of species.

Firstly, the two monitoring programs used different plot sizes. The UQ/QPWS monitoring program used variable plot sizes ranging from 25 to 400 m² (Hockings and Hobson, 2000) which were considerably smaller than the 500 m² standard plot used by the Queensland Herbarium. Despite the differences, the analysis of variance results comparing species richness data collected using the two methods between 1997 and 2021 did not find significant differences. This validates that the variable plot sizes used by UQ/QPWS – which were based on calculating species/area curves for each site to contain at least 90 % of the estimated number of species at a location (Hockings and Hobson, 2000) - provided reliable estimates of species richness.

Secondly, the comparison meant dealing with different methodologies used for estimating species cover. The UQ/QPWS monitoring program used the Braun-Blanquet cover abundance ranking scale of 1 to 5 to estimate cover of each species (Wikum and Shanholtzer, 1978). Since each cover scale is a range, we used the midpoint as the estimate of cover for each species to compare with cover values estimated by the Queensland Herbarium using the QBEIS dataset. It is therefore likely that species cover estimates based on the conversion of Braun-Blanquet scale to a single value may have underestimated or overestimated cover values leading to greater dissimilarity between measure comparisons.

Thirdly, there is potential for discrepancies to occur in species identification between the two measure programs. In the UQ/QPWS monitoring program, field assessments were undertaken between August and November, with most in October when flowering facilitated accurate species identification. However, in May 2021, a field assessment was undertaken that was specifically targeted at assessing vegetation recovery following the 2020 bushfire. So, except for sites that were unburnt, all the other sites were in early stages of recovery from fire, characterised by resprouting species and germinants. In both programs, where a species could not be positively identified in the field, specimens were collected and taken to the Queensland Herbarium for identification. In a few cases, in the absence of flowers or fruit, identification to species level was not possible. Field data collected in 1995 and 1996 which had been flagged to have low confidence in species identification due to limited botanical knowledge were excluded from the current analyses. Careful review of the historic data collected after 1996 showed no evidence of incorrect species identification (Bill McDonald pers comms, June 2022).

Increased tourism in K'gari has been recognised as acting as a driver for the introduction of invasive species (IUCN, 2020). For example, visitation data for K'gari in 2021 calendar year shows that QPWS issued 56,440 vehicle permits, 39,892 camping permits for 95,524 adults and 17,384 children (Queensland Government 2022) demonstrating high potential vulnerability. The Queensland Herbarium database (HERBRECS) has specimens of 109 naturalised non-native plant species collected on K'gari (HERBRECS analysis 5 July 2022) (Queensland Herbarium, 2021). However, over 200 invasive flora and fauna species have been reported to occur in the K'gari section of the Great Sandy National Park (IUCN, 2020). This study recorded only six invasive plant species in the 22 sites sampled. These were *Passiflora pallida* (spread by birds and water), *Solanum americanum* (dispersed by birds, mammals, water, soil and machinery), *Digitaria ciliaris* (dispersed by humans), *Sonchus oleraceus* (spread by humans and animals) and *Lantana camara* (spread by humans, birds and mammals). None of these invasive species were widespread except *Lantana camara* which is commonly seen in the western corridor of the Island. A comprehensive invasive flora survey was not conducted as part of this study, but the results are encouraging compared to those from frequently visited Parks in the southeast Queensland region (Ngugi et al., 2014) or more remote areas such as protected areas of the Cape York Peninsula (Ngugi and Neldner, 2017).

The successful removal of bitou bush (*Chrysanthemoides monilifera* subsp. *rotundata*) from K'gari required a 35-year period of collaborative annual surveys and control efforts (Behrendorff et al. 2019).

Pigs are a potential pest animal on K'gari, however their numbers are kept at a minimal level by the dingo population. As such, pigs are not a cause for concern on K'gari to the same degree they are on other coastal sand barrier islands in the region, such as Moreton Island. Signs of pig activity are rarely seen even after fire events and hence they are not a main threat to wetland or other ecosystems on the island. However, myrtle rust (*Austropuccinia psidii*), a wind-dispersed fungal plant pathogen, is a major threat to the vegetation communities on K'gari (Fraser Island (K'gari) Scientific Advisory Committee, 2018). Although it was not observed in the 22 sites monitored in 2021, a post fire assessment of the impacts of myrtle rust on post-fire regeneration at K'gari in 2021 reported, for the first time, symptoms of the rust on *Eucalyptus pilularis* and *Syncarpia hillii* trees, as well as on seedlings and reshoots of *Syncarpia hillii* (Pegg et al., 2021).

Pest management vigilance will always be required on K'gari because of the continuous potential source of new propagules associated with the dispersal capacity of birds and wind, the high volume of vehicles, campers and bushwalkers to the island and the residents and visitors of the permanent townships.

Conclusion

This study provides a rare assessment of the dynamics of species communities in the K'gari (Fraser Island) section of the Great Sandy National Park and the World Heritage Area over a 24-year period. Increasing tourism is acting as a driver for a number of threats to the Park, which include pollution, erosion and siltation, disturbance, and the introduction of invasive species, in addition to the ongoing threats of climate change (IUCN, 2020). Widespread, frequent, and severe bushfire is also a threat to the conservation of biodiversity on the Island. This study investigated vegetation dynamics using time series data from monitoring sites established in 1995 soon after the declaration of the World Heritage status of the island. Species richness and composition recorded from the historical monitoring sites were compared with data collected from the same sites in 2021. While there were fluctuations in species richness within regional ecosystems over time there were no detectable significant

differences in species richness over the monitoring period. The fluctuations in species richness among regional ecosystems were consistent with species differences that characterise different regional ecosystems. Species canopy cover was adversely affected by the 2021 fire events and resulted in statistically significant differences ($P = 0.0298$) between dissimilarity indices of burnt and unburnt sites, with recently burnt sites showing greater dissimilarity (Table 13). Unburnt sites ranged from 2 to 25 years since the last fire event.

There was a large discrepancy in the list of species that were observed in 1999 and those observed in 2021. Although the overall richness was similar, only 42% of the species were common between these two years. The extent to which this difference in unique species was related to exposure to recent bushfires could not be ascertained.

Recommendations

Further study is recommended to investigate the autecology and possible impacts of fires on the species that were recorded in the historic data but not recorded in 2021 and vice versa. This knowledge is required to inform management responses to the threat of increasing bushfire frequency and severity associated with a changing climate (Dowdy et al. 2015). It is also recommended that more of the UQ/QPWS sites that were not located in 2021, be revisited and resampled using the Queensland Herbarium survey methodology to further enhance the continuity of this valuable long-term vegetation monitoring program. Continued long-term monitoring on at least a five yearly basis is crucial for informing IUCN conservation outlook assessments of K'gari WHA.

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Appendices

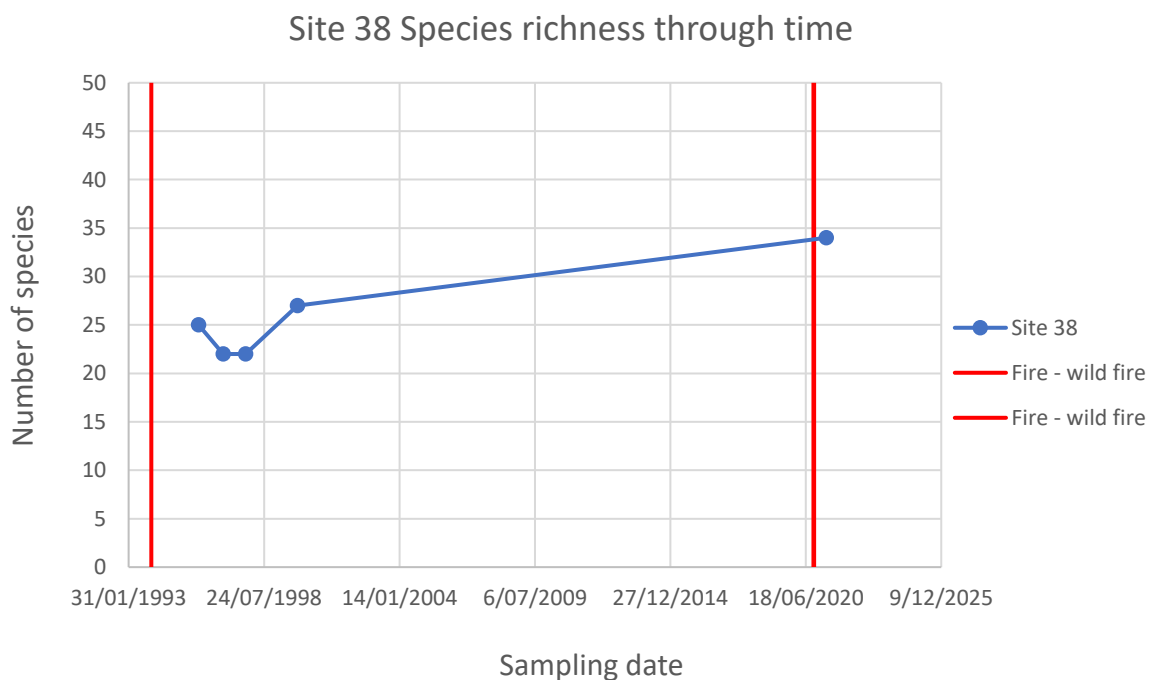
Appendix 1: Images of site condition in 2021, species richness and fire events.

Images showing the condition of each site in 2021, species richness from consecutive measurements and the date when fire events happened for all the 22 sites are presented in this Appendix.

Regional Ecosystem 12.2.5: *Corymbia intermedia* +/- *Lophostemon confertus* +/- *Banksia* spp. +/- *Callitris columellaris* open forest on beach ridges usually in southern half of bioregion.
 Site 38: This site was burnt by the 2020 bushfire. It was revisited, photographed and remeasured in 2021



Site 38 (Q18255), *Corymbia intermedia* woodland with *Melaleuca quinquenervia* and *Lophostemon suaveolens*.



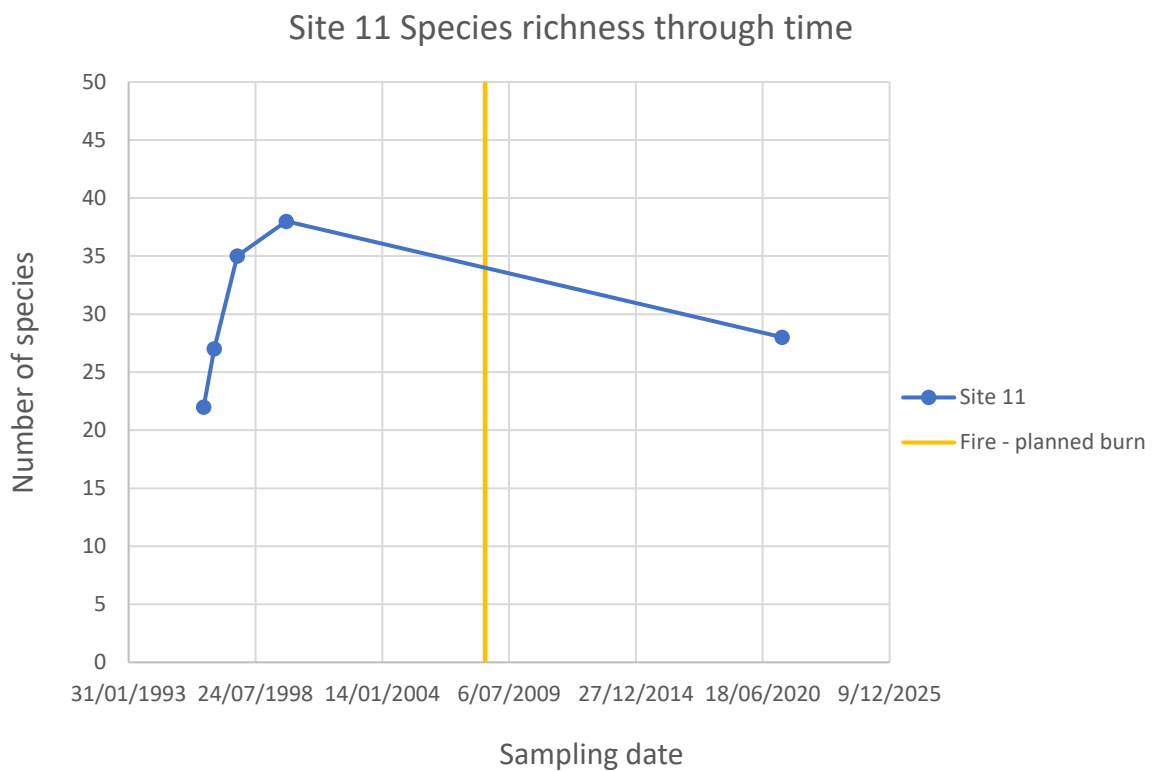
Site 38 species richness and recorded bushfire in 1993 and 2020

Regional Ecosystem 12.2.6: *Eucalyptus racemosa* subsp. *racemosa* open forest on dunes and sand plains. Usually deeply leached soils.

Site 11: This site was unburnt by the 2020 bushfire. It was revisited, photographed and remeasured in 2021



Site 11 (Q18285), *Eucalyptus racemosa*, *Syncarpia hillii* shrubby woodland.



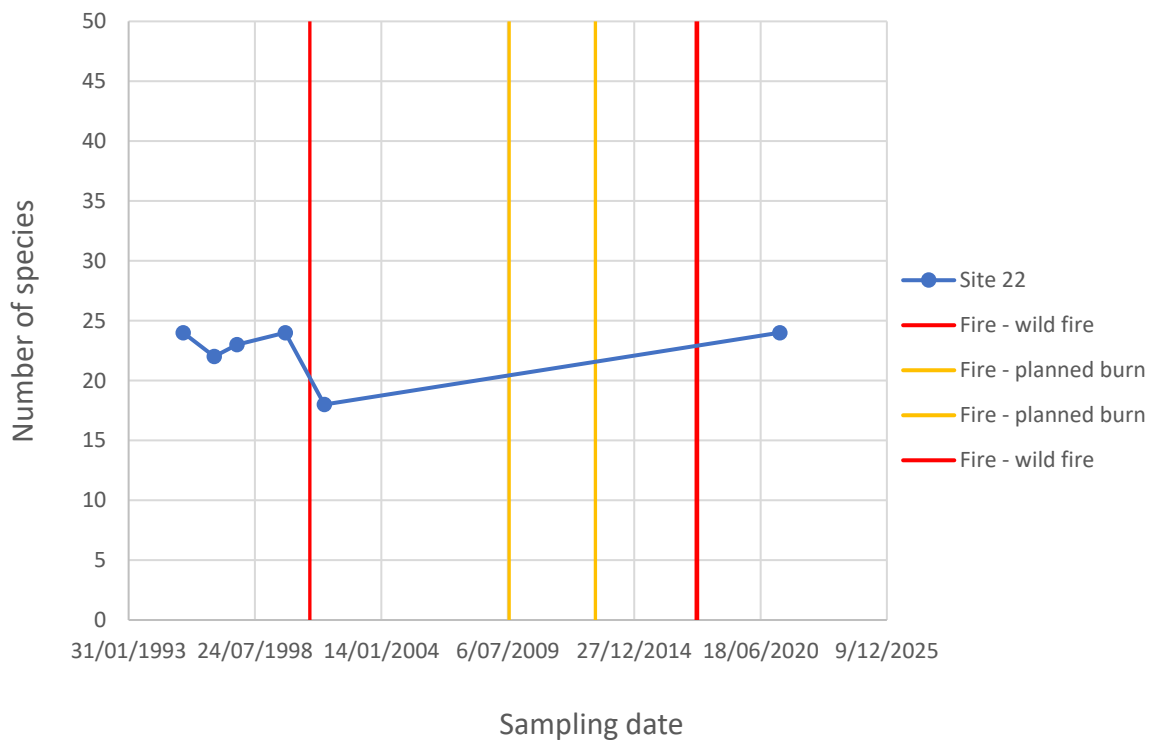
Site 11 species richness and the recorded planned burn in 2008 but no bushfire recorded.

Site 22: This site was unburnt by the 2020 bushfire. It was revisited, photographed and remeasured in 2021



Site 22 (Q18261), *Corymbia intermedia*, *Eucalyptus racemosa* open forest.

Site 22 Species richness through time

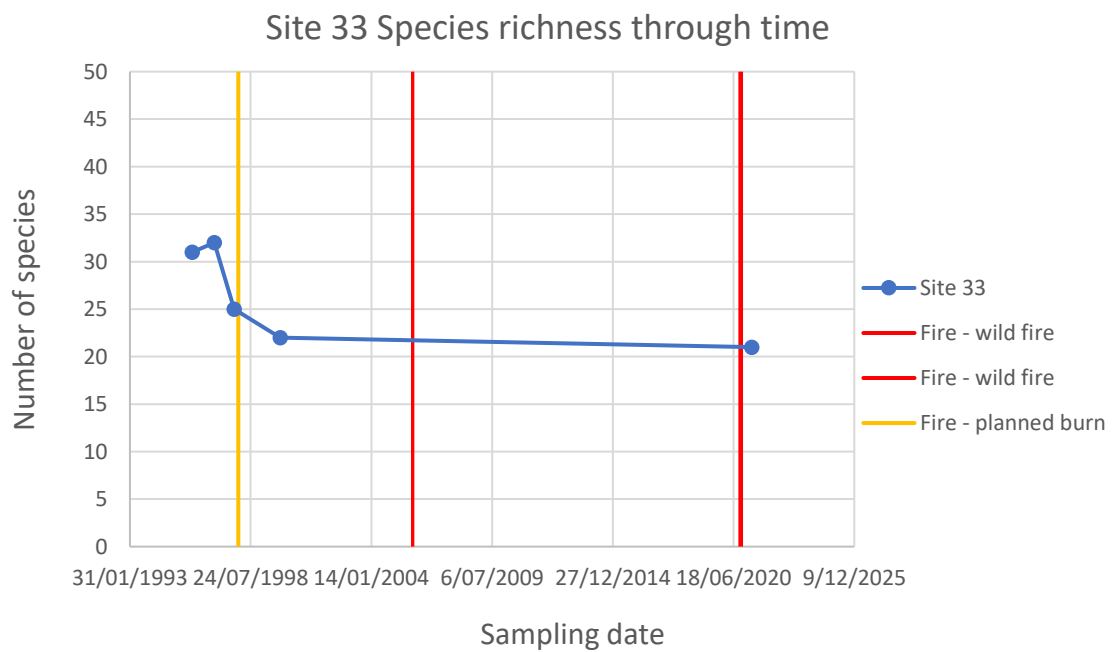


Site 22 species richness, two planned burns and two bushfires since 1999

Site 33: This site was burnt by the 2020 bushfire. It was revisited, photographed and remeasured in 2021



Site 33 (Q18256), severely burnt *Eucalyptus racemosa*, *Banksia aemula* woodland.

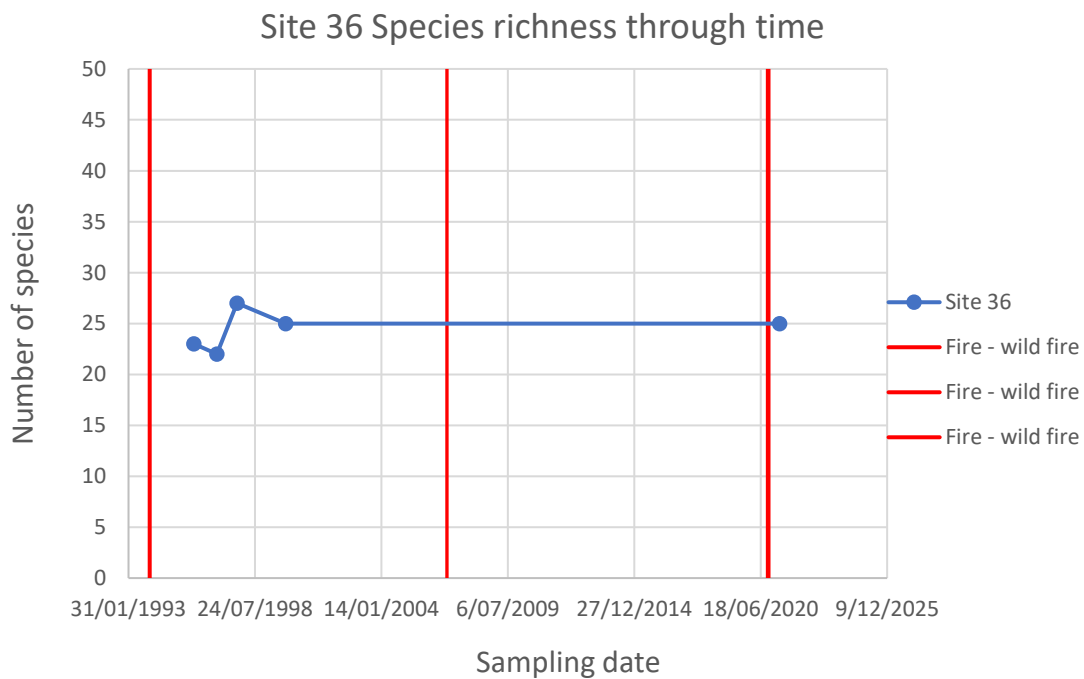


Site 33 species richness, one planned burn and two bushfires after 1998.

Site 36: This site was burnt by the 2020 bushfire. It was revisited, photographed and remeasured in 2021



Site 36R (Q18260), burnt *Corymbia intermedia*, *Lophostemon confertus* woodland.



Site 36 species richness and three recorded bushfires since 1993.

Site 42: This site was burnt by the 2020 bushfire. It was revisited, photographed and remeasured in 2021



Site 42 (Q18257), burnt *Eucalyptus racemosa*, *Corymbia gummifera* woodland.

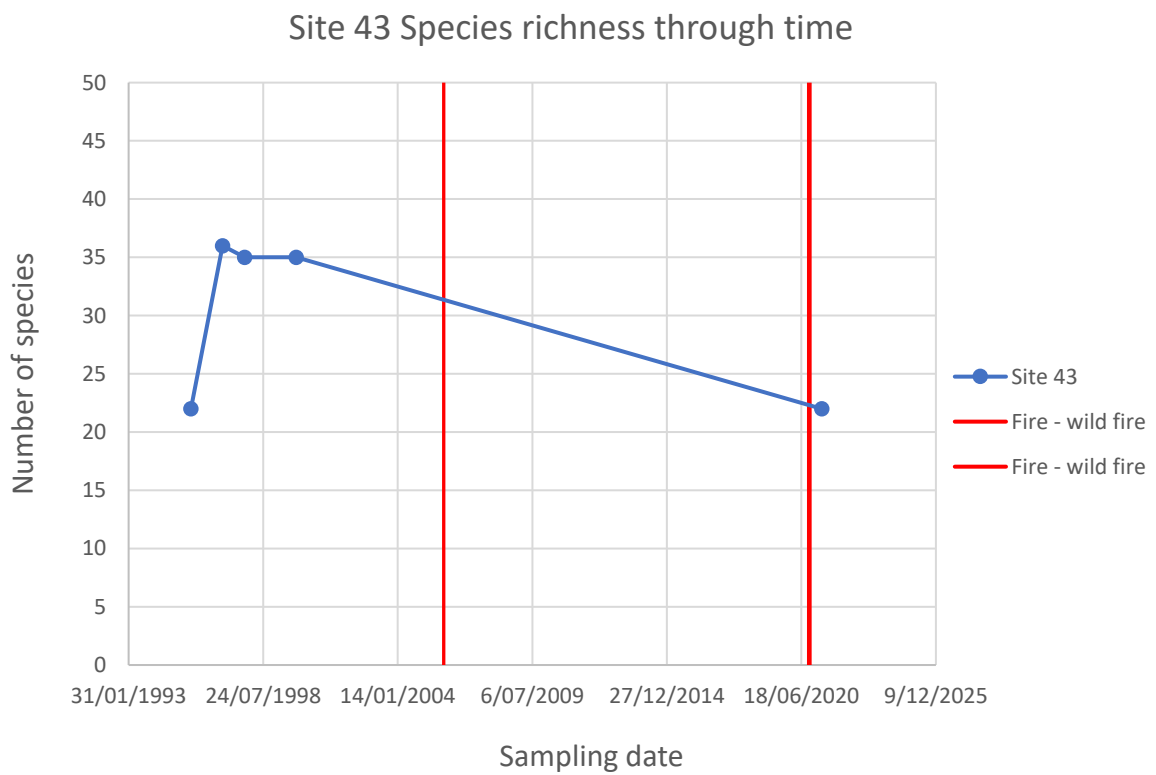


Site 42 species richness and the two recorded bushfires.

Site 43: This site was burnt by the 2020 bushfire. It was revisited, photographed and remeasured in 2021



Site 43 (Q18249), burnt *Eucalyptus racemosa*, *Corymbia gummifera* low woodland.



Site 43 species richness and the two recorded bushfires after the 1999 measure.

Site 47: This site was burnt by the 2020 bushfire. It was revisited, photographed and remeasured in 2021



Site 47 (Q18252), *Corymbia intermedia*, *Lophostemon confertus* open forest.



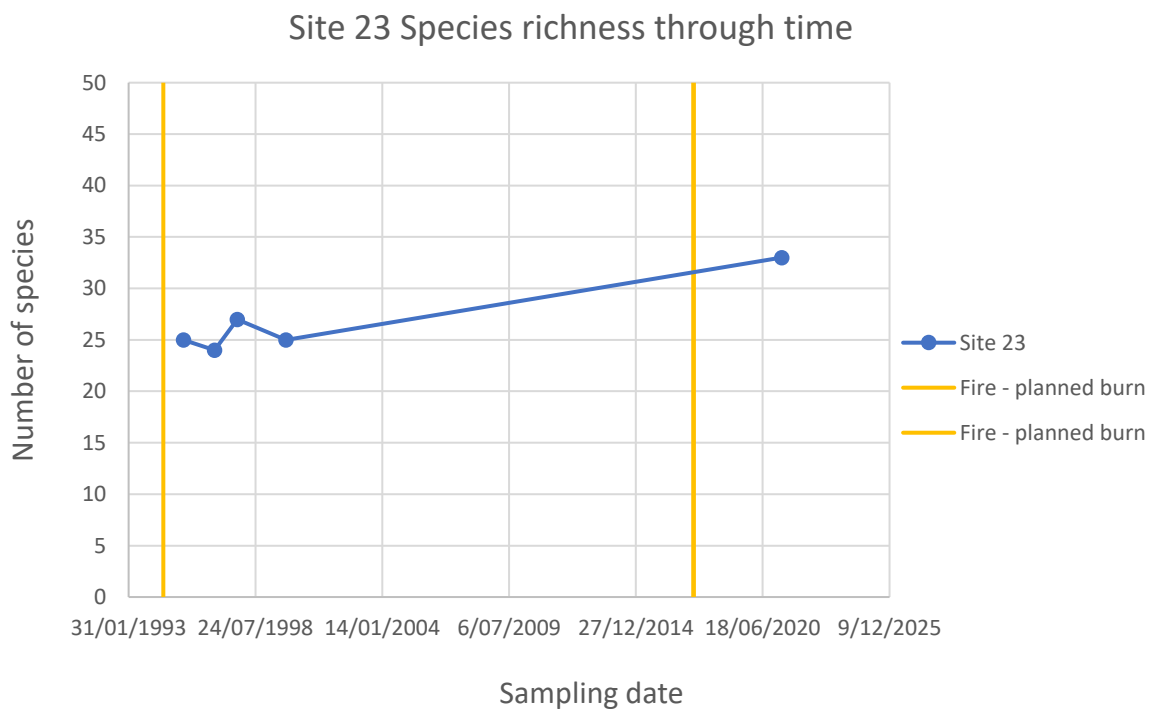
Site 47 species richness and the only bushfire record in 2020.

Regional Ecosystem 12.2.7: *Melaleuca quinquenervia* or rarely *M. dealbata* open forest on sand plains.

Site 23: This site was unburnt by the 2020 bushfire. It was revisited, photographed and remeasured in 2021



Site 23 (Q18262), *Melaleuca quinquenervia* open forest with *Lantana camara* shrubs.



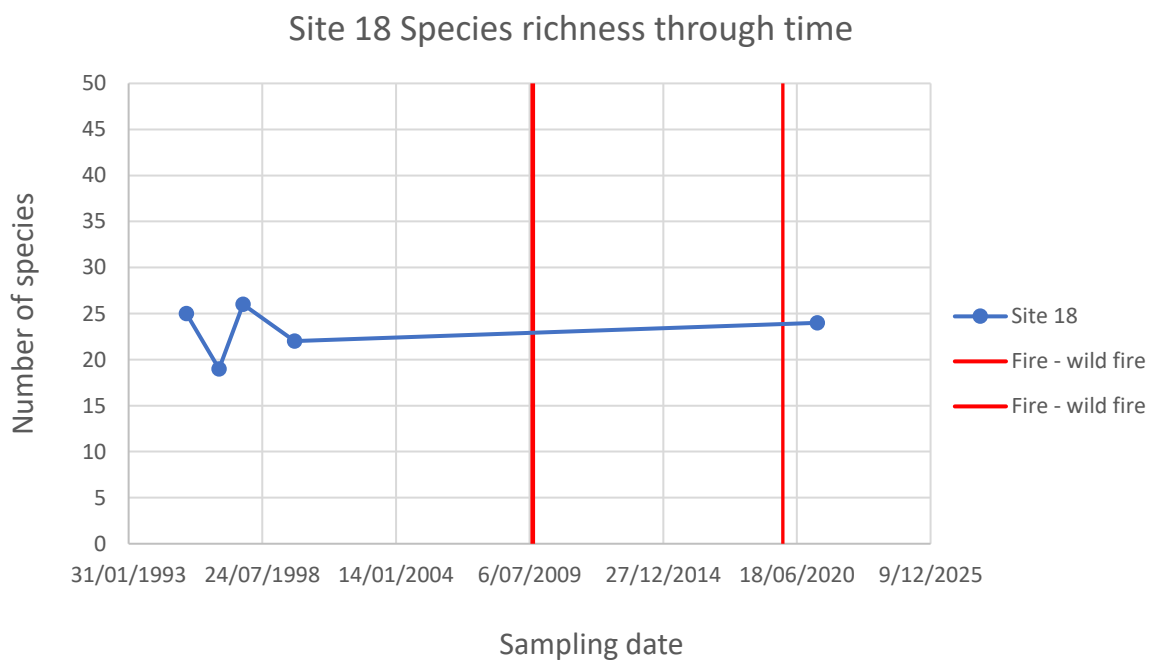
Site 23 species richness showing two planned burns and no bushfire.

Regional Ecosystem 12.2.8: *Eucalyptus pilularis* open forest on parabolic high dunes.

Site 18: This site was burnt by the 2019 bushfire. It was revisited, photographed and remeasured in 2021



Site 18 (Q18284), disturbed *Eucalyptus pilularis*, *Syncarpia hillii* woodland with dense cover of *Acacia penninervis* var. *longiracemosa* shrubs.

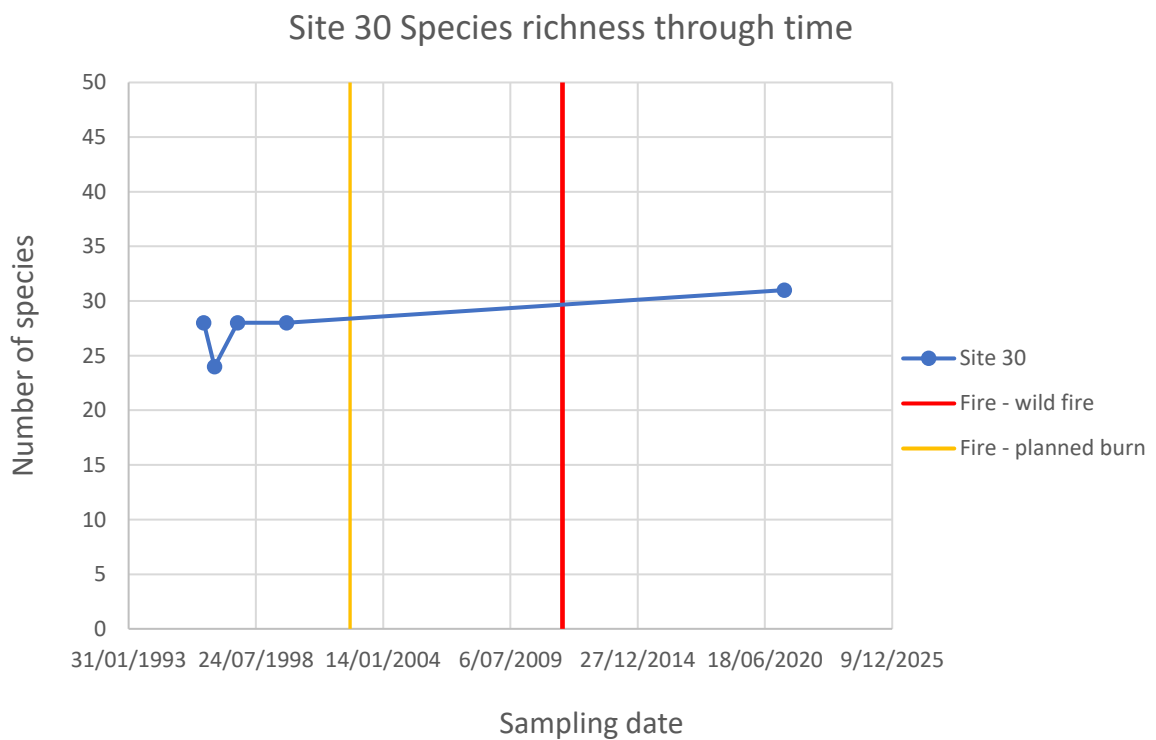


Site 18 species richness and two bushfires within 10 years of each other.

Site 30: This site was unburnt by the 2020 bushfire. It was revisited, photographed and remeasured in 2021



Site 30 (Q18259), *Eucalyptus pilularis* tall open forest with *Syncarpia hillii* and *Lophostemon confertus* subcanopy.

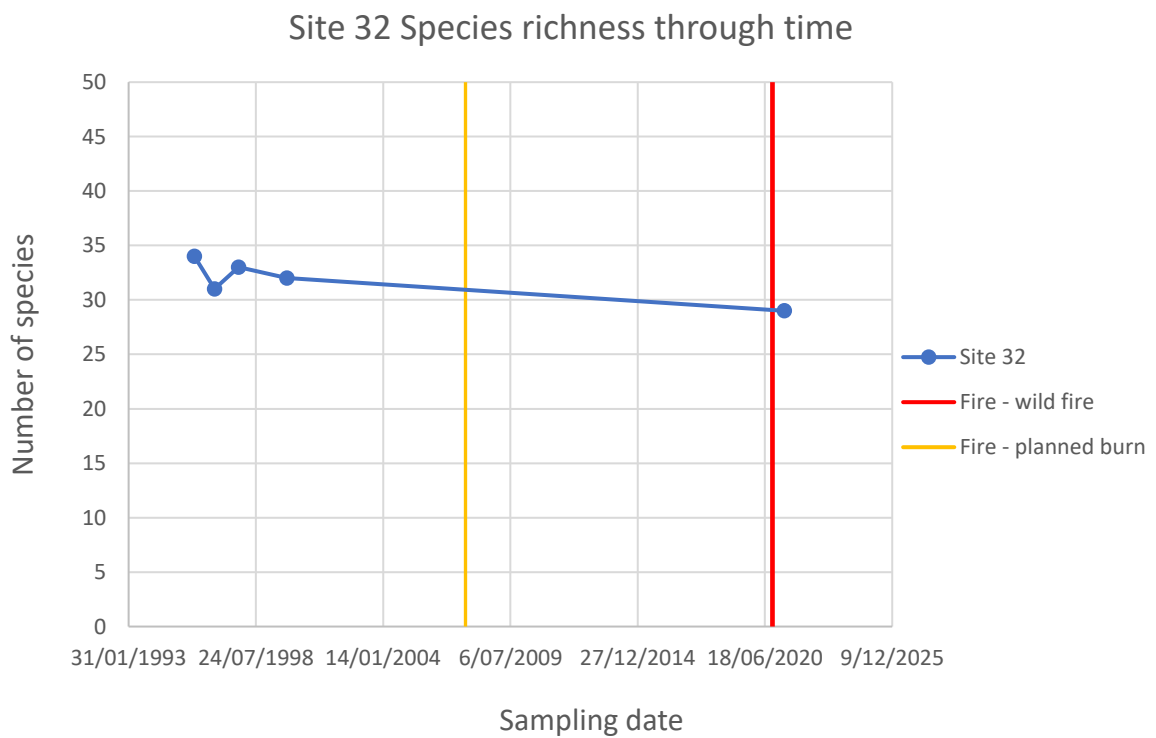


Site 30 species richness showing one planned burn in 2002 and one bushfire in 2011.

Site 32: This site was burnt by the 2020 bushfire. It was revisited, photographed and remeasured in 2021



Site 32 (Q18258), burnt *Eucalyptus pilularis* open forest.



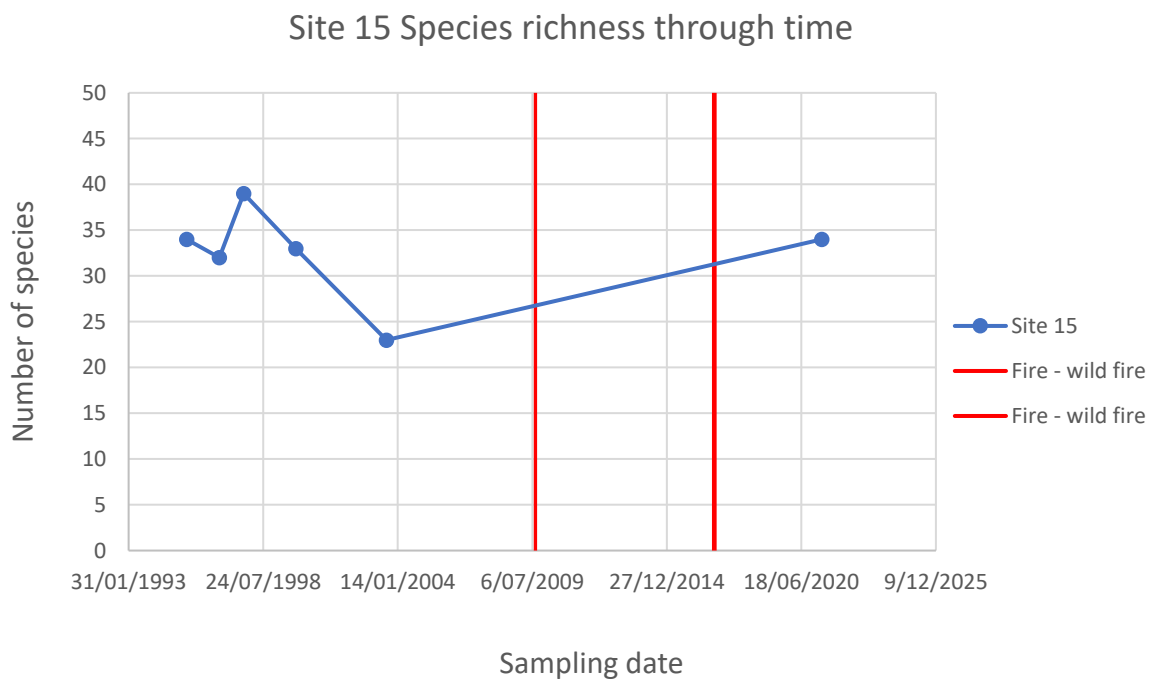
Site 32 species richness and record of one planned burn in 2007 and bushfire in 2020.

Regional Ecosystem 12.2.9: *Banksia aemula* low open woodland on dunes and sand plains. Usually deeply leached soils.

Site 15: This site was unburnt by the 2020 bushfire. It was revisited, photographed and remeasured in 2021



Site 15 (Q18254), *Banksia aemula*, *Allocasuarina littoralis* low open woodland with shrub layer.



Site 15 species richness and the two recorded bushfires in 2009 and 2016.

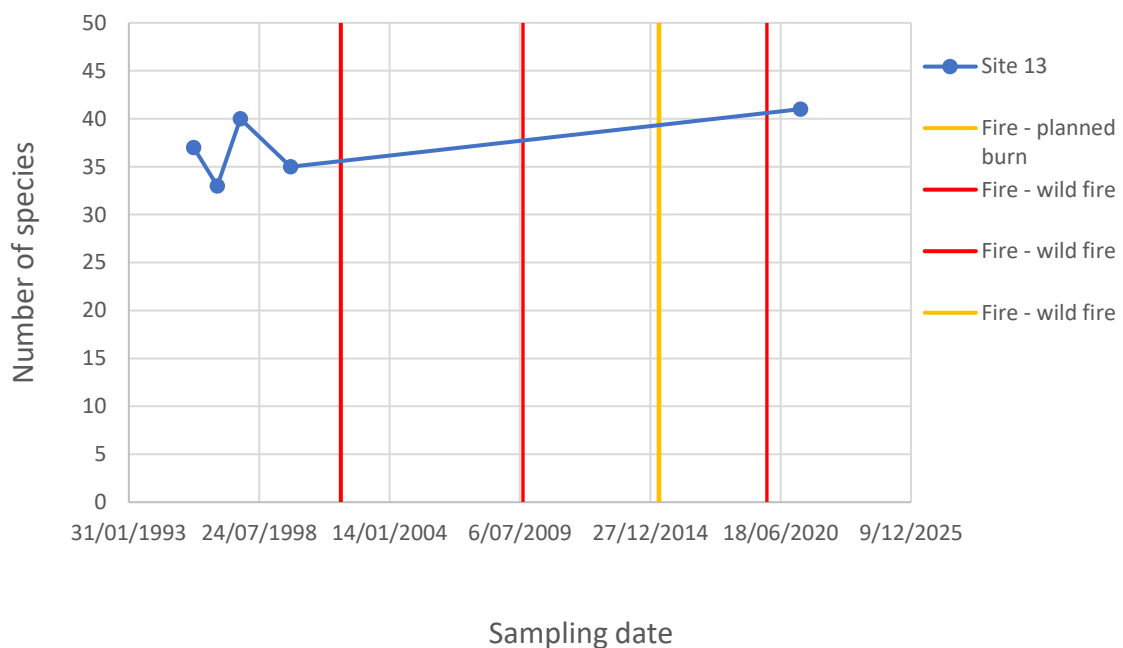
Regional Ecosystem 12.2.11: *Corymbia tessellaris* +/- *Eucalyptus tereticornis*, *C. intermedia* and *Livistona decora* woodland on beach ridges in northern half of bioregion.

Site 13: This site was unburnt by the 2020 bushfire. It was revisited, photographed and remeasured in 2021



Site 13 (Q18283), *Eucalyptus robusta*, *Melaleuca quinquenervia* with dense shrub layer of *Dodonaea viscosa* subsp. *burmanniana* and *Acacia flavescens*.

Site 13 Species richness through time



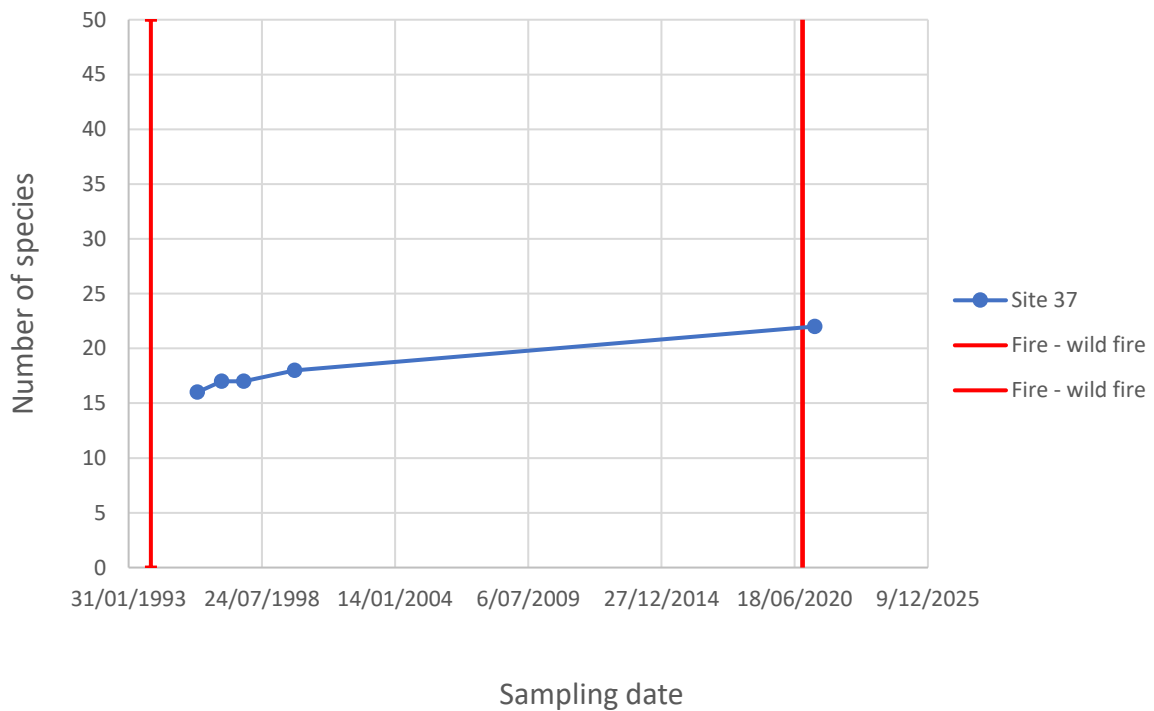
Site 13 species richness, three recorded bushfires (2001, 2009 and 2019) and one planned burn in 2015.

Site 37: Section of this site was burnt by the 2020 bushfire. It was revisited, photographed and remeasured in 2021



Site 37 (Q18281), *Corymbia intermedia*, *Eucalyptus tereticornis* woodland.

Site 37 Species richness through time



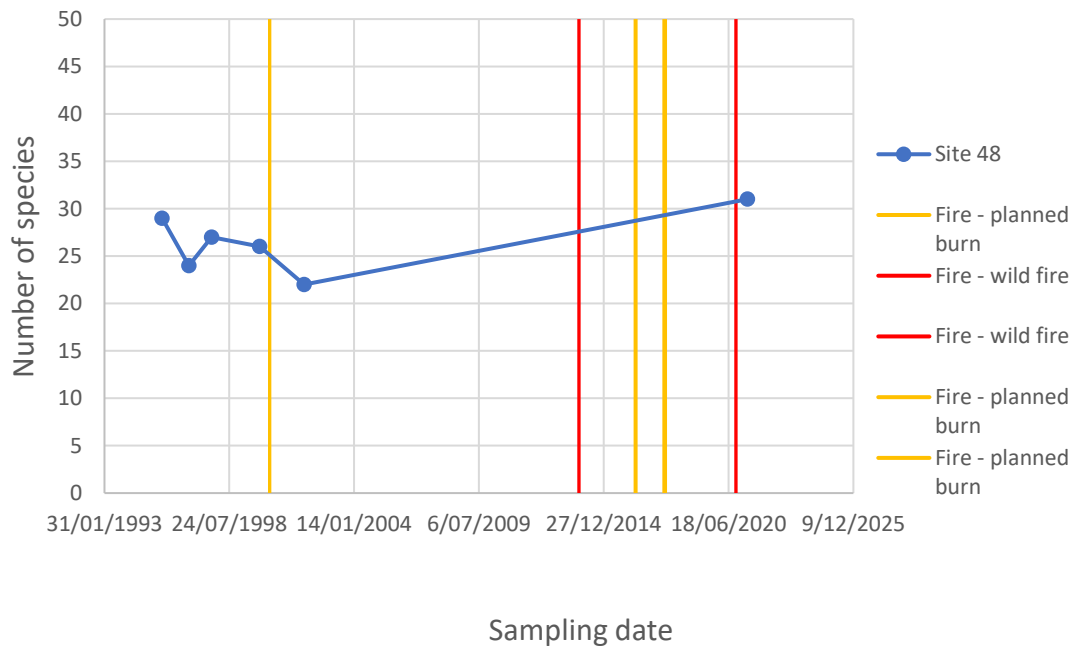
Site 37 showing species richness and two bushfires, one in 1994 and in 2020.

Site 48: This site was burnt by the 2020 bushfire. It was revisited, photographed and remeasured in 2021



Site 48R (Q18282), *Corymbia intermedia*, *C. tessellaris* open forest.

Site 48 Species richness through time



Site 48 showing species richness, five fire events since 2000. These are three planned burns and two bushfire.

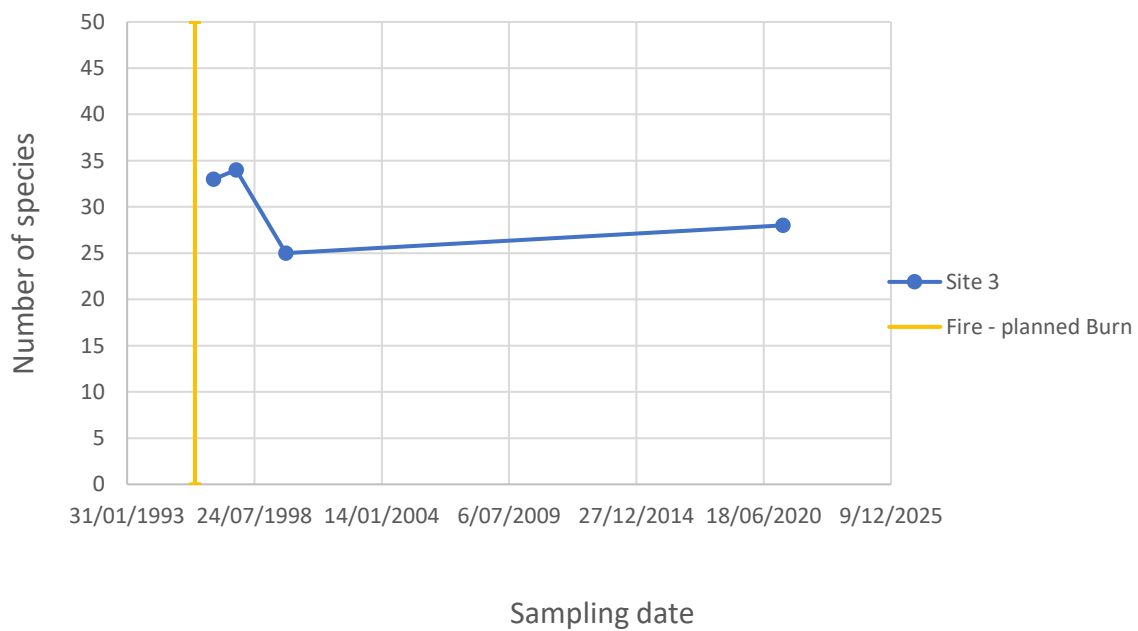
Regional Ecosystem 12.2.14: *Corymbia tessellaris*, *C. intermedia* with *Acacia leiocalyx*, *A. disparrima* low open forest.

Site 3: This site was unburnt by the 2020 bushfire. It was revisited, photographed and remeasured in 2021



Site 3 (Q18247), *Corymbia tessellaris*, *C. intermedia* with *Acacia leiocalyx*, *A. disparrima* low open forest.

Site 3 Species richness through time



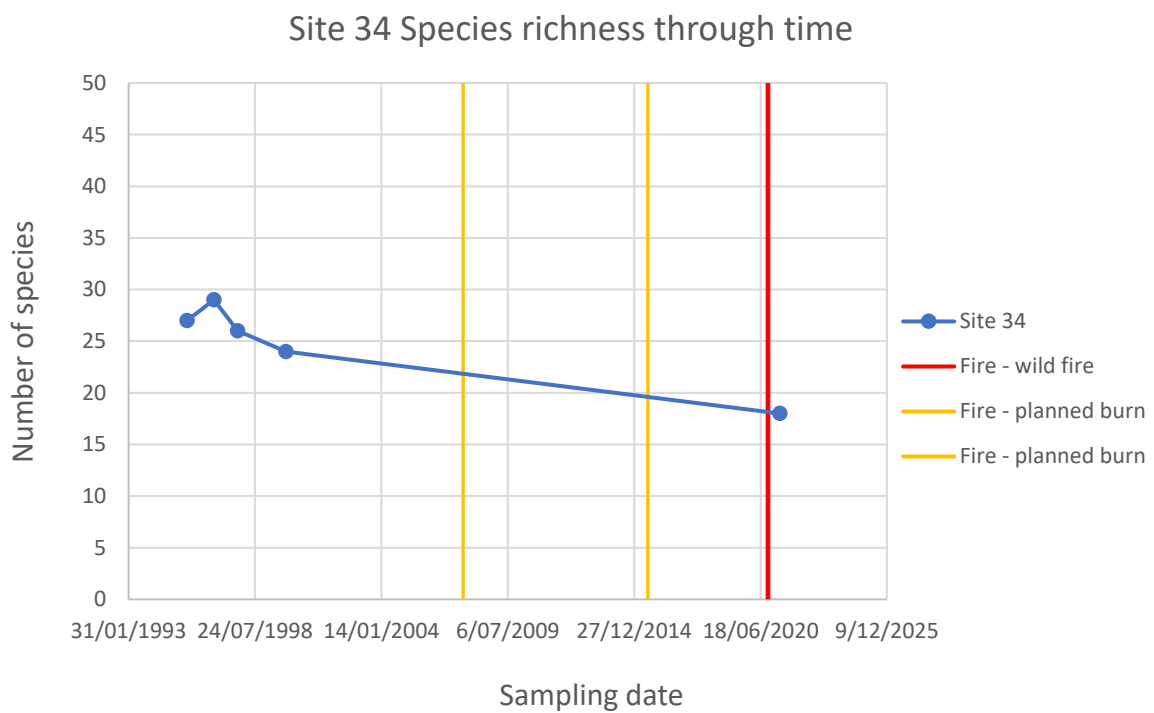
Site 3 species richness. Except for a planned burn in 1996, no fire has been recorded.

Regional Ecosystem 12.2.14a: *Casuarina equisetifolia* subsp. *incana* woodland to low open forest on exposed frontal areas.

Site 34: This site was burnt by the 2020 bushfire. It was revisited, photographed and remeasured in 2021



Site 34R (Q18289), burnt *Banksia integrifolia* low woodland.



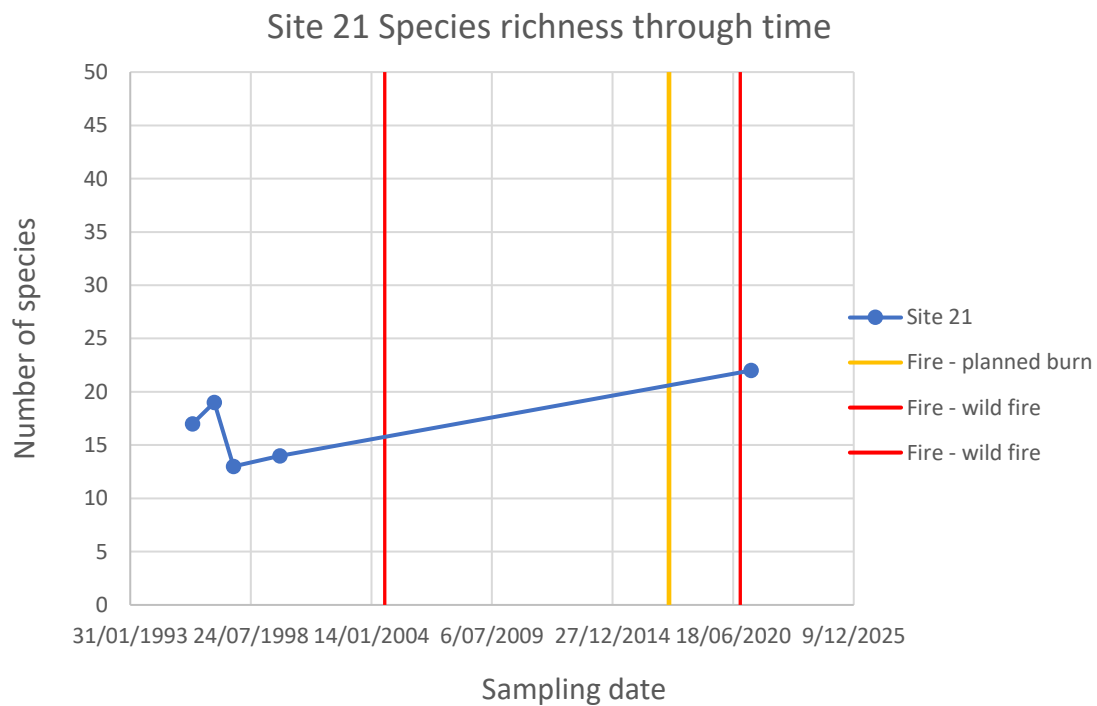
Site 34 showing species richness, two planned burns and a devastating bushfire in 2020.

Regional Ecosystem 12.2.15g: *Gahnia sieberiana*, *Empodisma minus*, *Gleichenia* spp. closed sedgeland in coastal swamps.

Site 21: This site was unburnt by the 2020 bushfire. It was revisited, photographed and remeasured in 2021



Site 21R (Q18290), Closed sedgeland with *Gahnia sieberiana*, *Leptospermum liversidgei* and *Banksia robur*.



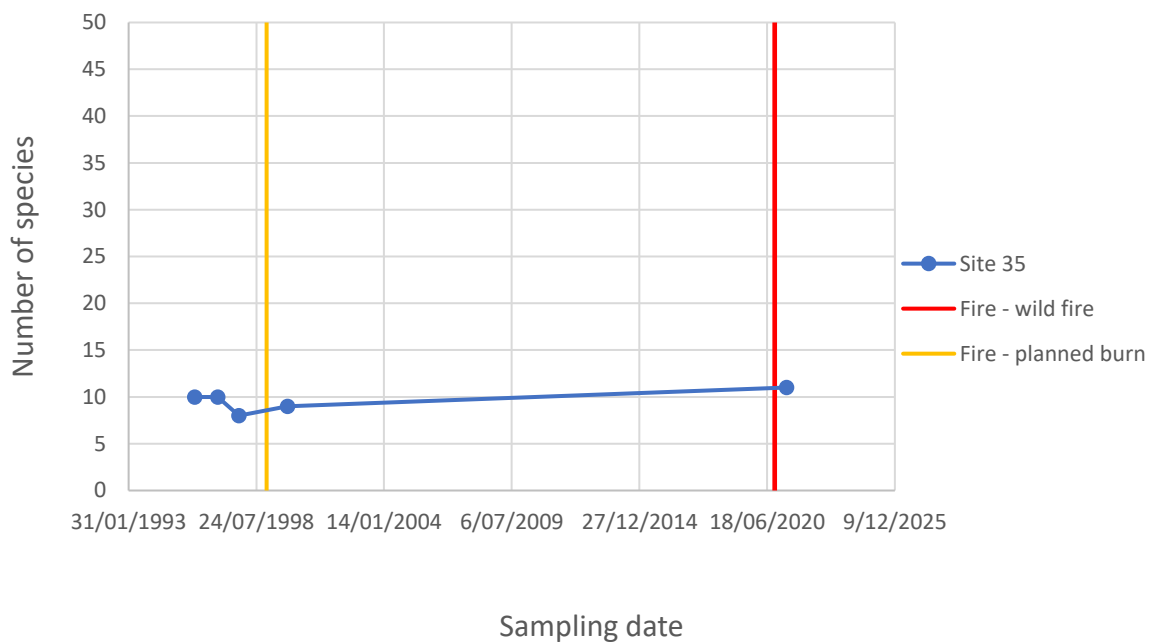
Site 21 species richness, one planned burn and two bushfire events

Site 35: This site was burnt by the 2020 bushfire. It was revisited, photographed and remeasured in 2021



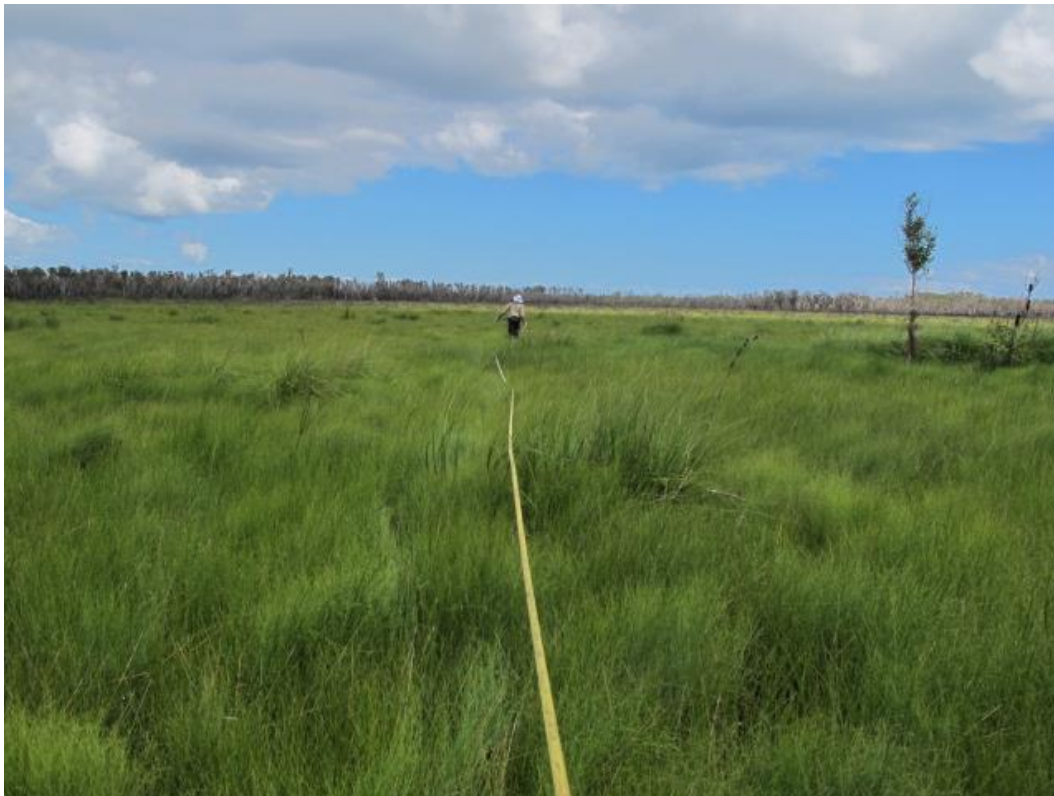
Site 35 (Q18291), *Empodisma minus*, *Gleichenia* spp. closed sedgeland.

Site 35 Species richness through time

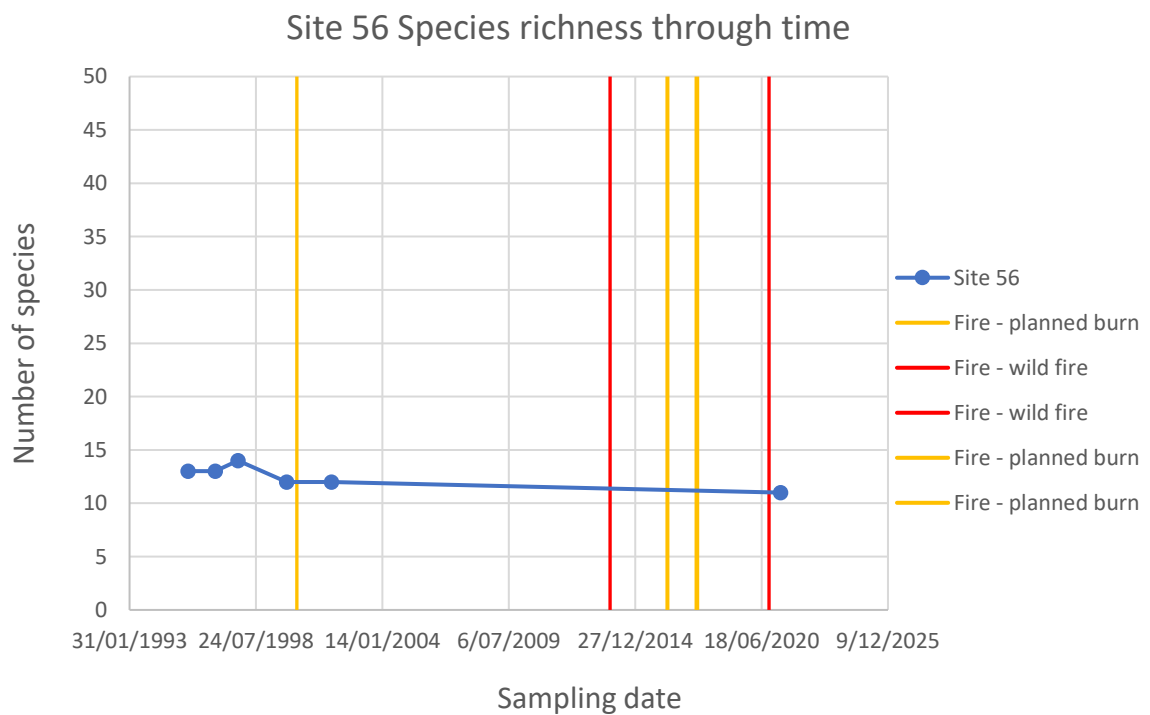


Site 35 species richness, one planned burn in 1999 and bushfire in 2020.

Site 56: This site was burnt by the 2020 bushfire. It was revisited, photographed and remeasured in 2021



Site 56 (Q18288), *Empodisma minus* closed sedgeland.



Site 56 showing species richness, three planned burns and two bushfires in the last 24 years.

Appendix 2: List of species observed in 1999 only and those observed in 2021 only in all sites within each Regional Ecosystem

RE	Sites	Species observed in 1999 only	Species observed in 2021 only
<p>12.2.5: <i>Corymbia intermedia</i> +/- <i>Lophostemon confertus</i> +/- <i>Banksia</i> spp. +/- <i>Callitris columellaris</i> open forest on beach ridges usually in southern half of bioregion</p>	38	<p><i>Eremochloa bimaclata</i> <i>Grevillea leiophylla</i> <i>Ischaemum australe</i> <i>Patersonia sericea</i> <i>Persoonia virgata</i> <i>Schizaea bifida</i> <i>Thysanotus tuberosus</i></p>	<p><i>Acacia disparrima</i> subsp. <i>disparrima</i> <i>Alloteropsis semialata</i> <i>Alphitonia excelsa</i> <i>Aotus ericoides</i> <i>Austromyrtus dulcis</i> <i>Geodorum densiflorum</i> <i>Hardenbergia violacea</i> <i>Imperata cylindrica</i> <i>Livistona decora</i> <i>Monotoca scoparia</i> <i>Paspalidium distans</i> <i>*Passiflora pallida</i> <i>Styphelia margarodes</i></p> <p><i>Xanthorrhoea latifolia</i></p>
<p>12.2.6: <i>Eucalyptus racemosa</i> subsp. <i>racemosa</i> open forest on dunes and sand plains. Usually deeply leached soils</p>	11, 22, 24, 33, 36, 42, 43, 47	<p><i>Acacia baueri</i> <i>Acacia quadrilateralis</i> <i>Acacia suaveolens</i> <i>Acacia ulicifolia</i> <i>Allocasuarina torulosa</i> <i>Astrotricha longifolia</i></p>	<p><i>Acacia flavescens</i> <i>Acacia leiocalyx</i> subsp. <i>leiocalyx</i> <i>Acmena smithii</i> <i>Acrotriche aggregata</i> <i>Alloteropsis semialata</i> <i>Angophora leiocarpa</i></p>

RE	Sites	Species observed in 1999 only	Species observed in 2021 only
		<i>Banksia integrifolia</i> subsp. <i>integrifolia</i>	<i>Aotus ericoides</i>
		<i>Boronia rosmarinifolia</i>	<i>Caustis flexuosa</i>
		<i>Bossiaea ensata</i>	<i>Chloanthes parviflora</i>
		<i>Bossiaea heterophylla</i>	<i>Coleocarya gracilis</i>
		<i>Brachyloma daphnoides</i>	<i>Cyperus scaber</i>
		<i>Brachyloma scortechinii</i>	<i>Cyperus stradbrokeensis</i>
		<i>Brachyloma scortechinii</i>	<i>Dianella caerulea</i>
		<i>Cassytha paniculata</i>	<i>Dillwynia glaberrima</i>
		<i>Cassytha pubescens</i>	<i>Dodonaea viscosa</i> subsp. <i>burmanniana</i>
		<i>Caustis blakei</i> subsp. <i>blakei</i>	<i>Drosera lunata</i>
		<i>Caustis recurvata</i>	<i>Elaeocarpus reticulatus</i>
		<i>Corymbia tessellaris</i>	<i>Endiandra sieberi</i>
		<i>Cymbidium suave</i>	<i>Eriachne pallescens</i> var. <i>pallescens</i>
		<i>Dillwynia retorta</i>	<i>Eucalyptus latisinensis</i>
		<i>Dodonaea triquetra</i>	<i>Eucalyptus racemosa</i>
		<i>Entolasia stricta</i>	<i>Eucalyptus tereticornis</i>
		<i>Glycine clandestina</i>	<i>Eustrephus latifolius</i>
		<i>Gompholobium pinnatum</i>	<i>Gompholobium virgatum</i>
		<i>Hibbertia acicularis</i>	<i>Hardenbergia violacea</i>
		<i>Hibbertia linearis</i>	<i>Imperata cylindrica</i>
		<i>Hibbertia linearis</i> var. <i>floribunda</i>	<i>Leptomeria acida</i>
		<i>Hibbertia scandens</i>	<i>Leptospermum amboinense</i>
		<i>Hibbertia vestita</i>	<i>Leptospermum polygalifolium</i>
		<i>Homoranthus virgatus</i>	<i>Lomandra laxa</i>

RE	Sites	Species observed in 1999 only	Species observed in 2021 only
		<i>Laxmannia gracilis</i> <i>Leichhardtia glandulifera</i> <i>Lepidosperma laterale</i> <i>Leptocarpus tenax</i> <i>Leucopogon affinis</i> <i>Lomandra obliqua</i> <i>Ochrosperma lineare</i> <i>Pandorea pandorana</i> <i>Paspalidium distans</i> <i>*Passiflora suberosa</i> <i>Patersonia glabrata</i> <i>Patersonia sericea</i> <i>Persoonia virgata</i> <i>Pimelea linifolia</i> <i>Pseudanthus orientalis</i> <i>Psychotria loniceroides</i> <i>Schizaea bifida</i> <i>Schizaea dichotoma</i> <i>Sporadanthus caudatus</i> <i>Styphelia deformis</i> <i>Styphelia leptospermoides</i> <i>Styphelia viridis</i> <i>Themeda triandra</i> <i>Woollsia pungens</i>	<i>Lomandra multiflora</i> subsp. <i>multiflora</i> <i>Monotoca</i> sp. (Fraser Island P.Baxter 777) <i>Phyllota phyllicoides</i> <i>Pomax umbellata</i> <i>Pteridium esculentum</i> <i>Schoenus ornithopodioides</i> <i>Schoenus sparteus</i> <i>Sprengelia sprengelioides</i> <i>Styphelia ericoides</i> <i>Syncarpia hillii</i> <i>Trachystylis stradbrokeensis</i> <i>Xanthorrhoea latifolia</i> <i>Xylomelum benthamii</i> <i>Zieria laxiflora</i>

RE	Sites	Species observed in 1999 only	Species observed in 2021 only
		<i>Xanthorrhoea johnsonii</i> <i>Xanthosia pilosa</i>	
12.2.7: <i>Melaleuca quinquenervia</i> or rarely <i>M. dealbata</i> open forest on sand plains	23	<i>Austromyrtus dulcis</i> <i>Banksia integrifolia</i> subsp. <i>integrifolia</i> <i>Centrolepis exserta</i> <i>Dianella caerulea</i> <i>Gahnia sieberiana</i> <i>Hakea</i> sp. <i>Hibbertia scandens</i> <i>Ischaemum fragile</i> <i>Lindsaea ensifolia</i> <i>Melastoma malabathricum</i> subsp. <i>malabathricum</i> <i>Myrsine variabilis</i> <i>Panicum effusum</i> var. <i>simile</i> <i>Schoenus brevifolius</i>	<i>Cassytha pubescens</i> <i>Centella asiatica</i> <i>Cheilanthes sieberi</i> <i>Cissus hypoglauca</i> <i>Cymbopogon refractus</i> <i>Desmodium rhytidophyllum</i> <i>Digitaria ciliaris</i> <i>Digitaria parviflora</i> <i>Eucalyptus tereticornis</i> <i>Geodorum densiflorum</i> <i>Glycine cyrtoloba</i> <i>Lobelia purpurascens</i> <i>Lomandra multiflora</i> subsp. <i>multiflora</i> <i>Ottochloa gracillima</i> <i>*Passiflora pallida</i> <i>*Passiflora suberosa</i> <i>Pteridium esculentum</i> <i>*Sonchus oleraceus</i>
12.2.8: <i>Eucalyptus pilularis</i> open forest on parabolic high dunes	18, 30, 32	<i>Bossiaea heterophylla</i> <i>Cymbidium suave</i> <i>Dodonaea triquetra</i>	<i>Acacia penninervis</i> var. <i>longiracemosa</i> <i>Astrotricha glabra</i> <i>Astrotricha longifolia</i>

RE	Sites	Species observed in 1999 only	Species observed in 2021 only
		<i>Elaeocarpus reticulatus</i> <i>Endiandra sieberi</i> <i>Eucalyptus resinifera</i> <i>Geitonoplesium cymosum</i> <i>Leucopogon affinis</i> <i>Lomandra confertifolia</i> <i>Lomandra filiformis subsp. filiformis</i> <i>Notelaea longifolia</i> <i>Paspalidium distans</i> <i>Persoonia virgata</i> <i>Schizaea dichotoma</i> <i>Smilax glyciophylla</i> <i>Syzygium johnsonii</i> <i>Themeda triandra</i> <i>Xanthorrhoea macronema</i> <i>Xylomelum pyriforme</i>	<i>Austromyrtus dulcis</i> <i>Banksia aemula</i> <i>Breynia oblongifolia</i> <i>Caustis flexuosa</i> <i>Dianella caerulea</i> <i>Digitaria parviflora</i> <i>Dodonaea viscosa subsp. burmanniana</i> <i>Eustrephus latifolius</i> <i>Goodenia rotundifolia</i> <i>Hardenbergia violacea</i> <i>Hibbertia linearis var. floribunda</i> <i>Hovea acutifolia</i> <i>Jagera pseudorhus</i> <i>Lomandra longifolia</i> <i>Lomandra multiflora subsp. multiflora</i> <i>Monotoca sp. (Fraser Island P.Baxter 777)</i> <i>Paspalidium gausum</i> <i>Phyllota phyllicoides</i> <i>Platysace lanceolata</i> <i>Pteridium esculentum</i>
12.2.9: <i>Banksia aemula</i> low open woodland on dunes and sand plains. Usually deeply leached soils	15	<i>Acacia baueri</i> <i>Brachyloma scortechinii</i> <i>Cassytha glabella</i> <i>Cassytha pubescens</i>	<i>Bossiaea heterophylla</i> <i>Cassytha filiformis</i> <i>Corunastylis conferta</i> <i>Corymbia intermedia</i>

RE	Sites	Species observed in 1999 only	Species observed in 2021 only
		<i>Gompholobium pinnatum</i> <i>Hibbertia acicularis</i> <i>Homoranthus virgatus</i> <i>Leptomeria acida</i> <i>Ochrosperma lineare</i> <i>Sporadanthus caudatus</i> <i>Styphelia viridis</i> <i>Woollsia pungens</i>	<i>Drosera lunata</i> <i>Hibbertia linearis</i> var. <i>floribunda</i> <i>Laxmannia gracilis</i> <i>Leucopogon pimeleoides</i> <i>Patersonia sericea</i> var. <i>sericea</i> <i>Schizaea bifida</i> <i>Schoenus ornithopodioides</i> <i>Stylidium graminifolium</i> <i>Xyris juncea</i>
12.2.11: <i>Corymbia tessellaris</i> +/- <i>Eucalyptus tereticornis</i> , <i>C. intermedia</i> and <i>Livistona decora</i> woodland on beach ridges in northern half of bioregion	13, 37, 48	<i>Baloskion tetraphyllum</i> <i>Banksia robur</i> <i>Cassytha pubescens</i> <i>Cymbopogon refractus</i> <i>Dodonaea triquetra</i> <i>Eriachne pallescens</i> var. <i>pallescens</i> <i>Eucalyptus umbra</i> <i>Gahnia sieberiana</i> <i>Lepidosperma laterale</i> <i>Leptospermum polygalifolium</i> <i>Leucopogon affinis</i> <i>Lomandra confertifolia</i> <i>Lomandra confertifolia</i> subsp. <i>pallida</i>	<i>Acacia disparrima</i> subsp. <i>disparrima</i> <i>Acacia penninervis</i> var. <i>longiracemosa</i> <i>Acmena smithii</i> <i>Alloteropsis semialata</i> <i>Alphitonia excelsa</i> <i>Alyxia ruscifolia</i> <i>Austromyrtus dulcis</i> <i>Banksia aemula</i> <i>Bossiaea heterophylla</i> <i>Callitris columellaris</i> <i>Commelina diffusa</i> <i>Corymbia intermedia</i> <i>Corymbia tessellaris</i>

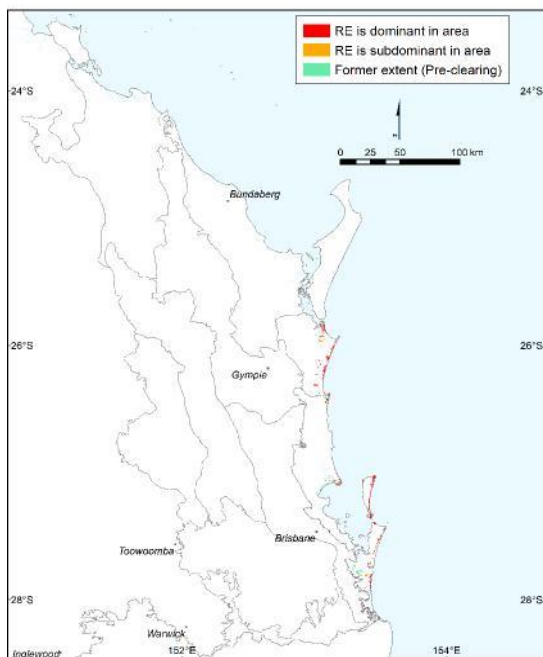
RE	Sites	Species observed in 1999 only	Species observed in 2021 only
		<i>Monotoca scoparia</i> <i>Notelaea longifolia</i> <i>Paspalidium distans</i> <i>Persoonia virgata</i> <i>Phebalium woombye</i> <i>Platysace lanceolata</i> <i>Poranthera microphylla</i> <i>Styphelia margarodes</i> <i>Telmatoblechnum indicum</i>	<i>Cyperus scaber</i> <i>Desmodium rhytidophyllum</i> <i>Dillwynia floribunda</i> <i>Eucalyptus latisinensis</i> <i>Eucalyptus tereticornis</i> <i>Hardenbergia violacea</i> <i>Hibbertia linearis var. floribunda</i> <i>Imperata cylindrica</i> <i>Leptospermum semibaccatum</i> <i>Lomandra laxa</i> <i>Lomandra longifolia</i> <i>Lomandra multiflora subsp. multiflora</i> <i>Melaleuca quinquenervia</i> <i>Monotoca sp. (Fraser Island P.Baxter 777)</i> <i>Paspalidium gausum</i> <i>*Passiflora pallida</i> <i>Pigea sp.</i> <i>Ricinocarpos pinifolius</i> <i>Schoenus ornithopodioides</i> <i>Smilax glycyphylla</i> <i>Xanthosia pilosa</i>
12.2.14: Fore dune complex comprising <i>Corymbia tessellaris</i> , <i>C. intermedia</i> with	3	<i>Banksia integrifolia subsp. integrifolia</i>	<i>Alyxia ruscifolia</i>

RE	Sites	Species observed in 1999 only	Species observed in 2021 only
<i>Acacia leiocalyx</i> , <i>A. disparrima</i> low open forest		<i>Banksia robur</i> <i>Brachyloma daphnoides</i> <i>Empodisma minus</i> <i>Entolasia stricta</i> <i>Gahnia sieberiana</i> <i>Gleichenia microphylla</i> <i>Hibbertia scandens</i> <i>Platysace linearifolia</i>	<i>Dianella caerulea</i> <i>Embelia australiana</i> <i>Imperata cylindrica</i> <i>Leucopogon pimeleoides</i> <i>Monotoca</i> sp. (Fraser Island P.Baxter 777) <i>Paspalidium distans</i> <i>Phebalium woombye</i> <i>Polyscias elegans</i> <i>Styphelia margarodes</i> <i>Zieria smithii</i>
12.2.14a: <i>Casuarina equisetifolia</i> subsp. <i>incana</i> woodland to low open forest on exposed frontal areas	34	<i>Canavalia rosea</i> <i>Carpobrotus glaucescens</i> <i>Cassytha filiformis</i> <i>Dianella congesta</i> <i>Dodonaea viscosa</i> subsp. <i>burmanniana</i> <i>Ficinia nodosa</i> <i>Lomandra longifolia</i> <i>Monotoca scoparia</i> <i>Myoporum acuminatum</i> <i>Oxalis corniculata</i> <i>Phebalium woombye</i> <i>*Richardia brasiliensis</i> <i>Themeda triandra</i> <i>Wollastonia biflora</i>	<i>Corymbia intermedia</i> <i>Cupaniopsis anacardioides</i> <i>Dianella caerulea</i> <i>Pandanus tectorius</i> <i>Polyscias elegans</i> <i>Solanum americanum</i> <i>Stephania japonica</i> var. <i>discolor</i> <i>Wikstroemia indica</i>

RE	Sites	Species observed in 1999 only	Species observed in 2021 only
12.2.15g: Swamps dominated by <i>Empodisma minus</i> , <i>Gahnia sieberiana</i> , other sedges, and forbs and shrubs such as <i>Leptospermum liversidgei</i>	21, 35, 56	<i>Comesperma defoliatum</i> <i>Epacris obtusifolia</i> <i>Epacris pulchella</i> <i>Gleichenia mendellii</i> <i>Lepidosperma laterale</i> <i>Leptospermum juniperinum</i> <i>Schoenus brevifolius</i> <i>Sporadanthus interruptus</i> <i>Stylidium tenerum</i> <i>Telmatoblechnum indicum</i>	<i>Baloskion pallens</i> <i>Baloskion tetraphyllum</i> <i>Boronia rivularis</i> <i>Boronia rosmarinifolia</i> <i>Bossiaea heterophylla</i> <i>Caustis flexuosa</i> <i>Cycnogeton procerus</i> <i>Dianella caerulea</i> <i>Dillwynia glaberrima</i> <i>Drosera binata</i> <i>Epacris microphylla</i> <i>Gonocarpus micranthus subsp. ramosissimus</i> <i>Schoenoplectus sp.</i> <i>Stylidium ornatum</i> <i>Thelionema caespitosum</i> <i>Utricularia sp.</i> <i>Xyris juncea</i>

Appendix 3: Technical Description of Regional Ecosystem

12.2.5: *Corymbia intermedia* +/- *Lophostemon confertus* +/- *Banksia* spp. +/- *Callitris columellaris* open forest on beach ridges usually in southern half of bioregion



Mapping data	Pre-clearing area = 15,845.2 ha; Remnant area 2019 = 10,759.1 ha; Remnant percent remaining in 2019 = 67.9 %
Species richness	total: 184 (22 sites); woody: 73 (22 sites); ground: 129 (18 sites); average spp./site: 26.1, standard deviation: 5.9 (18 sites)
Basal area	average/site: 18.8 m ² /ha; range: 9.0 - 33.0 m ² /ha; std. deviation: 6.7; (19 sites)
Ecological dominant layer (EDL) height	stratum: tree 1; average/site: 14.60m; range: 7.00 - 25.00m; (22 sites)
Ecological dominant layer (EDL) Crown Cover	stratum: tree 1; average: 64.2%; range: 15.0 - 97.0%; (22 sites)
Structural formation	Open Forest: 27.3 %; Woodland: 22.7 %; Closed Forest: 22.7 %; Low Open Forest: 9.1 %; Low Closed Forest: 9.1 %; Low Woodland: 4.5 %; Open Woodland: 4.5 %; (22 sites)
Representative site(s)	3977, 3994, 4372, 4374, 4458, 4466, 4467, 4468, 4487, 4507, 4508, 4510, 5673, 6649, 8025, 8364, 9162, 9493, 15869, 15949, 16338, 18074

Stratum: Tree 1 (EDL)

Height: average: 14.60m; range: 7.00 - 25.00m; (22 sites)

Crown Cover: average: 64.2%; range: 15.0 - 97.0%; (22 sites)

Stem Count: average: 840 stems/ha; range: 60 - 4,300 stems/ha; std. deviation: 1,077.5 stems/ha; (14 sites)

Basal area: average: 16.5 m²/ha; range: 7.0 - 33.0 m²/ha; std. deviation: 7.7 m²/ha; (19 sites)

Species list (frequency (%), average cover (%)):

Most frequent species (up to 6):

Corymbia intermedia (68.2, 19.9), *Lophostemon confertus* (63.6, 37.8), *Banksia aemula* (36.4, 9.6), *Callitris columellaris* (22.7, 17.0), *Banksia serrata* (18.2, 21.4), *Allocasuarina torulosa* (18.2, 11.8)

Additional species:

Banksia integrifolia (18.2, 4.3), *Melaleuca quinquenervia* (13.6, 38.0), *Corymbia gummifera* (13.6, 8.2), *Endiandra sieberi* (9.1, 7.5), *Persoonia stradbokensis* (9.1, 2.0), *Persoonia virgata* (9.1, 0.0), *Eucalyptus resinifera* (4.5, 51.0), *Acacia* (4.5, 50.4), *Eucalyptus tereticornis* (4.5, 25.0), *Acacia disparrima subsp. disparrima* (4.5, 5.0), *Eucalyptus racemosa subsp. racemosa* (4.5, 5.0), *Corymbia tessellaris* (4.5, 3.0), *Livistona australis* (4.5, 3.0), *Livistona decora* (4.5, 2.0), *Acronychia imperforata* (4.5, 0.0), *Elaeocarpus reticulatus* (4.5, 0.0), *Melastoma malabathricum subsp. malabathricum* (4.5, 0.0), *Monotoca sp. (Fraser Island P.Baxter 777)* (4.5, 0.0), *Syzygium oleosum* (4.5, 0.0)

Stratum: Tree 2

Height: average: 7.39m; range: 3.00 - 16.00m; (15 sites)

Crown Cover: average: 18.5%; range: 5.0 - 42.0%; (15 sites)

Stem Count: average: 267 stems/ha; range: 80 - 700 stems/ha; std. deviation: 241.2 stems/ha; (9 sites)

Basal area: average: 4.5 m²/ha; range: 2.0 - 9.0 m²/ha; std. deviation: 2.3 m²/ha; (8 sites)

Species list (frequency (%), average cover (%)):

Most frequent species (up to 6):

Lophostemon confertus (36.4, 7.4), *Corymbia intermedia* (31.8, 8.1), *Acacia leiocalyx subsp. leiocalyx* (27.3, 4.0), *Allocasuarina torulosa* (13.6, 9.0), *Monotoca scoparia* (13.6, 7.0), *Banksia integrifolia* (13.6, 5.0)

Additional species:

Callitris columellaris (13.6, 2.5), *Allocasuarina littoralis* (9.1, 6.0), *Acacia disparrima subsp. disparrima* (9.1, 5.0), *Endiandra sieberi* (9.1, 0.0), *Lophostemon suaveolens* (4.5, 25.0), *Banksia serrata* (4.5, 21.0), *Melaleuca quinquenervia* (4.5, 10.0), *Glochidion sumatranum* (4.5, 7.0), *Acacia flavescens* (4.5, 2.0), *Cissus hypoglauca* (4.5, 2.0), *Elaeocarpus reticulatus* (4.5, 2.0), *Petalostigma pubescens* (4.5, 1.0), *Alphitonia excelsa* (4.5, 0.5), *Eucalyptus resinifera* (4.5, 0.0)

Stratum: Shrub 1

Height: average: 2.37m; range: 0.90 - 4.80m; (21 sites)

Crown Cover: average: 20.3%; range: 0.0 - 62.0%; (21 sites)

Stem Count: average: 844 stems/ha; range: 20 - 3,200 stems/ha; std. deviation: 1,210.6 stems/ha; (10 sites)

Basal area: average: 4.0 m²/ha; range: 2.0 - 6.0 m²/ha; std. deviation: 2.8 m²/ha; (2 sites)

Species list (frequency (%), average cover (%)):

Most frequent species (up to 6):

Banksia integrifolia (27.3, 2.5), *Persoonia virgata* (27.3, 1.0), *Monotoca sp. (Fraser Island P.Baxter 777)* (22.7, 14.3), *Lantana camara* * (22.7, 2.3), *Banksia serrata* (22.7, 2.2), *Styphelia margarodes* (22.7, 2.0)

Additional species:

Acacia leiocalyx subsp. leiocalyx (22.7, 1.1), *Persoonia stradbokensis* (22.7, 0.5), *Acacia concurrens* (18.2, 21.7), *Monotoca scoparia* (18.2, 3.0), *Acacia disparrima subsp. disparrima* (13.6, 15.2), *Acacia ulicifolia* (13.6, 8.0), *Astrotricha glabra* (13.6, 5.5), *Alphitonia excelsa* (13.6, 2.8), *Banksia aemula* (13.6, 1.0), *Austromyrtus dulcis* (13.6, 0.7), *Leucopogon pimeleoides* (13.6, 0.5), *Lophostemon confertus* (9.1, 5.2), *Cupaniopsis anacardioides* (9.1, 2.8), *Allocasuarina littoralis* (9.1, 1.5), *Zieria smithii* (9.1, 0.5), *Aotus lanigera* (4.5, 30.0), *Acacia* (4.5, 24.0), *Cissus hypoglauca* (4.5, 20.0), *Dillwynia floribunda* (4.5, 20.0), *Dodonaea triquetra* (4.5, 15.0), *Leptospermum semibaccatum* (4.5, 15.0), *Acronychia imperforata* (4.5, 10.0), *Glochidion sumatranum* (4.5, 10.0), *Allocasuarina torulosa* (4.5, 5.0), *Melastoma malabathricum subsp. malabathricum* (4.5, 5.0), *Pultenaea villosa* (4.5, 5.0), *Acrotriche aggregata* (4.5, 2.0), *Elaeocarpus reticulatus* (4.5, 2.0), *Leptospermum trinervium* (4.5, 2.0), *Myrsine variabilis* (4.5, 2.0), *Petalostigma pubescens* (4.5, 2.0), *Smilax glycyphylla* (4.5, 2.0), *Exocarpos latifolius* (4.5, 1.0), *Ricinocarpos pinifolius* (4.5, 1.0), *Banksia oblongifolia* (4.5, 0.5), *Banksia robur* (4.5, 0.5), *Dodonaea viscosa subsp. burmanniana* (4.5, 0.5), *Endiandra sieberi* (4.5, 0.5), *Hibbertia linearis* (4.5, 0.5), *Parsonia straminea* (4.5, 0.5), *Duboisia myoporoides* (4.5, 0.0), *Heptapleurum actinophyllum* (4.5, 0.0), *Persoonia media* (4.5, 0.0), *Rhodomyrtus psidioides* (4.5, 0.0), *Styphelia leptospermoides* (4.5, 0.0), *Xanthorrhoea johnsonii* (4.5, 0.0), *Xylomelum salicinum* (4.5, 0.0)

Stratum: Shrub 2

Height: average: 0.72m; range: 0.50 - 1.20m; (11 sites)

Crown Cover: average: 9.5%; range: 2.0 - 25.0%; (11 sites)

Stem Count: No data available.

Basal area: No data available.

Species list (frequency (%), average cover (%)):

Most frequent species (up to 6):

Austromyrtus dulcis (31.8, 4.7), *Alphitonia excelsa* (13.6, 2.0), *Styphelia margarodes* (9.1, 5.5), *Dodonea triquetra* (9.1, 0.0), *Banksia robur* (4.5, 12.0), *Pultenaea villosa* (4.5, 10.0)

Additional species:

Zieria smithii (4.5, 8.0), *Leucopogon pimeleoides* (4.5, 6.0), *Monotoca scoparia* (4.5, 5.0), *Monotoca sp. (Fraser Island P.Baxter 777)* (4.5, 3.0), *Acacia ulicifolia* (4.5, 2.0), *Boronia rosmarinifolia* (4.5, 2.0), *Leptospermum trinervium* (4.5, 2.0), *Ochrosperma lineare* (4.5, 2.0), *Xylomelum salicinum* (4.5, 2.0), *Corymbia intermedia* (4.5, 1.0), *Platysace ericoides* (4.5, 1.0), *Banksia serrata* (4.5, 0.2), *Acacia leiocalyx subsp. leiocalyx* (4.5, 0.0), *Acacia suaveolens* (4.5, 0.0), *Hibbertia linearis* (4.5, 0.0), *Opuntia stricta** (4.5, 0.0), *Pultenaea paleacea* (4.5, 0.0), *Strangea linearis* (4.5, 0.0)

Stratum: Ground

Height: average: 0.68m; range: 0.30 - 1.50m; (18 sites)

Projective foliage cover (PFC): average: 34.0%; range: 4.0 - 70.0%; (18 sites)

Species list (frequency (%), average cover (%)):

Grass - perennial:

Most frequent species (up to 6):

Imperata cylindrica (83.3, 7.2), *Themeda triandra* (55.6, 6.1), *Cymbopogon refractus* (38.9, 4.8), *Eriachne pallescens* (33.3, 7.1), *Entolasia stricta* (27.8, 0.6), *Aristida calycina* (11.1, 0.0)

Additional species:

Eragrostis brownii (11.1, 0.0), *Eragrostis spartinoides* (11.1, 3.0), *Oplismenus aemulus* (11.1, 0.0), *Paspalidium gausum* (11.1, 1.0), *Aristida* (5.6, 2.0), *Capillipedium spicigerum* (5.6, 0.0), *Digitaria parviflora* (5.6, 0.0), *Leersia hexandra* (5.6, 0.0), *Panicum simile* (5.6, 0.0), *Paspalidium distans* (5.6, 0.0), *Sporobolus creber* (5.6, 0.0)

Grass - annual/biennial:

Not present

Forbs & other:

Most frequent species (up to 6):

Pteridium esculentum (88.9, 8.9), *Lomandra longifolia* (77.8, 2.4), *Dianella caerulea* (66.7, 0.9), *Smilax australis* (38.9, 3.5), *Desmodium rhytidophyllum* (27.8, 1.0), *Hibbertia scandens* (27.8, 1.9)

Additional species:

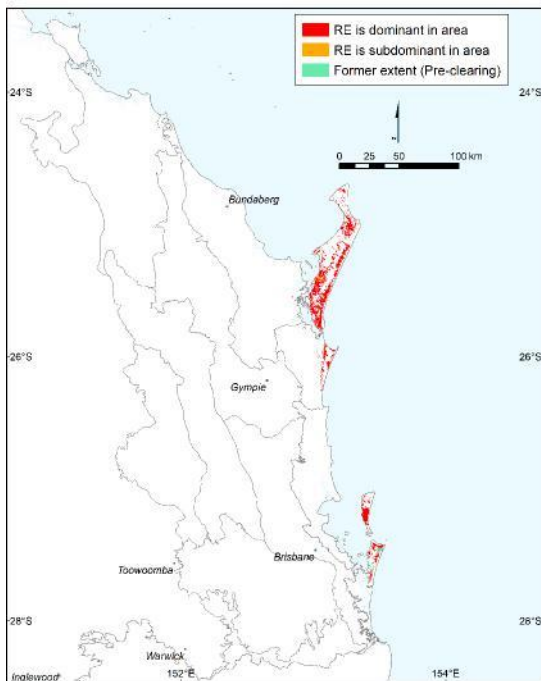
Lepidosperma laterale (27.8, 3.5), *Stephania japonica var. discolor* (27.8, 2.6), *Commelina diffusa* (22.2, 1.0), *Geodorum densiflorum* (22.2, 0.0), *Hardenbergia violacea* (16.7, 0.0), *Lomandra multiflora subsp. multiflora* (16.7, 2.2), *Lomatia silaifolia* (16.7, 5.0), *Passiflora suberosa** (16.7, 0.0), *Pomax umbellata* (16.7, 10.0), *Schizaea bifida* (16.7, 1.5), *Schoenus nitens* (16.7, 1.0), *Xanthorrhoea johnsonii* (16.7, 0.2), *Acacia disparima subsp. disparima* (11.1, 0.0), *Allocasuarina torulosa* (11.1, 0.0), *Alphitonia excelsa* (11.1, 0.0), *Austromyrtus dulcis* (11.1, 0.0), *Bossiaea heterophylla* (11.1, 0.0), *Brunoniella australis* (11.1, 0.0), *Cassytha glabella forma glabella* (11.1, 1.0), *Caustis blakei subsp. blakei* (11.1, 22.5), *Cissus hypoglauca* (11.1, 10.0), *Clematicissus opaca* (11.1, 0.0), *Cyperus stradbrokeensis* (11.1, 5.5), *Dianella crinoides* (11.1, 0.0), *Emilia sonchifolia** (11.1, 0.0), *Eustrephus latifolius* (11.1, 0.0), *Gahnia sieberiana* (11.1, 25.0), *Gleichenia mendellii* (11.1, 7.0), *Glycine clandestina* (11.1, 0.0), *Hibbertia linearis* (11.1, 0.0), *Lantana camara** (11.1, 0.0), *Leucopogon pimeleoides* (11.1, 1.0), *Lygodium microphyllum* (11.1, 6.0), *Machaerina rubiginosa* (11.1, 3.5), *Maundia triglochinos* (11.1, 6.0), *Monotoca scoparia* (11.1, 0.0), *Monotoca sp. (Fraser Island P.Baxter 777)* (11.1, 0.0), *Oxalis rubens* (11.1, 0.0), *Platysace ericoides* (11.1, 2.0), *Smilax glycyphylla* (11.1, 0.0), *Todea barbara* (11.1, 4.0), *Abrus precatorius* (5.6, 0.0), *Asparagus africanus** (5.6, 0.0), *Asteraceae* (5.6, 0.0), *Baloskion tetraphyllum subsp. meiostachyum* (5.6, 8.0), *Banksia integrifolia* (5.6, 0.0), *Banksia serrata* (5.6, 0.0), *Boronia rosmarinifolia* (5.6, 0.0), *Breyeria oblongifolia* (5.6, 0.0), *Calochlaena dubia* (5.6, 0.0), *Cassytha filiformis* (5.6, 0.0), *Cassytha pubescens* (5.6, 0.0), *Caustis recurvata* (5.6, 10.0), *Clerodendrum floribundum* (5.6, 0.0), *Coleus australis* (5.6, 0.0), *Corymbia intermedia* (5.6, 1.0), *Crassocephalum crepidioides** (5.6, 0.0), *Cyanthillium cinereum* (5.6, 0.0), *Cyperus* (5.6, 0.0), *Cyperus eglobosus* (5.6, 0.2), *Cyperus enervis* (5.6, 0.0), *Cyperus scaber* (5.6, 1.0), *Cyperus subulatus* (5.6, 0.0), *Cyperus trinervis* (5.6, 0.0), *Desmodium* (5.6, 0.0), *Desmodium gunnii* (5.6, 0.0), *Dianella revoluta* (5.6, 3.2), *Dipodium variegatum* (5.6, 0.0), *Dodonea viscosa subsp. burmanniana* (5.6, 0.0), *Eucalyptus racemosa subsp. racemosa* (5.6,

0.0), *Freycinetia excelsa* (5.6, 0.0), *Gahnia clarkei* (5.6, 10.0), *Geitonoplesium cymosum* (5.6, 0.0), *Gleichenia dicarpa* (5.6, 0.0), *Glochidion ferdinandi* var. *ferdinandi* (5.6, 0.0), *Glycine cyrtoloba* (5.6, 0.0), *Gompholobium pinnatum* (5.6, 0.0), *Heptapleurum actinophyllum* (5.6, 0.0), *Hibbertia stricta* (5.6, 0.0), *Hibbertia vestita* (5.6, 0.0), *Isolepis inundata* (5.6, 15.0), *Kennedia rubicunda* (5.6, 0.0), *Leptomeria acida* (5.6, 0.0), *Livistona australis* (5.6, 0.0), *Lomandra confertifolia* subsp. *pallida* (5.6, 0.0), *Lophostemon confertus* (5.6, 0.0), *Machaerina articulata* (5.6, 0.0), *Machaerina juncea* (5.6, 0.0), *Melaleuca salicina* (5.6, 0.0), *Patersonia glabrata* (5.6, 0.0), *Persoonia stradbokensis* (5.6, 0.0), *Persoonia virgata* (5.6, 0.0), *Petrophile shirleyae* (5.6, 0.0), *Poranthera microphylla* (5.6, 0.0), *Pterostylis nutans* (5.6, 0.0), *Rubus parvifolius* (5.6, 1.2), *Schoenoplectus** (5.6, 0.0), *Sticherus flabellatus* var. *flabellatus* (5.6, 6.0), *Strangea linearis* (5.6, 0.0), *Symphyotrichum subulatum** (5.6, 0.0), *Telmatoblechnum indicum* (5.6, 1.0), *Trachystylis stradbokensis* (5.6, 0.0), *Tricoryne elatior* (5.6, 1.0), *Trochocarpa laurina* (5.6, 0.0), *Vallisneria nana* (5.6, 0.0), *Zieria smithii* (5.6, 0.0)

Species list: Frequency (percent of total sites) and cover (average of species cover across sites where that species is present). Ordered by decreasing frequency. Naturalised species have an asterisk (*) after the name. indet. after listed name if indeterminate species or genus.

Technical Description Regional Ecosystem: 12.2.6

12.2.6: *Eucalyptus racemosa* subsp. *racemosa* open forest on dunes and sand plains. Usually deeply leached soils



Mapping data	Pre-clearing area = 73,538.5 ha; Remnant area 2019 = 69,359.5 ha; Remnant percent remaining in 2019 = 94.3 %
Species richness	total: 205 (53 sites); woody: 107 (53 sites); ground: 164 (49 sites); average spp./site: 30.0, standard deviation: 5.1 (49 sites)
Basal area	average/site: 19.3 m ² /ha; range: 7.0 - 36.0 m ² /ha; std. deviation: 6.4; (53 sites)
Ecological dominant layer (EDL) height	stratum: tree 1; average/site: 14.14m; range: 6.00 - 28.00m; (53 sites)
Ecological dominant layer (EDL) Crown Cover	stratum: tree 1; average: 54.7%; range: 3.4 - 93.0%; (53 sites)
Structural formation	Open Forest: 39.6 %; Woodland: 32.1 %; Closed Forest: 9.4 %; Low Woodland: 7.5 %; Low Open Forest: 5.7 %; Open Woodland: 3.8 %; Low Open Woodland: 1.9 %; (53 sites)
Representative site(s)	3983, 3985, 3986, 3987, 3991, 4367, 4375, 4469, 4470, 4471, 4509, 5813, 9159, 9165, 9166, 9168, 9169, 9170, 9172, 9173, 9174, 9178, 9179, 9204, 9205, 9491, 9496, 9497, 9498, 9499, 10142, 10144, 10145, 10146, 10147, 11602, 12064, 14123, 14128, 14554, 15556, 16088, 16327, 16330, 17470, 17874, 17927, 17929, 17982, 18249, 18252, 18261, 18285

Stratum: Tree 1 (EDL)

Height: average: 14.14m; range: 6.00 - 28.00m; (53 sites)

Crown Cover: average: 54.7%; range: 3.4 - 93.0%; (53 sites)

Stem Count: average: 312 stems/ha; range: 40 - 1,200 stems/ha; std. deviation: 255.7 stems/ha; (48 sites)

Basal area: average: 13.2 m²/ha; range: 2.0 - 26.0 m²/ha; std. deviation: 6.1 m²/ha; (53 sites)

Species list (frequency (%), average cover (%)):

Most frequent species (up to 6):

Eucalyptus racemosa subsp. *racemosa* (98.1, 36.8), *Corymbia intermedia* (54.7, 10.4), *Angophora leiocarpa* (26.4, 8.4), *Corymbia gummifera* (24.5, 13.0), *Eucalyptus pilularis* (20.8, 12.5), *Allocasuarina torulosa* (17.0, 10.2)

Additional species:

Lophostemon confertus (17.0, 9.2), *Banksia aemula* (13.2, 15.2), *Eucalyptus planchoniana* (7.5, 28.0), *Persoonia virgata* (5.7, 0.0), *Banksia serrata* (3.8, 9.6), *Allocasuarina littoralis* (3.8, 7.0), *Syncarpia hillii* (1.9, 24.0), *Eucalyptus latisinensis* (1.9, 15.0), *Banksia integrifolia* (1.9, 6.0), *Eucalyptus robusta* (1.9, 3.0), *Alphitonia excelsa* (1.9, 2.0), *Acacia concurrens* (1.9, 0.0), *Elaeocarpus reticulatus* (1.9, 0.0), *Eucalyptus tereticomis* (1.9, 0.0)

Stratum: Tree 2

Height: average: 7.45m; range: 4.00 - 14.00m; (51 sites)

Crown Cover: average: 21.2%; range: 3.0 - 70.0%; (51 sites)

Stem Count: average: 654 stems/ha; range: 40 - 2,500 stems/ha; std. deviation: 612.7 stems/ha; (42 sites)

Basal area: average: 5.7 m²/ha; range: 1.0 - 16.0 m²/ha; std. deviation: 4.1 m²/ha; (47 sites)

Species list (frequency (%), average cover (%)):

Most frequent species (up to 6):

Banksia aemula (66.0, 11.1), *Corymbia intermedia* (35.8, 9.5), *Lophostemon confertus* (28.3, 8.7), *Allocasuarina torulosa* (28.3, 6.2), *Leptospermum trinervium* (26.4, 5.5), *Banksia serrata* (20.8, 8.2)

Additional species:

Eucalyptus racemosa subsp. *racemosa* (18.9, 4.0), *Angophora leiocarpa* (15.1, 3.1), *Monotoca* sp. (*Fraser Island P.Baxter 777*) (13.2, 10.0), *Elaeocarpus reticulatus* (11.3, 5.8), *Endiandra sieberi* (9.4, 11.0), *Corymbia gummifera* (9.4, 10.3), *Allocasuarina littoralis* (9.4, 7.5), *Banksia integrifolia* (9.4, 1.8), *Acacia flavescens* (3.8, 20.0), *Ricinocarpos pinifolius* (3.8, 5.8), *Acacia leiocalyx* subsp. *leiocalyx* (3.8, 2.5), *Alphitonia excelsa* (3.8, 0.0), *Eucalyptus pilularis* (3.8, 0.0), *Monotoca scoparia* (1.9, 15.0), *Persoonia stradbrogensis* (1.9, 9.0), *Leptospermum polygalifolium* (1.9, 4.0), *Leucopogon pimeleoides* (1.9, 3.0), *Melaleuca nodosa* (1.9, 3.0), *Acacia disparrima* subsp. *disparrima* (1.9, 2.0), *Acacia concurrens* (1.9, 0.0), *Acacia longifolia* (1.9, 0.0), *Acacia penninervis* var. *longiracemosa* (1.9, 0.0), *Acacia suaveolens* (1.9, 0.0), *Acacia ulicifolia* (1.9, 0.0), *Acrotriche aggregata* (1.9, 0.0), *Callitris columellaris* (1.9, 0.0), *Glochidion ferdinandi* var. *ferdinandi* (1.9, 0.0)

Stratum: Tree 3

Height: average: 4.25m; range: 3.00 - 5.50m; (2 sites)

Crown Cover: average: 23.6%; range: 0.0 - 47.2%; (2 sites)

Stem Count: average: 4,860 stems/ha; range: 120 - 9,600 stems/ha; std. deviation: 6,703.4 stems/ha; (2 sites)

Basal area: average: 1.0 m²/ha; range: 1.0 - 1.0 m²/ha; std. deviation: 0.0 m²/ha; (2 sites)

Species list (frequency (%), average cover (%)):

Most frequent species (up to 6):

Allocasuarina littoralis (3.8, 12.6), *Ricinocarpos pinifolius* (1.9, 23.4), *Acrotriche aggregata* (1.9, 7.6), *Endiandra sieberi* (1.9, 2.8), *Leptospermum trinervium* (1.9, 2.8), *Elaeocarpus reticulatus* (1.9, 1.6)

Additional species:

Acacia flavescens (1.9, 0.2), *Acmena smithii* (1.9, 0.2), *Parsonia straminea* (1.9, 0.2), *Persoonia virgata* (1.9, 0.2), *Lophostemon confertus* (1.9, 0.0), *Monotoca scoparia* (1.9, 0.0)

Stratum: Shrub 1

Height: average: 2.17m; range: 1.00 - 4.30m; (52 sites)

Crown Cover: average: 28.2%; range: 0.0 - 80.0%; (52 sites)

Stem Count: average: 1,871 stems/ha; range: 100 - 10,600 stems/ha; std. deviation: 1,944.8 stems/ha; (44 sites)

Basal area: average: 2.5 m²/ha; range: 0.5 - 7.0 m²/ha; std. deviation: 2.2 m²/ha; (23 sites)

Species list (frequency (%), average cover (%)):

Most frequent species (up to 6):

Monotoca sp. (*Fraser Island P.Baxter 777*) (64.2, 15.6), *Persoonia virgata* (54.7, 4.3), *Banksia aemula* (47.2, 7.8), *Styphelia margarodes* (41.5, 5.2), *Leptospermum trinervium* (39.6, 10.0), *Xanthorrhoea johnsonii* (35.8, 16.4)

Additional species: *Leucopogon pimeleoides* (32.1, 4.0), *Persoonia stradbokensis* (22.6, 5.9), *Leptomeria acida* (20.8, 2.0), *Allocasuarina torulosa* (20.8, 1.5), *Styphelia viridis* (17.0, 0.0), *Elaeocarpus reticulatus* (15.1, 6.9), *Banksia integrifolia* (15.1, 4.6), *Leptospermum polygalifolium* (13.2, 6.2), *Lophostemon confertus* (11.3, 4.0), *Monotoca scoparia* (11.3, 4.0), *Banksia serrata* (11.3, 2.4), *Acacia leiocalyx subsp. leiocalyx* (11.3, 1.0), *Acacia ulicifolia* (11.3, 0.5), *Ricinocarpus pinifolius* (9.4, 10.6), *Woolisia pungens* (9.4, 6.3), *Lomatia silaifolia* (9.4, 1.0), *Dillwynia retorta* (9.4, 0.0), *Eucalyptus racemosa subsp. racemosa* (9.4, 0.0), *Gompholobium virgatum* (7.5, 2.5), *Homoranthus virgatus* (7.5, 2.0), *Strangea linearis* (7.5, 0.8), *Corymbia gummifera* (7.5, 0.0), *Corymbia intermedia* (7.5, 0.0), *Styphelia ericoides* (7.5, 0.0), *Acrotriche aggregata* (5.7, 6.7), *Endiandra sieberi* (5.7, 3.3), *Boronia rosmarinifolia* (5.7, 1.5), *Phebalium woombye* (3.8, 9.2), *Banksia oblongifolia* (3.8, 6.0), *Dillwynia floribunda* (3.8, 5.0), *Petrophile shirleyae* (3.8, 5.0), *Epacris pulchella* (3.8, 4.0), *Agiortia pedicellata* (3.8, 3.5), *Allocasuarina littoralis* (3.8, 2.0), *Aotus ericoides* (3.8, 1.2), *Duboisia myoporoides* (3.8, 1.0), *Petrophile canescens* (3.8, 1.0), *Astrotricha glabra* (3.8, 0.8), *Acacia suaveolens* (3.8, 0.5), *Pimelea linifolia subsp. linifolia* (3.8, 0.5), *Austromyrtus dulcis* (3.8, 0.2), *Angophora leiocarpa* (3.8, 0.0), *Bossiaea heterophylla* (3.8, 0.0), *Daviesia umbellulata* (3.8, 0.0), *Leptospermum semibaccatum* (3.8, 0.0), *Phyllota phyllicoides* (3.8, 0.0), *Styphelia leptospermoides* (3.8, 0.0), *Xylomelum salicinum* (3.8, 0.0), *Leucopogon* (1.9, 20.0), *Podocarpus spinulosus* (1.9, 6.0), *Epacris microphylla* (1.9, 5.0), *Lophostemon suaveolens* (1.9, 4.0), *Ochrosperma lineare* (1.9, 3.0), *Acacia disparima subsp. disparima* (1.9, 2.0), *Baeckea frutescens* (1.9, 2.0), *Pultenaea villosa* (1.9, 2.0), *Acacia flavescens* (1.9, 1.0), *Dodonaea triquetra* (1.9, 1.0), *Exocarpos cupressiformis* (1.9, 0.5), *Persoonia cornifolia* (1.9, 0.5), *Cassutha filiformis* (1.9, 0.2), *Hakea benthamii* (1.9, 0.2), *Brachyloma scortechinii* (1.9, 0.0), *Callitris rhomboidea* (1.9, 0.0), *Eustrephus latifolius* (1.9, 0.0), *Hibbertia linearis* (1.9, 0.0), *Jacksonia scoparia* (1.9, 0.0), *Pomax umbellata* (1.9, 0.0), *Xanthorrhoea latifolia subsp. latifolia* (1.9, 0.0), *Xanthosia pilosa* (1.9, 0.0), *Zieria laxiflora* (1.9, 0.0)

Stratum: Shrub 2

Height: average: 0.50m; range: 0.50 - 0.60m; (39 sites)

Crown Cover: average: 21.9%; range: 4.0 - 50.0%; (39 sites)

Stem Count: average: 200 stems/ha; range: 200 - 200 stems/ha; std. deviation: 0.0 stems/ha; (2 sites)

Basal area: No data available.

Species list (frequency (%), average cover (%)):

Most frequent species (up to 6):

Xanthorrhoea johnsonii (52.8, 11.7), *Austromyrtus dulcis* (34.0, 5.6), *Styphelia leptospermoides* (30.2, 2.6), *Boronia rosmarinifolia* (28.3, 2.6), *Woolisia pungens* (26.4, 2.2), *Monotoca scoparia* (20.8, 8.2)

Additional species:

Hibbertia linearis (20.8, 1.8), *Monotoca sp. (Fraser Island P.Baxter 777)* (18.9, 1.3), *Hibbertia vestita* (17.0, 3.6), *Banksia aemula* (17.0, 1.6), *Platysace ericoides* (17.0, 0.9), *Strangea linearis* (15.1, 4.1), *Styphelia margarodes* (13.2, 2.1), *Persoonia virgata* (13.2, 1.1), *Leptospermum trinervium* (11.3, 2.0), *Bossiaea heterophylla* (9.4, 2.1), *Acacia ulicifolia* (7.5, 2.3), *Bossiaea ensata* (7.5, 1.5), *Leucopogon pimeleoides* (7.5, 1.5), *Hibbertia acicularis* (7.5, 1.0), *Epacris pulchella* (7.5, 0.9), *Brachyloma daphnoides* (5.7, 3.3), *Leucopogon virgatus* (5.7, 3.0), *Styphelia ericoides* (5.7, 2.7), *Leptospermum semibaccatum* (3.8, 6.5), *Melichrus procumbens* (3.8, 3.5), *Petrophile canescens* (3.8, 2.0), *Lomatia silaifolia* (3.8, 1.5), *Aotus lanigera* (3.8, 1.0), *Elaeocarpus reticulatus* (3.8, 1.0), *Gompholobium virgatum* (3.8, 1.0), *Homoranthus virgatus* (3.8, 1.0), *Persoonia stradbokensis* (3.8, 1.0), *Pimelea linifolia subsp. linifolia* (3.8, 1.0), *Styphelia viridis* (3.8, 1.0), *Banksia serrata* (3.8, 0.6), *Ochrosperma lineare* (3.8, 0.6), *Styphelia deformis* (1.9, 7.0), *Xanthorrhoea fulva* (1.9, 4.0), *Banksia integrifolia* (1.9, 2.0), *Leptospermum polygalifolium* (1.9, 2.0), *Xanthorrhoea latifolia subsp. latifolia* (1.9, 2.0), *Angophora leiocarpa* (1.9, 1.0), *Banksia oblongifolia* (1.9, 1.0), *Comesperma retusum* (1.9, 1.0), *Jacksonia scoparia* (1.9, 1.0), *Leptomeria acida* (1.9, 1.0), *Pseudanthus orientalis* (1.9, 1.0), *Eucalyptus racemosa subsp. racemosa* (1.9, 0.8), *Corymbia intermedia* (1.9, 0.2), *Cassutha filiformis* (1.9, 0.0), *Desmodium rhytidophyllum* (1.9, 0.0), *Petrophile shirleyae* (1.9, 0.0), *Tetratheca thymifolia* (1.9, 0.0), *Xanthosia pilosa* (1.9, 0.0)

Stratum: Ground

Height: average: 0.56m; range: 0.10 - 1.00m; (49 sites)

Projective foliage cover (PFC): average: 27.2%; range: 1.0 - 76.0%; (49 sites)

Species list (frequency (%), average cover (%)):

Grass - perennial:

Most frequent species (up to 6):

Themeda triandra (59.2, 3.1), *Imperata cylindrica* (44.9, 7.0), *Eriachne pallescens* (36.7, 5.2), *Entolasia stricta* (18.4, 2.3), *Aristida jerichoensis var. jerichoensis* (10.2, 1.0), *Eriachne pallescens var. pallescens* (8.2, 4.0)

Additional species:

Cymbopogon refractus (6.1, 2.0), *Aristida calycina* (4.1, 1.0), *Panicum simile* (4.1, 0.0), *Alloteropsis semialata* (2.0, 0.2), *Aristida holathera var. holathera* (2.0, 0.0), *Entolasia whiteana* (2.0, 2.0), *Paspalidium breviflorum* (2.0, 0.2)

Grass - annual/biennial:

Not present

Forbs & other:

Most frequent species (up to 6):

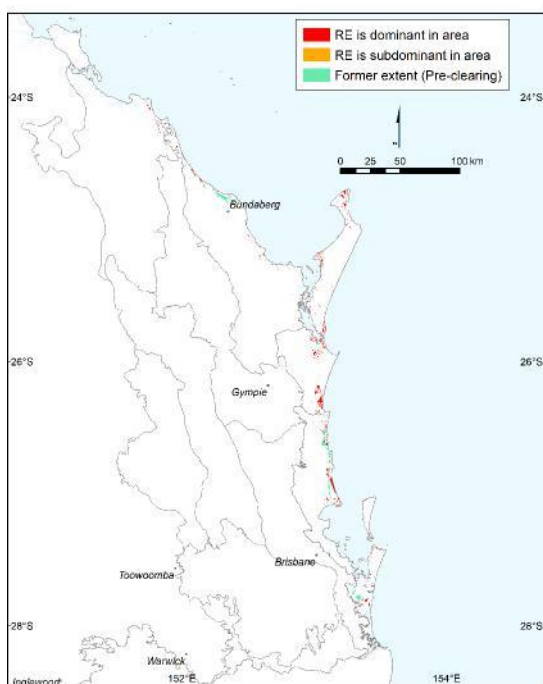
Pteridium esculentum (77.6, 9.7), *Lomandra longifolia* (59.2, 3.0), *Lomandra multiflora* subsp. *multiflora* (53.1, 1.3), *Dianella caerulea* (40.8, 1.2), *Caustis recurvata* (34.7, 4.2), *Baloskion tetraphyllum* subsp. *meiostachyum* (30.6, 7.6)

Additional species:

Acacia ulicifolia (28.6, 0.0), *Bossiaea heterophylla* (28.6, 1.0), *Platysace ericoides* (28.6, 1.0), *Schizaea bifida* (28.6, 0.7), *Gompholobium virgatum* (26.5, 0.0), *Hibbertia linearis* (26.5, 0.0), *Lepidosperma laterale* (24.5, 1.6), *Patersonia glabrata* (22.4, 0.9), *Hardenbergia violacea* (20.4, 0.8), *Leucopogon pimeleoides* (20.4, 0.0), *Styphelia leptospermoides* (20.4, 0.0), *Xanthosia pilosa* (20.4, 0.7), *Coleocarya gracilis* (18.4, 14.1), *Pimelea linifolia* subsp. *linifolia* (18.4, 0.0), *Austromyrtus dulcis* (16.3, 0.0), *Boronia rosmarinifolia* (16.3, 3.0), *Ricinocarpos pinifolius* (14.3, 5.7), *Smilax glycyphylla* (14.3, 4.0), *Strangea linearis* (14.3, 0.0), *Styphelia margarodes* (14.3, 1.1), *Xanthorrhoea johnsonii* (14.3, 14.0), *Aotus lanigera* (12.2, 0.0), *Cassytha filiformis* (12.2, 0.0), *Caustis blakei* subsp. *blakei* (12.2, 25.8), *Dianella crinoides* (12.2, 1.0), *Hibbertia vestita* (12.2, 1.0), *Monotoca scoparia* (12.2, 1.0), *Parsonia straminea* (12.2, 0.2), *Patersonia sericea* (12.2, 1.0), *Persoonia virgata* (12.2, 0.7), *Phyllota phyllicoides* (12.2, 0.0), *Pomax umbellata* (12.2, 5.0), *Pseudanthus orientalis* (12.2, 1.0), *Styphelia viridis* (12.2, 0.0), *Acacia suaveolens* (10.2, 0.0), *Laxmannia gracilis* (10.2, 1.0), *Monotoca* sp. (*Fraser Island P.Baxter 777*) (10.2, 0.0), *Styphelia ericoides* (10.2, 0.0), *Tricoryne anceps* subsp. *pteroaulon* (10.2, 1.0), *Cassytha glabella* forma *glabella* (8.2, 2.0), *Dianella revoluta* (8.2, 1.4), *Epacris pulchella* (8.2, 0.0), *Hibbertia acicularis* (8.2, 0.0), *Hypolaena fastigiata* (8.2, 5.5), *Lomatia silaifolia* (8.2, 1.6), *Ochrosperma lineare* (8.2, 0.0), *Petrophile canescens* (8.2, 0.0), *Schizaea dichotoma* (8.2, 0.2), *Trachystylis stradbrokeensis* (8.2, 0.0), *Brachyloma daphnoides* (6.1, 0.0), *Cassytha pubescens* (6.1, 0.0), *Clematicissus opaca* (6.1, 0.4), *Dampiera sylvestris* (6.1, 1.0), *Elaeocarpus reticulatus* (6.1, 0.0), *Gompholobium pinnatum* (6.1, 0.0), *Leptomeria acida* (6.1, 0.0), *Lomandra confertifolia* subsp. *pallida* (6.1, 2.0), *Persoonia stradbrokeensis* (6.1, 0.0), *Smilax australis* (6.1, 1.8), *Zieria laxiflora* (6.1, 0.0), *Acrotriche aggregata* (4.1, 0.0), *Agiortia pedicellata* (4.1, 0.0), *Astrotricha longifolia* (4.1, 0.0), *Bossiaea ensata* (4.1, 0.0), *Hibbertia scandens* (4.1, 0.0), *Homoranthus virgatus* (4.1, 0.0), *Jacksonia scoparia* (4.1, 0.0), *Leptospermum polygalifolium* (4.1, 0.0), *Lomandra filiformis* subsp. *filiformis* (4.1, 2.0), *Lomandra laxa* (4.1, 0.6), *Melichrus procumbens* (4.1, 0.0), *Olax retusa* (4.1, 0.0), *Podolepis neglecta* (4.1, 1.0), *Schoenus brevifolius* (4.1, 38.0), *Woolisia pungens* (4.1, 0.0), *Acacia disparrima* subsp. *disparrima* (2.0, 0.0), *Acacia flavescens* (2.0, 0.0), *Acacia hubbardiana* (2.0, 1.0), *Acacia leiocalyx* subsp. *leiocalyx* (2.0, 0.0), *Acianthus** (2.0, 0.2), *Allocasuarina littoralis* (2.0, 0.2), *Allocasuarina torulosa* (2.0, 5.0), *Aotus ericoides* (2.0, 0.0), *Baccharis halimifolia** (2.0, 0.0), *Banksia aemula* (2.0, 0.0), *Banksia integrifolia* (2.0, 0.0), *Banksia oblongifolia* (2.0, 0.0), *Banksia serrata* (2.0, 0.0), *Bidens pilosa** (2.0, 0.0), *Brunonia australis* (2.0, 0.0), *Calochlaena dubia* (2.0, 1.0), *Caustis flexuosa* (2.0, 1.0), *Cissus hypoglauca* (2.0, 2.0), *Clerodendrum tomentosum* (2.0, 0.0), *Corymbia intermedia* (2.0, 1.0), *Cyperus scaber* (2.0, 0.0), *Cyperus stradbrokeensis* (2.0, 0.0), *Daviesia umbellulata* (2.0, 0.0), *Desmodium rhytidophyllum* (2.0, 0.0), *Dillwynia floribunda* (2.0, 0.0), *Dillwynia retorta* (2.0, 0.0), *Drosera lunata* (2.0, 0.2), *Emilia sonchifolia** (2.0, 0.0), *Empodisma minus* (2.0, 10.0), *Erigeron* (2.0, 0.0), *Erigeron sumatrensis** (2.0, 0.0), *Eucalyptus racemosa* subsp. *racemosa* (2.0, 0.0), *Exocarpos cupressiformis* (2.0, 0.5), *Fimbristylis polytrichoides* (2.0, 0.6), *Gahnia clarkei* (2.0, 0.0), *Glycine clandestina* var. *clandestina* (2.0, 0.0), *Glycine cyrtoloba* (2.0, 0.0), *Haemodorum austroqueenslandicum* (2.0, 0.0), *Haemodorum tenuifolium* (2.0, 1.0), *Heptapleurum actinophyllum* (2.0, 0.0), *Hibbertia fasciculata* (2.0, 0.0), *Lantana camara** (2.0, 0.0), *Lepidosperma longitudinale* (2.0, 0.0), *Leptospermum liversidgei* (2.0, 0.0), *Leptospermum semibaccatum* (2.0, 0.0), *Leucopogon virgatus* (2.0, 0.0), *Lophostemon confertus* (2.0, 0.0), *Melaleuca quinquenervia* (2.0, 0.0), *Myrsine variabilis* (2.0, 2.0), *Orchidaceae* (2.0, 0.0), *Passiflora suberosa** (2.0, 0.0), *Patersonia sericea* var. *sericea* (2.0, 0.0), *Petalostigma pubescens* (2.0, 0.0), *Petrophile shirleyae* (2.0, 0.0), *Phebalium woombye* (2.0, 0.0), *Pigea monopetala* (2.0, 0.0), *Pultenaea villosa* (2.0, 0.0), *Rhaphiolepis indica** (2.0, 0.0), *Scaevola calendulacea* (2.0, 0.0), *Schoenus ericetorum* (2.0, 0.0), *Schoenus nitens* (2.0, 1.0), *Schoenus ornithopodioides* (2.0, 0.0), *Stephania japonica* (2.0, 0.0), *Styphelia deformis* (2.0, 1.0), *Styphelia sieberi* (2.0, 0.5), *Syagrus romanzoffiana** (2.0, 0.0), *Tetragonia tetragonoides* (2.0, 0.2), *Tetrastigma nitens* (2.0, 0.0), *Xanthorrhoea latifolia* subsp. *latifolia* (2.0, 5.4), *Xanthorrhoea macronema* (2.0, 0.0)

Species list: Frequency (percent of total sites) and cover (average of species cover across sites where that species is present). Ordered by decreasing frequency. Naturalised species have an asterisk (*) after the name. indet. after listed name if indeterminate species or genus.

12.2.7: Melaleuca quinquenervia or rarely M. dealbata open forest on sand plains



Mapping data	Pre-clearing area = 30,010.8 ha; Remnant area 2019 = 18,515.7 ha; Remnant percent remaining in 2019 = 61.7 %
Species richness	total: 300 (53 sites); woody: 79 (53 sites); ground: 252 (47 sites); average spp./site: 20.8, standard deviation: 9.0 (47 sites)
Basal area	average/site: 35.6 m ² /ha; range: 4.0 - 72.0 m ² /ha; std. deviation: 13.6; (45 sites)
Ecological dominant layer (EDL) height	stratum: tree 1; average/site: 13.34m; range: 3.50 - 25.00m; (53 sites)
Ecological dominant layer (EDL) Crown Cover	stratum: tree 1; average: 55.9%; range: 0.0 - 96.0%; (53 sites)
Structural formation	Open Forest: 45.3 %; Woodland: 18.9 %; Low Woodland: 9.4 %; Closed Forest: 9.4 %; Low Open Forest: 5.7 %; Open Woodland: 3.8 %; Low Closed Forest: 3.8 %; Shrubland: 1.9 %; Tall Open Shrubland: 1.9 %; (53 sites)
Representative site(s)	1846, 2015, 2299, 2540, 3095, 3229, 3533, 4366, 4472, 5168, 5669, 5672, 5675, 6648, 9248, 9337, 9502, 9505, 9515, 9518, 9527, 9531, 9532, 9533, 9536, 9705, 9706, 9756, 10420, 10497, 10510, 10580, 10581, 10586, 10589, 10592, 10593, 10614, 10630, 11485, 12102, 13543, 13548, 13549, 13576, 14516, 15252, 15996, 15998, 15999, 16000, 16004, 16005

Stratum: Tree 1 (EDL)

Height: average: 13.34m; range: 3.50 - 25.00m; (53 sites)

Crown Cover: average: 55.9%; range: 0.0 - 96.0%; (53 sites)

Stem Count: average: 1,633 stems/ha; range: 120 - 13,000 stems/ha; std. deviation: 2,828.3 stems/ha; (19 sites)

Basal area: average: 33.3 m²/ha; range: 4.0 - 72.0 m²/ha; std. deviation: 14.2 m²/ha; (45 sites)

Species list (frequency (%), average cover (%)):

Most frequent species (up to 6):

Melaleuca quinquenervia (96.2, 50.2), *Eucalyptus tereticornis* (18.9, 4.7), *Lophostemon suaveolens* (17.0, 5.0), *Eucalyptus robusta* (15.1, 14.0), *Corymbia intermedia* (13.2, 7.6), *Casuarina glauca* (5.7, 10.3)

Additional species:

Acacia leiocalyx subsp. *leiocalyx* (3.8, 13.0), *Glochidion ferdinandi* var. *ferdinandi* (3.8, 12.5), *Alphitonia excelsa* (3.8, 4.0), *Banksia integrifolia* (3.8, 1.8), *Melaleuca dealbata* (1.9, 66.0), *Glochidion sumatranum* (1.9, 29.0), *Eucalyptus bancroftii* (1.9, 12.0), *Allocasuarina littoralis* (1.9, 8.0), *Lophostemon confertus* (1.9, 5.0), *Banksia aemula* (1.9, 4.0), *Livistona decora* (1.9, 2.0), *Homalanthus populifolius* (1.9, 0.0), *Parsonsia straminea* (1.9, 0.0), *Symplocos thwaitesii* (1.9, 0.0)

Stratum: Tree 2

Height: average: 8.54m; range: 4.00 - 18.00m; (30 sites)

Crown Cover: average: 19.0%; range: 2.0 - 65.0%; (30 sites)

Stem Count: average: 328 stems/ha; range: 220 - 460 stems/ha; std. deviation: 102.6 stems/ha; (5 sites)

Basal area: average: 3.7 m²/ha; range: 1.0 - 11.0 m²/ha; std. deviation: 2.9 m²/ha; (25 sites)

Species list (frequency (%), average cover (%)):

Most frequent species (up to 6):

Melaleuca quinquenervia (43.4, 12.7), *Lophostemon suaveolens* (18.9, 7.2), *Glochidion sumatranum* (15.1, 9.4), *Eucalyptus robusta* (7.5, 5.7), *Banksia integrifolia* (7.5, 5.3), *Corymbia intermedia* (7.5, 3.6)

Additional species:

Glochidion ferdinandi var. *ferdinandi* (5.7, 16.0), *Acacia disparrima* subsp. *disparrima* (5.7, 2.3), *Acacia leiocalyx* subsp. *leiocalyx* (3.8, 6.5), *Acacia concurrans* (3.8, 4.5), *Alphitonia excelsa* (1.9, 10.0), *Planchonia careya* (1.9, 3.0), *Melaleuca cheelii* (1.9, 2.0), *Melaleuca linariifolia* (1.9, 2.0), *Eucalyptus tereticornis* (1.9, 1.0), *Melaleuca sieberi* (1.9, 1.0)

Stratum: Tree 3

Height: average: 8.62m; range: 4.50 - 15.00m; (4 sites)

Crown Cover: average: 8.8%; range: 5.0 - 10.0%; (4 sites)

Stem Count: No data available.

Basal area: average: 1.0 m²/ha; range: 1.0 - 1.0 m²/ha; std. deviation: 0.0 m²/ha; (1 site)

Species list (frequency (%), average cover (%)):

Most frequent species (up to 6):

Melicope elleryana (3.8, 7.5), *Melaleuca quinquenervia* (1.9, 10.0), *Acacia leiocalyx* subsp. *leiocalyx* (1.9, 5.0), *Alphitonia excelsa* (1.9, 4.0), *Lophostemon suaveolens* (1.9, 1.0), *Acacia disparrima* subsp. *disparrima* (1.9, 0.0)

Additional species:

Stratum: Shrub 1

Height: average: 2.67m; range: 1.20 - 8.00m; (46 sites)

Crown Cover: average: 13.6%; range: 0.0 - 65.0%; (47 sites)

Stem Count: average: 3,517 stems/ha; range: 20 - 18,100 stems/ha; std. deviation: 5,616.3 stems/ha; (13 sites)

Basal area: average: 2.0 m²/ha; range: 1.0 - 4.0 m²/ha; std. deviation: 1.2 m²/ha; (5 sites)

Species list (frequency (%), average cover (%)):

Most frequent species (up to 6):

Melaleuca quinquenervia (26.4, 7.2), *Acacia disparrima* subsp. *disparrima* (17.0, 3.7), *Lantana camara** (17.0, 3.5), *Acacia leiocalyx* subsp. *leiocalyx* (15.1, 8.8), *Baccharis halimifolia** (13.2, 9.5), *Glochidion sumatranum* (11.3, 3.2)

Additional species:

Leptospermum juniperinum (9.4, 21.0), *Banksia robur* (9.4, 14.0), *Alphitonia excelsa* (9.4, 5.7), *Lophostemon suaveolens* (9.4, 5.0), *Hakea actites* (7.5, 5.7), *Melastoma malabathricum* subsp. *malabathricum* (7.5, 2.8), *Melaleuca pachyphylla* (5.7, 12.7), *Acacia melanoxylon* (5.7, 6.0), *Macaranga tanarius* (5.7, 3.0), *Banksia integrifolia* (5.7, 2.2), *Cupaniopsis anacardioides* (5.7, 2.0), *Eucalyptus robusta* (3.8, 17.5), *Glochidion ferdinandi* var. *ferdinandi* (3.8, 6.0), *Elaeocarpus reticulatus* (3.8, 4.5), *Allocasuarina littoralis* (3.8, 2.8), *Pultenaea myrtoides* (3.8, 2.5), *Persoonia virgata* (3.8, 2.0), *Parsonsia straminea* (3.8, 1.0), *Hibiscus diversifolius* subsp. *diversifolius* (3.8, 0.0), *Xanthorrhoea fulva* (1.9, 9.0), *Gahnia sieberiana* (1.9, 8.0), *Hakea florulenta* (1.9, 4.0), *Hovea acutifolia* (1.9, 3.0), *Passiflora*

*suberosa** (1.9, 2.0), *Phragmites australis* (1.9, 2.0), *Viminaria juncea* (1.9, 2.0), *Acacia concurrens* (1.9, 1.6), *Baeckea frutescens* (1.9, 1.0), *Banksia oblongifolia* (1.9, 1.0), *Callitris columellaris* (1.9, 1.0), *Gahnia aspera* (1.9, 1.0), *Heptapleurum actinophyllum* (1.9, 1.0), *Livistona decora* (1.9, 1.0), *Melicope elleryana* (1.9, 1.0), *Acronychia imperforata* (1.9, 0.6), *Dodonaea triquetra* (1.9, 0.5), *Lophostemon confertus* (1.9, 0.5), *Persoonia media* (1.9, 0.5), *Acacia hubbardiana* (1.9, 0.0), *Acacia leptocarpa* (1.9, 0.0), *Acacia maidenii* (1.9, 0.0), *Austromyrtus dulcis* (1.9, 0.0), *Corymbia tessellaris* (1.9, 0.0), *Cyclophyllum coprosmoides* (1.9, 0.0), *Diplatia furcata* (1.9, 0.0), *Epacris pulchella* (1.9, 0.0), *Exocarpos latifolius* (1.9, 0.0), *Glochidion lobocarpum* (1.9, 0.0), *Muellerina celastroides* (1.9, 0.0), *Pleiogynium timorense* (1.9, 0.0), *Styphelia leptospermoides* (1.9, 0.0), *Styphelia sieberi* (1.9, 0.0), *Trema tomentosa* (1.9, 0.0)

Stratum: Shrub 2

Height: average: 1.32m; range: 0.50 - 3.00m; (13 sites)

Crown Cover: average: 20.0%; range: 2.0 - 60.0%; (12 sites)

Stem Count: No data available.

Basal area: No data available.

Species list (frequency (%), average cover (%)):

Most frequent species (up to 6):

*Baccharis halimifolia** (5.7, 17.2), *Lantana camara** (5.7, 16.0), *Melastoma malabathricum* subsp. *malabathricum* (5.7, 3.0),

Leucopogon pimeleoides (5.7, 1.7), *Banksia robur* (3.8, 19.0), *Austromyrtus dulcis* (3.8, 8.5)

Additional species:

Melaleuca quinquenervia (3.8, 8.0), *Alphitonia excelsa* (3.8, 5.2), *Lophostemon suaveolens* (3.8, 3.5), *Leptospermum juniperinum* (3.8, 1.5), *Pultenaea paleacea* (1.9, 10.0), *Leptospermum polygalifolium* (1.9, 7.0), *Xanthorrhoea latifolia* subsp. *latifolia* (1.9, 7.0), *Acacia melanoxylon* (1.9, 2.0), *Hakea florulenta* (1.9, 2.0), *Pimelea linifolia* subsp. *linifolia* (1.9, 2.0), *Styphelia leptospermoides* (1.9, 2.0), *Melaleuca thymifolia* (1.9, 1.0), *Monotoca scoparia* (1.9, 1.0), *Platysace linearifolia* (1.9, 1.0)

Stratum: Ground

Height: average: 0.96m; range: 0.40 - 2.00m; (47 sites)

Projective foliage cover (PFC): average: 65.2%; range: 0.0 - 106.0%; (47 sites)

Species list (frequency (%), average cover (%)):

Grass - perennial:

Most frequent species (up to 6):

Imperata cylindrica (68.1, 30.1), *Themeda triandra* (27.7, 25.9), *Paspalum scrobiculatum* (23.4, 1.0), *Entolasia stricta* (19.1, 7.0),

Entolasia marginata (17.0, 0.0), *Leersia hexandra* (17.0, 27.5)

Additional species:

Phragmites australis (17.0, 24.1), *Sacciolepis indica* (14.9, 0.2), *Ischaemum australe* (6.4, 1.0), *Andropogon virginicus** (4.3, 3.0), *Cymbopogon refractus* (4.3, 1.0), *Cynodon dactylon** (4.3, 5.0), *Megathyrsus maximus** (4.3, 0.0), *Ottochloa gracillima* (4.3, 0.0), *Panicum effusum* (4.3, 0.0), *Paspalidium distans* (4.3, 0.0), *Paspalidium gracile* (4.3, 0.0), *Aristida calycina* (2.1, 0.0), *Aristida warburgii* (2.1, 3.0), *Axonopus fissifolius** (2.1, 0.0), *Cenchrus echinatus** (2.1, 0.0), *Eragrostis brownii* (2.1, 0.0), *Eragrostis spartinoides* (2.1, 0.0), *Eremochloa bimaculata* (2.1, 2.0), *Eriachne glabrata* (2.1, 15.0), *Heteropogon contortus* (2.1, 1.0), *Panicum simile* (2.1, 0.0), *Paspalidium disjunctum* (2.1, 0.0), *Paspalum paniculatum** (2.1, 0.0)

Grass - annual/biennial:

Not present

Forbs & other:

Most frequent species (up to 6):

Telmatoblechnum indicum (63.8, 31.1), *Pteridium esculentum* (36.2, 8.6), *Parsonsia straminea* (34.0, 2.0), *Baccharis halimifolia** (31.9, 1.7), *Machaerina rubiginosa* (29.8, 9.9), *Baloskion pallens* (27.7, 27.7)

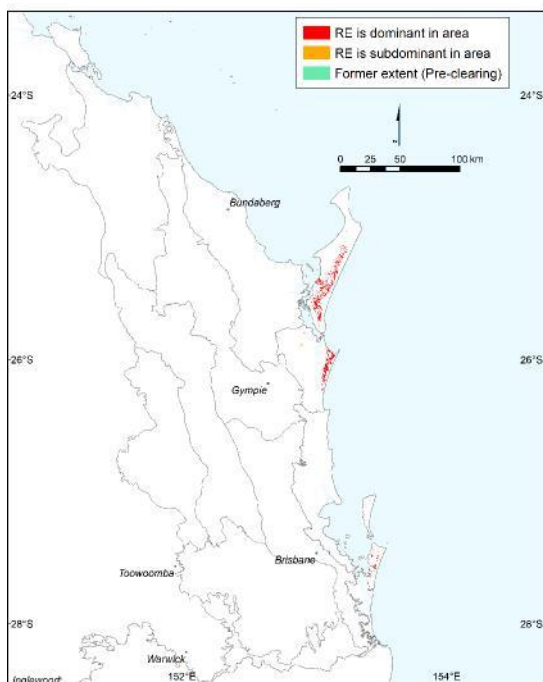
Additional species:

Lomandra longifolia (25.5, 0.6), *Alphitonia excelsa* (23.4, 0.2), *Hibbertia scandens* (23.4, 1.8), *Machaerina juncea* (23.4, 13.0), *Schoenus brevifolius* (23.4, 5.7), *Gahnia sieberiana* (21.3, 11.4), *Melastoma malabathricum* subsp. *malabathricum* (19.1, 0.0), *Cyperus polystachyos* var. *polystachyos* (17.0, 1.0), *Dianella caerulea* (17.0, 7.0), *Elaeocarpus reticulatus* (17.0, 0.0), *Glochidion sumatranum* (17.0, 0.0), *Lygodium microphyllum* (17.0, 15.0), *Austromyrtus dulcis* (14.9, 0.0), *Centella asiatica* (14.9, 3.0), *Lantana camara** (14.9,

0.0), *Lepironia articulata* (14.9, 30.3), *Smilax australis* (14.9, 1.0), *Baloskion tetraphyllum* subsp. *meiostachyum* (12.8, 3.3), *Chorizandra cymbaria* (12.8, 10.0), *Liparophyllum exaltatum* (12.8, 0.0), *Passiflora suberosa** (12.8, 25.7), *Cyclosorus interruptus* (10.6, 7.8), *Hibbertia vestita* (10.6, 0.0), *Hibiscus diversifolius* subsp. *diversifolius* (10.6, 0.0), *Leptospermum juniperinum* (10.6, 6.2), *Livistona australis* (10.6, 0.0), *Lophostemon suaveolens* (10.6, 1.0), *Machaerina articulata* (10.6, 8.9), *Persoonia virgata* (10.6, 0.0), *Stephania japonica* (10.6, 4.0), *Acacia disparima* subsp. *disparima* (8.5, 0.0), *Acacia leiocalyx* subsp. *leiocalyx* (8.5, 0.0), *Banksia oblongifolia* (8.5, 0.0), *Cassytha pubescens* (8.5, 0.0), *Glochidion ferdinandi* var. *ferdinandi* (8.5, 0.0), *Goodenia mystrophylla* (8.5, 0.0), *Kennedia rubicunda* (8.5, 0.0), *Machaerina teretifolia* (8.5, 0.0), *Pimelea linifolia* subsp. *linifolia* (8.5, 0.0), *Pinus elliotii** (8.5, 0.0), *Psychotria loniceroides* (8.5, 0.0), *Sporadanthus caudatus* (8.5, 5.0), *Tricoryne elatior* (8.5, 0.0), *Ageratum houstonianum** (6.4, 0.0), *Gahnia aspera* (6.4, 0.0), *Gomphocarpus physocarpus** (6.4, 1.0), *Hypolepis muelleri* (6.4, 5.0), *Ipomoea cairica** (6.4, 11.0), *Melaleuca quinquenervia* (6.4, 1.0), *Melicope elleryana* (6.4, 0.0), *Styphelia leptospermoides* (6.4, 0.0), *Xanthorrhoea fulva* (6.4, 6.0), *Xyris complanata* (6.4, 0.0), *Baeckea frutescens* (4.3, 0.4), *Banksia robur* (4.3, 0.0), *Calochlaena dubia* (4.3, 25.0), *Casuarina glauca* (4.3, 0.0), *Cladium procerum* (4.3, 45.0), *Crassocephalum crepidioides** (4.3, 0.0), *Cupaniopsis anacardioides* (4.3, 0.0), *Cyperus lucidus* (4.3, 2.0), *Dianella* (4.3, 0.0), *Dianella brevipedunculata* (4.3, 7.0), *Dianella caerulea* var. *vannata* (4.3, 0.0), *Dianella congesta* (4.3, 0.0), *Dicranopteris linearis* var. *subferruginea* (4.3, 0.0), *Drosera spatulata* (4.3, 0.0), *Elaeocarpus obovatus* (4.3, 0.0), *Eriocaulon australe* (4.3, 30.0), *Eurychorda complanata* (4.3, 5.0), *Eustrephus latifolius* (4.3, 0.0), *Exocarpos latifolius* (4.3, 0.0), *Ficus coronata* (4.3, 0.0), *Ficus opposita* (4.3, 0.0), *Gahnia clarkei* (4.3, 3.5), *Glycine clandestina* (4.3, 0.0), *Gompholobium pinnatum* (4.3, 0.0), *Gonocarpus micranthus* subsp. *ramosissimus* (4.3, 0.0), *Heptapleurum actinophyllum* (4.3, 0.0), *Homalanthus populifolius* (4.3, 0.0), *Lepidosperma longitudinale* (4.3, 22.4), *Leptospermum polygalifolium* (4.3, 0.0), *Lepyrodia scariosa* (4.3, 0.0), *Leucopogon pimeleoides* (4.3, 0.0), *Passiflora subpeltata** (4.3, 0.0), *Persicaria decipiens* (4.3, 0.0), *Persicaria strigosa* (4.3, 0.0), *Philydrum lanuginosum* (4.3, 10.0), *Phytolacca octandra** (4.3, 1.0), *Pomax umbellata* (4.3, 1.0), *Pultenaea retusa* (4.3, 0.0), *Schinus terebinthifolius** (4.3, 0.0), *Schoenus apogon* var. *apogon* (4.3, 0.0), *Schoenus calostachyus* (4.3, 1.0), *Stackhousia viminea* (4.3, 0.0), *Viola hederacea* (4.3, 3.0), *Acacia leptocarpa* (2.1, 0.0), *Acmena smithii* (2.1, 0.0), *Acronychia imperforata* (2.1, 0.0), *Acrostichum speciosum* (2.1, 0.0), *Acrothamnus melaleucooides* (2.1, 0.0), *Alternanthera denticulata* (2.1, 0.0), *Angiopteris evecta* (2.1, 4.0), *Asclepias curassavica** (2.1, 0.0), *Banksia integrifolia* (2.1, 0.0), *Banksia integrifolia* subsp. *integrifolia* (2.1, 0.0), *Boronia falcifolia* (2.1, 0.0), *Bossiaea heterophylla* (2.1, 0.0), *Breynia oblongifolia* (2.1, 0.0), *Carex appressa* (2.1, 4.0), *Cassytha glabella* forma *glabella* (2.1, 1.0), *Cirsium vulgare** (2.1, 0.0), *Comesperma defoliatum* (2.1, 0.0), *Commelina diffusa* (2.1, 0.0), *Corymbia intermedia* (2.1, 0.0), *Crotalaria lanceolata* subsp. *lanceolata** (2.1, 0.0), *Cyanthillium cinereum* (2.1, 0.0), *Cyathochaeta diandra* (2.1, 1.0), *Cyperus exaltatus* (2.1, 0.0), *Cyperus haspan* (2.1, 0.0), *Desmodium rhytidophyllum* (2.1, 0.0), *Dianella longifolia* (2.1, 0.0), *Drymaria cordata** (2.1, 15.0), *Eleocharis minuta** (2.1, 0.0), *Emilia sonchifolia** (2.1, 0.0), *Endiandra sieberi* (2.1, 0.0), *Erigeron bonariensis** (2.1, 0.0), *Eucalyptus pilularis* (2.1, 0.0), *Evolvulus alsinoides* (2.1, 0.0), *Exocarpos cupressiformis* (2.1, 0.0), *Ficus* (2.1, 0.0), *Ficus macrophylla* forma *macrophylla* (2.1, 0.0), *Ficus rubiginosa* (2.1, 0.0), *Ficus virens* var. *virens* (2.1, 0.0), *Fimbristylis* (2.1, 0.0), *Fimbristylis bisumbellata* (2.1, 0.0), *Fimbristylis ferruginea* (2.1, 0.0), *Geitonoplesium cymosum* (2.1, 0.0), *Geodorum densiflorum* (2.1, 0.0), *Gleichenia dicarpa* (2.1, 0.0), *Gleichenia mendellii* (2.1, 8.0), *Gonocarpus chinensis* subsp. *verrucosus* (2.1, 0.0), *Goodenia paniculata* (2.1, 0.0), *Goodenia rotundifolia* (2.1, 0.0), *Grevillea leiophylla* (2.1, 0.0), *Hakea actites* (2.1, 0.0), *Hakea florulenta* (2.1, 0.0), *Hibbertia stricta* (2.1, 0.0), *Histopteris incisa* (2.1, 0.0), *Hydrilla verticillata* (2.1, 0.0), *Hydrocotyle acutiloba* (2.1, 0.0), *Hydrocotyle bonariensis** (2.1, 0.0), *Hydrocotyle verticillata* (2.1, 0.0), *Hypericum gramineum* (2.1, 0.0), *Hypochaeris radicata** (2.1, 0.0), *Ipomoea pes-caprae* subsp. *brasiliensis* (2.1, 0.0), *Jasminum didymum* subsp. *racemosum* (2.1, 0.0), *Juncus articulatus** (2.1, 10.0), *Juncus continuus* (2.1, 0.0), *Juncus usitatus* (2.1, 0.0), *Lepidosperma laterale* (2.1, 54.0), *Leptocarpus tenax* (2.1, 0.0), *Lindsaea ensifolia* subsp. *ensifolia* (2.1, 0.0), *Lindsaea incisa* (2.1, 0.0), *Livistona decora* (2.1, 1.0), *Lobelia anceps* (2.1, 0.2), *Lobelia purpurascens* (2.1, 0.0), *Lomandra confertifolia* subsp. *pallida* (2.1, 0.0), *Lomandra hystrix* (2.1, 0.0), *Lomandra multiflora* subsp. *multiflora* (2.1, 0.2), *Ludwigia octovalvis* (2.1, 0.0), *Melaleuca linariifolia* (2.1, 0.0), *Melaleuca thymifolia* (2.1, 0.0), *Mitrasacme paludosa* (2.1, 0.0), *Mitrasacme polymorpha* (2.1, 0.0), *Murraya paniculata* 'Exotica'* (2.1, 0.0), *Myoporum acuminatum* (2.1, 0.0), *Notelaea punctata* (2.1, 0.0), *Ochna serrulata** (2.1, 0.0), *Ozothamnus diosmifolius* (2.1, 0.0), *Passiflora edulis** (2.1, 0.0), *Patersonia fragilis* (2.1, 0.0), *Persicaria attenuata* (2.1, 0.0), *Persoonia stradbrokeensis* (2.1, 0.0), *Phaius** (2.1, 0.0), *Phyla nodiflora* (2.1, 0.0), *Phyllanthus virgatus* (2.1, 0.0), *Pittosporum revolutum* (2.1, 0.0), *Planchonia careya* (2.1, 0.0), *Platycerium bifurcatum* (2.1, 0.0), *Polymeria calycina* (2.1, 1.2), *Pseudanthus orientalis* (2.1, 0.0), *Psilotum nudum* (2.1, 0.0), *Pterostylis* (2.1, 0.0), *Pultenaea myrtoides* (2.1, 0.0), *Pultenaea paleacea* (2.1, 0.0), *Rhynchospora corymbosa* (2.1, 0.0), *Rivina humilis** (2.1, 0.0), *Schoenus melanostachys* (2.1, 0.0), *Scleria sphacelata* (2.1, 1.0), *Selaginella uliginosa* (2.1, 0.0), *Senna pendula* var. *glabrata** (2.1, 0.0), *Smilax glycyphylla* (2.1, 0.0), *Solanum torvum** (2.1, 0.0), *Sonchus oleraceus** (2.1, 0.0), *Sowerbaea juncea* (2.1, 0.0), *Sprengelia sprengelioides* (2.1, 0.0), *Syagrus romanzoffiana** (2.1, 0.0), *Thelypteris confluens* (2.1, 0.0), *Thysanotus tuberosus* (2.1, 0.0), *Timonius timon* var. *timon* (2.1, 0.0), *Todea barbara* (2.1, 0.0), *Viola betonicifolia* (2.1, 0.0), *Wikstroemia indica* (2.1, 0.0), *Xanthorrhoea johnsonii* (2.1, 0.0), *Xyris juncea* (2.1, 0.0), *Xyris operculata* (2.1, 0.0)

Species list: Frequency (percent of total sites) and cover (average of species cover across sites where that species is present). Ordered by decreasing frequency. Naturalised species have an asterisk (*) after the name. indet. after listed name if indeterminate species or genus.

12.2.8: *Eucalyptus pilularis* open forest on parabolic high dunes



Mapping data	Pre-clearing area = 22,375.7 ha; Remnant area 2019 = 21,565.0 ha; Remnant percent remaining in 2019 = 96.4 %
Species richness	total: 195 (32 sites); woody: 116 (32 sites); ground: 130 (31 sites); average spp./site: 32.4, standard deviation: 6.5 (31 sites)
Basal area	average/site: 23.4 m ² /ha; range: 12.0 - 45.0 m ² /ha; std. deviation: 8.1; (32 sites)
Ecological dominant layer (EDL) height	stratum: tree 1; average/site: 17.11m; range: 9.00 - 30.00m; (32 sites)
Ecological dominant layer (EDL) Crown Cover	stratum: tree 1; average: 60.7%; range: 22.0 - 100.0%; (32 sites)
Structural formation	Open Forest: 62.5 %; Woodland: 18.8 %; Closed Forest: 9.4 %; Low Woodland: 6.2 %; Tall Open Forest: 3.1 %; (32 sites)
Representative site(s)	3984, 3989, 4373, 5593, 9167, 9171, 9175, 9176, 9489, 9490, 9492, 9494, 9495, 10141, 11603, 11604, 13602, 14122, 14124, 14701, 14881, 14991, 15170, 15726, 15730, 16336, 16895, 17471, 17870, 17873, 18258, 18259

Stratum: Tree 1 (EDL)

Height: average: 17.11m; range: 9.00 - 30.00m; (32 sites)

Crown Cover: average: 60.7%; range: 22.0 - 100.0%; (32 sites)

Stem Count: average: 246 stems/ha; range: 40 - 1,200 stems/ha; std. deviation: 238.5 stems/ha; (29 sites)

Basal area: average: 16.5 m²/ha; range: 7.0 - 34.0 m²/ha; std. deviation: 6.1 m²/ha; (32 sites)

Species list (frequency (%), average cover (%)):

Most frequent species (up to 6):

Eucalyptus pilularis (100.0, 46.1), *Eucalyptus racemosa subsp. racemosa* (68.8, 9.7), *Corymbia intermedia* (31.2, 7.9), *Eucalyptus planchoniana* (25.0, 20.9), *Corymbia gummifera* (21.9, 6.0), *Angophora leiocarpa* (15.6, 5.3)

Additional species:

Allocasuarina torulosa (6.2, 0.0), *Persoonia virgata* (6.2, 0.0), *Lophostemon confertus* (3.1, 2.0), *Monotoca sp. (Fraser Island P.Baxter 777)* (3.1, 0.0)

Stratum: Tree 2

Height: average: 9.01m; range: 4.50 - 19.00m; (32 sites)

Crown Cover: average: 20.7%; range: 5.0 - 64.0%; (32 sites)

Stem Count: average: 558 stems/ha; range: 60 - 2,200 stems/ha; std. deviation: 514.8 stems/ha; (29 sites)

Basal area: average: 6.1 m²/ha; range: 1.0 - 22.0 m²/ha; std. deviation: 5.0 m²/ha; (28 sites)

Species list (frequency (%), average cover (%)):

Most frequent species (up to 6):

Banksia aemula (50.0, 17.9), *Banksia serrata* (31.2, 6.9), *Allocasuarina torulosa* (31.2, 4.9), *Corymbia intermedia* (31.2, 2.3), *Eucalyptus pilularis* (28.1, 11.8), *Lophostemon confertus* (21.9, 8.5)

Additional species:

Leptospermum trinervium (21.9, 7.0), *Angophora leiocarpa* (18.8, 2.6), *Monotoca sp. (Fraser Island P.Baxter 777)* (15.6, 10.7), *Corymbia gummifera* (12.5, 2.0), *Eucalyptus racemosa subsp. racemosa* (9.4, 0.0), *Endiandra sieberi* (6.2, 10.0), *Acacia concurrens* (6.2, 0.0), *Eucalyptus planchoniana* (6.2, 0.0), *Persoonia stradbrokeensis* (6.2, 0.0), *Syncarpia hillii* (3.1, 32.4), *Endiandra glauca* (3.1, 26.6), *Acacia disparrima subsp. disparrima* (3.1, 15.0), *Syncarpia glomulifera subsp. glomulifera* (3.1, 5.0), *Acacia flavescens* (3.1, 2.0), *Allocasuarina littoralis* (3.1, 2.0), *Flindersia bennettii* (3.1, 2.0), *Callitris columellaris* (3.1, 1.0), *Livistona australis* (3.1, 1.0), *Banksia integrifolia* (3.1, 0.0), *Melaleuca* (3.1, 0.0), *Persoonia virgata* (3.1, 0.0)

Stratum: Tree 3

Height: average: 6.14m; range: 4.00 - 8.00m; (7 sites)

Crown Cover: average: 25.0%; range: 7.0 - 71.0%; (7 sites)

Stem Count: average: 1,007 stems/ha; range: 100 - 4,480 stems/ha; std. deviation: 1,711.8 stems/ha; (6 sites)

Basal area: average: 5.4 m²/ha; range: 3.0 - 8.0 m²/ha; std. deviation: 2.1 m²/ha; (5 sites)

Species list (frequency (%), average cover (%)):

Most frequent species (up to 6):

Banksia aemula (9.4, 7.0), *Eucalyptus pilularis* (9.4, 1.0), *Monotoca sp. (Fraser Island P.Baxter 777)* (6.2, 50.0), *Lophostemon confertus* (6.2, 18.0), *Acacia disparrima subsp. disparrima* (6.2, 9.0), *Allocasuarina torulosa* (6.2, 8.0)

Additional species:

Banksia integrifolia (3.1, 15.0), *Leptospermum trinervium* (3.1, 15.0), *Acacia flavescens* (3.1, 5.0), *Monotoca scoparia* (3.1, 5.0), *Endiandra glauca* (3.1, 4.0), *Elaeocarpus reticulatus* (3.1, 3.0), *Endiandra sieberi* (3.1, 2.0), *Styphelia leptospermoides* (3.1, 1.0), *Denhamia celastroides* (3.1, 0.0), *Diospyros pentamera* (3.1, 0.0), *Dodonaea viscosa subsp. burmanniana* (3.1, 0.0), *Eucalyptus racemosa subsp. racemosa* (3.1, 0.0)

Stratum: Shrub 1

Height: average: 2.11m; range: 1.50 - 4.00m; (32 sites)

Crown Cover: average: 32.7%; range: 2.0 - 80.0%; (32 sites)

Stem Count: average: 2,673 stems/ha; range: 40 - 10,000 stems/ha; std. deviation: 2,301.9 stems/ha; (31 sites)

Basal area: average: 2.3 m²/ha; range: 1.0 - 7.0 m²/ha; std. deviation: 2.0 m²/ha; (9 sites)

Species list (frequency (%), average cover (%)):

Most frequent species (up to 6):

Monotoca sp. (Fraser Island P.Baxter 777) (93.8, 20.2), *Xanthorrhoea johnsonii* (62.5, 8.6), *Leucopogon pimeleoides* (46.9, 2.8), *Styphelia margarodes* (43.8, 8.4), *Persoonia virgata* (43.8, 5.4), *Banksia aemula* (37.5, 4.3)

Additional species:

Leptospermum trinervium (31.2, 5.9), *Leptomeria acida* (25.0, 7.0), *Banksia serrata* (21.9, 6.3), *Persoonia stradbrokeensis* (21.9, 1.0), *Styphelia viridis* (21.9, 0.0), *Eucalyptus pilularis* (18.8, 2.0), *Banksia integrifolia* (18.8, 1.5), *Monotoca scoparia* (15.6, 0.8), *Petrophile*

canescens (15.6, 0.8), *Lophostemon confertus* (12.5, 11.7), *Dodonaea triquetra* (12.5, 5.0), *Allocasuarina torulosa* (12.5, 2.0), *Elaeocarpus reticulatus* (12.5, 2.0), *Acacia leiocalyx* subsp. *leiocalyx* (12.5, 0.5), *Hibbertia scandens* (9.4, 6.0), *Endiandra sieberi* (9.4, 1.3), *Acacia suaveolens* (9.4, 1.0), *Styphelia ericoides* (9.4, 0.0), *Woolfsia pungens* (6.2, 8.0), *Austromyrtus dulcis* (6.2, 6.5), *Astrotricha glabra* (6.2, 5.5), *Acacia concurrens* (6.2, 5.0), *Cryptocarya glaucescens* (6.2, 3.0), *Brachyloma scortechinii* (6.2, 0.0), *Corymbia intermedia* (6.2, 0.0), *Denhamia celastroides* (6.2, 0.0), *Dillwynia retorta* (6.2, 0.0), *Gompholobium virgatum* (6.2, 0.0), *Styphelia leptospermoides* (6.2, 0.0), *Zieria laxiflora* (6.2, 0.0), *Phebalium woombye* (3.1, 22.0), *Dodonaea viscosa* subsp. *burmanniana* (3.1, 20.0), *Pultenaea villosa* (3.1, 15.0), *Endiandra glauca* (3.1, 7.0), *Platysace lanceolata* (3.1, 6.0), *Acronychia imperforata* (3.1, 5.0), *Acacia penninervis* (3.1, 4.0), *Acacia penninervis* var. *longiracemosa* (3.1, 4.0), *Acacia disparrima* subsp. *disparrima* (3.1, 2.0), *Archontophoenix cunninghamiana* (3.1, 2.0), *Cissus hypoglauca* (3.1, 2.0), *Jacksonia scoparia* (3.1, 2.0), *Petrophile shirleyae* (3.1, 2.0), *Acacia cincinnata* (3.1, 1.0), *Alphitonia excelsa* (3.1, 1.0), *Bossiaea ensata* (3.1, 1.0), *Haemodorum austroqueenslandicum* (3.1, 1.0), *Lomatia silaifolia* (3.1, 1.0), *Notelaea longifolia* (3.1, 1.0), *Acacia melanoxydon* (3.1, 0.5), *Acacia ulicifolia* (3.1, 0.5), *Backhousia myrtifolia* (3.1, 0.5), *Brachychiton bidwillii* (3.1, 0.5), *Flagellaria indica* (3.1, 0.5), *Glochidion sumatranum* (3.1, 0.5), *Heptapleurum actinophyllum* (3.1, 0.5), *Lantana camara** (3.1, 0.5), *Ptilidostigma rhytidpermum* (3.1, 0.5), *Syzygium oleosum* (3.1, 0.5), *Acacia oshanesii* (3.1, 0.0), *Angophora leiocarpa* (3.1, 0.0), *Breynea oblongifolia* (3.1, 0.0), *Cassytha filiformis* (3.1, 0.0), *Comesperma retusum* (3.1, 0.0), *Conospermum taxifolium* (3.1, 0.0), *Corymbia gummifera* (3.1, 0.0), *Daviesia umbellulata* (3.1, 0.0), *Eucalyptus planchoniana* (3.1, 0.0), *Hovea acutifolia* (3.1, 0.0), *Jagera pseudorhus* var. *pseudorhus* (3.1, 0.0), *Leptospermum* (3.1, 0.0), *Phyllota phyllicoides* (3.1, 0.0), *Pittosporum revolutum* (3.1, 0.0), *Psychotria loniceroides* (3.1, 0.0), *Smilax glypticphylla* (3.1, 0.0), *Strangea linearis* (3.1, 0.0), *Synoum glandulosum* subsp. *glandulosum* (3.1, 0.0)

Stratum: Shrub 2

Height: average: 0.51m; range: 0.50 - 0.75m; (26 sites)

Crown Cover: average: 18.1%; range: 0.0 - 44.2%; (26 sites)

Stem Count: average: 2,000 stems/ha; range: 2,000 - 2,000 stems/ha; std. deviation: 0.0 stems/ha; (1 site)

Basal area: No data available.

Species list (frequency (%), average cover (%)):

Most frequent species (up to 6):

Xanthorrhoea johnsonii (53.1, 11.7), *Boronia rosmarinifolia* (46.9, 1.6), *Austromyrtus dulcis* (37.5, 6.6), *Monotoca* sp. (*Fraser Island P.Baxter 777*) (37.5, 1.2), *Styphelia leptospermoides* (34.4, 1.9), *Petrophile canescens* (31.2, 1.5)

Additional species:

Hibbertia vestita (31.2, 1.5), *Styphelia margarodes* (25.0, 0.6), *Banksia aemula* (21.9, 1.5), *Hibbertia linearis* (21.9, 1.2), *Platysace ericoides* (21.9, 0.9), *Leucopogon pimeleoides* (18.8, 2.2), *Strangea linearis* (18.8, 2.0), *Leptospermum trinervium* (15.6, 1.2), *Woolfsia pungens* (12.5, 2.9), *Persoonia virgata* (12.5, 2.0), *Banksia serrata* (9.4, 1.0), *Brachyloma daphnoides* (9.4, 1.0), *Monotoca scoparia* (9.4, 0.7), *Bossiaea heterophylla* (9.4, 0.5), *Styphelia viridis* (9.4, 0.2), *Melichrus procumbens* (6.2, 2.5), *Acacia ulicifolia* (6.2, 1.0), *Hibbertia acicularis* (6.2, 1.0), *Homoranthus virgatus* (6.2, 1.0), *Pimelea linifolia* subsp. *linifolia* (6.2, 1.0), *Acacia suaveolens* (6.2, 0.6), *Lomatia silaifolia* (6.2, 0.6), *Brachyloma scortechinii* (6.2, 0.4), *Elaeocarpus reticulatus* (6.2, 0.3), *Macrozamia douglasii* (3.1, 22.6), *Leptospermum semibaccatum* (3.1, 4.0), *Monotoca* (3.1, 4.0), *Xanthorrhoea macronema* (3.1, 4.0), *Allocasuarina torulosa* (3.1, 1.4), *Acrotriche aggregata* (3.1, 1.0), *Bossiaea ensata* (3.1, 1.0), *Daviesia umbellulata* (3.1, 1.0), *Dodonaea triquetra* (3.1, 1.0), *Gompholobium pinnatum* (3.1, 1.0), *Gompholobium virgatum* (3.1, 1.0), *Banksia integrifolia* (3.1, 0.8), *Eucalyptus pilularis* (3.1, 0.4), *Phyllota phyllicoides* (3.1, 0.4), *Zieria* (3.1, 0.4), *Epacris pulchella* (3.1, 0.2), *Leptospermum polygalifolium* (3.1, 0.2), *Zieria furfuracea** (3.1, 0.2), *Hibbertia scandens* (3.1, 0.0), *Leichhardtia fraseri* (3.1, 0.0), *Muellerina celastroides* (3.1, 0.0), *Petrophile shirleyae* (3.1, 0.0), *Smilax australis* (3.1, 0.0)

Stratum: Ground

Height: average: 0.53m; range: 0.20 - 0.80m; (31 sites)

Projective foliage cover (PFC): average: 22.4%; range: 3.0 - 61.0%; (31 sites)

Species list (frequency (%), average cover (%)):

Grass - perennial:

Most frequent species (up to 6):

Imperata cylindrica (74.2, 2.0), *Themeda triandra* (71.0, 4.8), *Eriachne pallascens* (51.6, 3.0), *Entolasia stricta* (19.4, 0.8), *Aristida jerichoensis* var. *jerichoensis* (16.1, 0.6), *Panicum simile* (6.5, 1.0)

Additional species:

Alloteropsis semialata (3.2, 1.0), *Digitaria parviflora* (3.2, 0.0), *Ottochloa nodosa* (3.2, 35.0)

Grass - annual/biennial:

Most frequent species (up to 6):

Schizachyrium fragile (6.5, 1.0),

Additional species:

Forbs & other:

Most frequent species (up to 6):

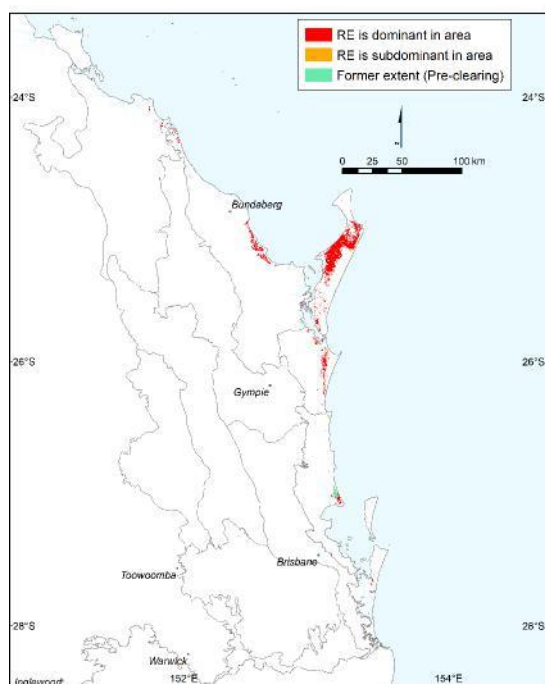
Pteridium esculentum (83.9, 3.8), *Lomandra longifolia* (64.5, 2.1), *Lomandra multiflora* subsp. *multiflora* (64.5, 1.0), *Dianella caerulea* (54.8, 1.4), *Baloskion tetraphyllum* subsp. *meiostachyum* (48.4, 11.1), *Hibbertia linearis* (41.9, 0.0)

Additional species:

Schizaea bifida (35.5, 1.0), *Styphelia leptospermoides* (29.0, 0.2), *Caustis recurvata* (25.8, 1.9), *Smilax glyciophylla* (25.8, 2.2), *Austromyrtus dulcis* (22.6, 2.1), *Hardenbergia violacea* (22.6, 0.5), *Lepidosperma laterale* (22.6, 1.2), *Pomax umbellata* (22.6, 1.0), *Xanthosia pilosa* (22.6, 0.3), *Boronia rosmarinifolia* (19.4, 0.0), *Gompholobium virgatum* (19.4, 0.0), *Leucopogon pimeleoides* (19.4, 0.0), *Persoonia virgata* (19.4, 0.0), *Platysace ericoides* (19.4, 1.7), *Strangea linearis* (19.4, 0.0), *Styphelia margarodes* (19.4, 0.0), *Cassytha pubescens* (16.1, 0.0), *Dianella revoluta* (16.1, 0.2), *Leptomeria acida* (16.1, 0.0), *Melichrus procumbens* (16.1, 0.0), *Monotoca scoparia* (16.1, 0.0), *Patersonia glabrata* (16.1, 1.0), *Acacia ulicifolia* (12.9, 0.0), *Bossiaea ensata* (12.9, 0.0), *Brachyloma daphnoides* (12.9, 0.0), *Brachyloma scortechinii* (12.9, 0.0), *Cassytha filiformis* (12.9, 0.2), *Coleocarya gracilis* (12.9, 19.8), *Hibbertia acicularis* (12.9, 0.0), *Parsonsia straminea* (12.9, 0.0), *Phyllota phyllicoides* (12.9, 0.0), *Ricinocarpos pinifolius* (12.9, 0.0), *Smilax australis* (12.9, 2.8), *Styphelia ericoides* (12.9, 0.0), *Trachystylis stradbokensis* (12.9, 1.0), *Acacia suaveolens* (9.7, 0.0), *Aotus lanigera* (9.7, 0.0), *Bossiaea heterophylla* (9.7, 0.0), *Cassytha glabella* forma *glabella* (9.7, 0.0), *Dampiera sylvestris* (9.7, 0.6), *Eustrephus latifolius* (9.7, 0.6), *Gompholobium pinnatum* (9.7, 0.0), *Homoranthus virgatus* (9.7, 0.0), *Styphelia viridis* (9.7, 0.0), *Xanthorrhoea johnsonii* (9.7, 30.0), *Acrotriche aggregata* (6.5, 0.0), *Caustis blakei* subsp. *blakei* (6.5, 25.0), *Caustis flexuosa* (6.5, 0.0), *Cissus hypoglauca* (6.5, 4.6), *Conospermum taxifolium* (6.5, 0.0), *Haemodorum austroqueenslandicum* (6.5, 1.0), *Hibbertia scandens* (6.5, 1.0), *Hibbertia vestita* (6.5, 1.0), *Lomatia silaifolia* (6.5, 0.0), *Lophostemon confertus* (6.5, 0.0), *Ochrosperma lineare* (6.5, 0.0), *Pseudanthus orientalis* (6.5, 0.0), *Schoenus brevifolius* (6.5, 0.0), *Woolfsia pungens* (6.5, 0.0), *Acacia oshanesii* (3.2, 0.0), *Acianthus fornicatus* (3.2, 0.4), *Araujia sericifera** (3.2, 0.0), *Austrocallerya megasperma* (3.2, 0.0), *Banksia aemula* (3.2, 0.0), *Billardiera scandens* (3.2, 0.0), *Blechnum cartilagineum* (3.2, 2.0), *Breynia oblongifolia* (3.2, 0.0), *Brunoniella australis* (3.2, 0.0), *Calochlaena dubia* (3.2, 1.0), *Commelina ensifolia* (3.2, 0.0), *Cordylina rubra* (3.2, 0.0), *Denhamia celastroides* (3.2, 0.0), *Dianella crinoides* (3.2, 0.0), *Dillwynia retorta* (3.2, 0.0), *Dioscorea transversa* (3.2, 0.0), *Eucalyptus pilularis* (3.2, 0.4), *Eupomatia laurina* (3.2, 1.0), *Flagellaria indica* (3.2, 0.0), *Gahnia clarkei* (3.2, 0.0), *Galactia tenuiflora* (3.2, 0.0), *Geitonoplesium cymosum* (3.2, 0.0), *Glycine tomentella* (3.2, 0.0), *Gymnostachys anceps* (3.2, 0.0), *Hibbertia aspera* (3.2, 0.0), *Hibbertia linearis* var. *floribunda* (3.2, 1.0), *Hovea acutifolia* (3.2, 0.0), *Laxmannia gracilis* (3.2, 1.0), *Leichhardtia fraseri* (3.2, 0.2), *Lomandra filiformis* (3.2, 0.2), *Lomandra laxa* (3.2, 0.0), *Lomandra spicata* (3.2, 0.0), *Palmeria scandens* (3.2, 0.0), *Patersonia sericea* (3.2, 0.2), *Petrophile canescens* (3.2, 0.0), *Pimelea linifolia* subsp. *linifolia* (3.2, 0.0), *Piper hederaceum* (3.2, 0.0), *Planchonella chartacea* (3.2, 0.0), *Platylobium formosum* (3.2, 0.0), *Platysace lanceolata* (3.2, 0.4), *Pultenaea paleacea* (3.2, 0.0), *Schizaea dichotoma* (3.2, 0.0), *Scleria sphacelata* (3.2, 3.0), *Styphelia deformis* (3.2, 0.0), *Tabernaemontana pandacaqui* (3.2, 0.0), *Tetrastigma nitens* (3.2, 0.0), *Tetratheca thymifolia* (3.2, 0.0), *Tricoryne anceps* subsp. *pteroaulon* (3.2, 2.0), *Tricoryne elatior* (3.2, 1.0), *Trochocarpa laurina* (3.2, 2.0), *Trophis scandens* subsp. *scandens* (3.2, 0.0), *Xanthorrhoea latifolia* subsp. *latifolia* (3.2, 2.0), *Xanthorrhoea macronema* (3.2, 1.4), *Zieria laxiflora* (3.2, 0.0), *Zieria minutiflora* (3.2, 1.0)

Species list: Frequency (percent of total sites) and cover (average of species cover across sites where that species is present). Ordered by decreasing frequency. Naturalised species have an asterisk (*) after the name. indet. after listed name if indeterminate species or genus.

12.2.9: Banksia aemula low open woodland on dunes and sand plains. Usually deeply leached soils



Mapping data	Pre-clearing area = 59,740.1 ha; Remnant area 2019 = 56,714.5 ha; Remnant percent remaining in 2019 = 94.9 %
Species richness	total: 189 (34 sites); woody: 105 (34 sites); ground: 145 (27 sites); average spp./site: 28.1, standard deviation: 8.7 (28 sites)
Basal area	average/site: 9.0 m ² /ha; range: 1.0 - 31.5 m ² /ha; std. deviation: 6.9; (29 sites)
Ecological dominant layer (EDL) height	stratum: tree 1; average/site: 5.89m; range: 2.20 - 10.00m; (29 sites)
Ecological dominant layer (EDL) Crown Cover	stratum: tree 1; average: 25.4%; range: 6.0 - 96.4%; (29 sites)
Structural formation	Low Open Woodland: 52.9 %; Low Woodland: 23.5 %; Low Closed Forest: 5.9 %; Open Shrubland: 2.9 %; Tall Open Shrubland: 2.9 %; Shrubland: 2.9 %; Tall Shrubland: 2.9 %; Herbland: 2.9 %; No Data: 2.9 %; (34 sites)
Representative site(s)	1840, 1843, 1857, 2016, 2438, 2457, 2626, 3044, 3067, 3096, 3255, 3257, 4371, 4475, 4478, 5170, 9161, 11896, 12103, 13575, 13704, 14147, 14983, 16747, 17157, 17516, 17518, 17627, 17628, 17735, 18086, 18143, 18254, 18286

Stratum: Emergent

Height: average: 8.16m; range: 5.00 - 11.00m; (5 sites)

Crown Cover: average: 2.5%; range: 0.0 - 5.0%; (5 sites)

Stem Count: average: 70 stems/ha; range: 70 - 70 stems/ha; std. deviation: 0.0 stems/ha; (1 site)

Basal area: average: 2.1 m²/ha; range: 1.0 - 3.5 m²/ha; std. deviation: 1.1 m²/ha; (4 sites)

Species list (frequency (%), average cover (%)):

Most frequent species (up to 6):

Eucalyptus racemosa subsp. racemosa (8.8, 4.2), *Eucalyptus robusta* (2.9, 3.0), *Banksia aemula* (2.9, 1.0), *Syncarpia hillii* (2.9, 0.0),

Additional species:

Stratum: Tree 1 (EDL)

Height: average: 5.89m; range: 2.20 - 10.00m; (29 sites)

Crown Cover: average: 25.4%; range: 6.0 - 96.4%; (29 sites)

Stem Count: average: 1,190 stems/ha; range: 60 - 4,400 stems/ha; std. deviation: 1,219.1 stems/ha; (20 sites)

Basal area: average: 7.9 m²/ha; range: 1.0 - 31.5 m²/ha; std. deviation: 6.4 m²/ha; (28 sites)

Species list (frequency (%), average cover (%)):

Most frequent species (up to 6):

Banksia aemula (82.4, 16.4), *Leptospermum trinervium* (29.4, 7.0), *Allocasuarina littoralis* (17.6, 15.2), *Corymbia intermedia* (17.6, 8.1), *Melaleuca quinquenervia* (11.8, 7.0), *Eucalyptus latisinensis* (11.8, 4.8)

Additional species:

Eucalyptus racemosa subsp. racemosa (8.8, 3.4), *Lophostemon confertus* (5.9, 8.0), *Eucalyptus robusta* (5.9, 7.0), *Leptospermum semibaccatum* (2.9, 19.4), *Corymbia gummifera* (2.9, 18.0), *Acacia penninervis* (2.9, 15.0), *Acacia flavescens* (2.9, 3.0), *Conospermum taxifolium* (2.9, 0.5), *Leptospermum polygalifolium* (2.9, 0.5), *Micromyrtus littoralis* (2.9, 0.5), *Cassytha pubescens* (2.9, 0.0), *Lophostemon suaveolens* (2.9, 0.0)

Stratum: Tree 2

Height: average: 3.50m; range: 3.00 - 4.00m; (3 sites)

Crown Cover: average: 23.8%; range: 5.0 - 45.0%; (3 sites)

Stem Count: average: 320 stems/ha; range: 320 - 320 stems/ha; std. deviation: 0.0 stems/ha; (1 site)

Basal area: average: 3.7 m²/ha; range: 2.0 - 7.0 m²/ha; std. deviation: 2.9 m²/ha; (3 sites)

Species list (frequency (%), average cover (%)):

Most frequent species (up to 6):

Banksia aemula (8.8, 11.9), *Leptospermum trinervium* (5.9, 10.5), *Allocasuarina littoralis* (2.9, 7.6), *Leptospermum polygalifolium* (2.9, 5.0), *Eucalyptus latisinensis* (2.9, 2.0), *Eucalyptus racemosa subsp. racemosa* (2.9, 0.0)

Additional species:

Stratum: Shrub 1

Height: average: 1.71m; range: 0.50 - 4.00m; (34 sites)

Crown Cover: average: 31.4%; range: 1.2 - 89.0%; (34 sites)

Stem Count: average: 21,403 stems/ha; range: 20 - 86,000 stems/ha; std. deviation: 28,760.2 stems/ha; (16 sites)

Basal area: average: 4.0 m²/ha; range: 1.0 - 12.0 m²/ha; std. deviation: 4.5 m²/ha; (5 sites)

Species list (frequency (%), average cover (%)):

Most frequent species (up to 6):

Banksia aemula (76.5, 6.9), *Leptospermum polygalifolium* (38.2, 16.6), *Phebalium woombye* (35.3, 6.6), *Leptospermum semibaccatum* (32.4, 8.3), *Baeckea frutescens* (29.4, 3.7), *Styphelia leptospermoides* (26.5, 4.3)

Additional species:

Monotoca scoparia (26.5, 2.6), *Homoranthus virgatus* (26.5, 2.1), *Ochrosperma lineare* (26.5, 1.9), *Allocasuarina littoralis* (26.5, 1.8), *Gompholobium virgatum* (26.5, 1.4), *Ricinocarpos pinifolius* (23.5, 4.6), *Leptospermum trinervium* (23.5, 4.6), *Strangea linearis* (23.5, 4.2), *Acacia suaveolens* (23.5, 1.9), *Conospermum taxifolium* (23.5, 1.2), *Phyllota phyllicoides* (20.6, 8.9), *Xanthorrhoea johnsonii* (20.6, 8.1), *Melaleuca nodosa* (20.6, 7.9), *Zieria laxiflora* (20.6, 3.7), *Acacia ulicifolia* (20.6, 1.6), *Aotus lanigera* (17.6, 8.5), *Persoonia virgata* (17.6, 1.0), *Eucalyptus latisinensis* (14.7, 3.6), *Leptospermum whitei* (14.7, 3.0), *Monotoca sp. (Fraser Island P. Baxter 777)* (11.8, 7.3), *Dillwynia retorta* (11.8, 5.7), *Woollisia pungens* (11.8, 4.6), *Dillwynia floribunda* (11.8, 4.0), *Hibbertia linearis* (11.8, 0.8), *Epacris pulchella* (11.8, 0.6), *Leptomeria acida* (11.8, 0.6), *Melaleuca quinquenervia* (11.8, 0.6), *Olax retusa* (11.8, 0.6), *Micromyrtus littoralis* (8.8, 7.5), *Aotus ericoides* (8.8, 3.3), *Boronia falcifolia* (8.8, 2.9), *Leucopogon pimeleoides* (8.8, 1.2), *Cassytha pubescens* (8.8, 1.0), *Styphelia deformis* (8.8, 1.0), *Acacia quadrilateralis* (8.8, 0.8), *Brachyloma daphnoides* (8.8, 0.5), *Bossiaea heterophylla* (8.8, 0.1), *Corymbia intermedia* (8.8, 0.0), *Pseudanthus orientalis* (8.8, 0.0), *Dodonaea triquetra* (5.9, 10.0), *Austromyrtus dulcis* (5.9, 7.7), *Styphelia margarodes* (5.9, 2.2), *Platysace linearifolia* (5.9, 1.8), *Petrophile shirleyae* (5.9, 1.1), *Elaeocarpus reticulatus* (5.9, 1.0), *Banksia oblongifolia* (5.9, 0.5), *Hibbertia linearis var. floribunda* (5.9, 0.2), *Banksia integrifolia* (5.9, 0.0), *Brachyloma scortechinii* (5.9,

0.0), *Cassytha filiformis* (5.9, 0.0), *Pimelea linifolia* (5.9, 0.0), *Tetradlea thymifolia* (5.9, 0.0), *Melaleuca sieberi* (2.9, 10.0), *Acronychia imperforata* (2.9, 5.4), *Acrotriche aggregata* (2.9, 5.0), *Lophostemon confertus* (2.9, 5.0), *Boronia rosmarinifolia* (2.9, 4.2), *Hibbertia* (2.9, 2.0), *Eriostemon australasius* (2.9, 1.2), *Astrotricha longifolia* (2.9, 1.0), *Acacia leiocalyx subsp. leiocalyx* (2.9, 0.6), *Bossiaea ensata* (2.9, 0.4), *Acacia disparrima subsp. disparrima* (2.9, 0.2), *Acacia baueri subsp. baueri* (2.9, 0.0), *Acacia concurrens* (2.9, 0.0), *Acacia hubbardiana* (2.9, 0.0), *Baeckea imbricata* (2.9, 0.0), *Daviesia umbellulata* (2.9, 0.0), *Dendrophthoe glabrescens* (2.9, 0.0), *Eucalyptus racemosa subsp. racemosa* (2.9, 0.0), *Eucalyptus robusta* (2.9, 0.0), *Hibbertia acicularis* (2.9, 0.0), *Hibbertia scandens* (2.9, 0.0), *Jacksonia stackhousei* (2.9, 0.0), *Leucopogon virgatus* (2.9, 0.0), *Mirbelia rubifolia* (2.9, 0.0), *Parsonia straminea* (2.9, 0.0), *Patersonia fragilis* (2.9, 0.0), *Philotheca queenslandica* (2.9, 0.0), *Platysace ericoides* (2.9, 0.0), *Psychotria loniceroides* (2.9, 0.0), *Sprengelia sprengelioides* (2.9, 0.0), *Xanthorrhoea fulva* (2.9, 0.0), *Xanthosia pilosa* (2.9, 0.0)

Stratum: Shrub 2

Height: average: 0.69m; range: 0.50 - 2.00m; (20 sites)

Crown Cover: average: 35.7%; range: 1.0 - 72.0%; (18 sites)

Stem Count: average: 1,810 stems/ha; range: 20 - 3,600 stems/ha; std. deviation: 2,531.4 stems/ha; (2 sites)

Basal area: No data available.

Species list (frequency (%), average cover (%)):

Most frequent species (up to 6):

Styphelia leptospermoides (35.3, 3.1), *Phyllota phyllicoides* (26.5, 10.2), *Ochrosperma lineare* (20.6, 1.3), *Strangea linearis* (20.6, 1.2), *Banksia aemula* (17.6, 12.3), *Xanthorrhoea johnsonii* (17.6, 8.0)

Additional species:

Leptospermum semibaccatum (14.7, 14.1), *Leptospermum polygalifolium* (14.7, 8.6), *Ricinocarpos pinifolius* (14.7, 3.7), *Micromyrtus littoralis* (11.8, 7.5), *Baeckea frutescens* (11.8, 2.5), *Boronia rosmarinifolia* (8.8, 15.0), *Aotus lanigera* (8.8, 10.2), *Eucalyptus latisinensis* (8.8, 7.7), *Woolfsia pungens* (8.8, 4.5), *Monotoca scoparia* (8.8, 4.2), *Acacia ulicifolia* (8.8, 3.0), *Dillwynia floribunda* (8.8, 3.0), *Phebalium woombye* (8.8, 2.5), *Leptospermum trinervium* (8.8, 2.0), *Homoranthus virgatus* (8.8, 0.7), *Platysace linearifolia* (5.9, 10.2), *Leucopogon pimeleoides* (5.9, 5.0), *Epacris pulchella* (5.9, 4.5), *Pimelea linifolia* (5.9, 2.5), *Styphelia deformis* (5.9, 1.5), *Brachyloma daphnoides* (5.9, 1.3), *Hibbertia linearis* (5.9, 1.0), *Zieria laxiflora* (5.9, 0.8), *Persoonia virgata* (5.9, 0.5), *Corymbia intermedia* (5.9, 0.0), *Baeckea* (2.9, 10.0), *Sprengelia sprengelioides* (2.9, 5.0), *Banksia oblongifolia* (2.9, 2.0), *Boronia* (2.9, 2.0), *Conospermum taxifolium* (2.9, 2.0), *Epacris microphylla* (2.9, 2.0), *Hibbertia acicularis* (2.9, 2.0), *Petrophile shirleyae* (2.9, 2.0), *Pseudanthus orientalis* (2.9, 1.4), *Acacia quadrilateralis* (2.9, 1.0), *Allocasuarina littoralis* (2.9, 1.0), *Brachyloma scortechinii* (2.9, 1.0), *Hibbertia fasciculata* (2.9, 1.0), *Hibbertia linearis var. floribunda* (2.9, 1.0), *Hibbertia vestita* (2.9, 1.0), *Monotoca sp. (Fraser Island P.Baxter 777)* (2.9, 1.0), *Persoonia stradbokensis* (2.9, 1.0), *Platysace ericoides* (2.9, 1.0), *Xanthorrhoea latifolia subsp. latifolia* (2.9, 1.0), *Jacksonia stackhousei* (2.9, 0.6), *Leucopogon virgatus* (2.9, 0.5), *Styphelia ericoides* (2.9, 0.4), *Austromyrtus dulcis* (2.9, 0.0), *Cassytha pubescens* (2.9, 0.0), *Dillwynia retorta* (2.9, 0.0), *Elaeocarpus reticulatus* (2.9, 0.0), *Exocarpos cupressiformis* (2.9, 0.0), *Gompholobium virgatum* (2.9, 0.0), *Hibbertia scandens* (2.9, 0.0), *Leichhardtia fraseri* (2.9, 0.0)

Stratum: Ground

Height: average: 0.52m; range: 0.10 - 1.20m; (28 sites)

Projective foliage cover (PFC): average: 23.8%; range: 0.0 - 59.0%; (27 sites)

Species list (frequency (%), average cover (%)):

Grass - perennial:

Most frequent species (up to 6):

Entolasia stricta (14.3, 2.5), *Eriachne glabrata* (7.1, 1.0), *Eriachne pallescens* (7.1, 0.0), *Themeda triandra* (7.1, 10.0), *Triodia marginata* (7.1, 12.5), *Aristida warburgii* (3.6, 0.0)

Additional species:

Entolasia whiteana (3.6, 0.0), *Eriachne mucronata* (3.6, 0.0), *Imperata cylindrica* (3.6, 1.0), *Melinis minutiflora** (3.6, 1.0), *Paspalidium* (3.6, 0.0), *Paspalidium gausum* (3.6, 0.0)

Grass - annual/biennial:

Not present

Forbs & other:

Most frequent species (up to 6):

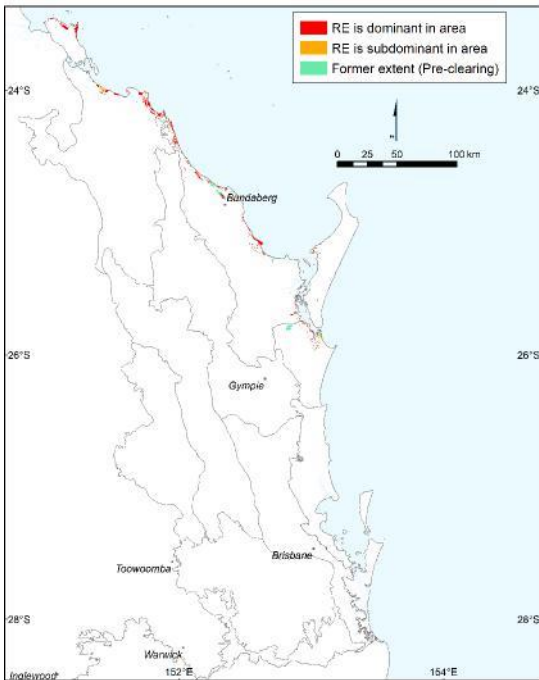
Caustis recurvata (78.6, 4.9), *Pimelea linifolia* (46.4, 1.5), *Pseudanthus orientalis* (35.7, 1.0), *Coleocarya gracilis* (28.6, 11.0), *Baloskion pallens* (25.0, 5.8), *Bossiaea heterophylla* (25.0, 0.0)

Additional species:

Persoonia virgata (25.0, 0.5), *Xanthorrhoea johnsonii* (25.0, 8.7), *Cassytha filiformis* (21.4, 10.0), *Cassytha pubescens* (21.4, 2.0), *Ricinocarpos pinifolius* (21.4, 18.8), *Xanthorrhoea fulva* (21.4, 6.5), *Homoranthus virgatus* (17.9, 0.0), *Lomandra elongata* (17.9, 2.2), *Patersonia sericea* var. *sericea* (17.9, 0.4), *Pteridium esculentum* (17.9, 0.0), *Schoenus calostachyus* (17.9, 1.2), *Schoenus ornithopodioides* (17.9, 1.7), *Zieria laxiflora* (17.9, 0.0), *Allocasuarina littoralis* (14.3, 0.6), *Baloskion tenuiculme* (14.3, 2.3), *Hibbertia acicularis* (14.3, 0.2), *Jacksonia stackhousei* (14.3, 0.0), *Ochrosperma lineare* (14.3, 0.0), *Boronia rosmarinifolia* (10.7, 2.0), *Burchardia umbellata* (10.7, 0.5), *Cassytha glabella* forma *glabella* (10.7, 1.0), *Comesperma defoliatum* (10.7, 1.0), *Empodisma minus* (10.7, 4.0), *Gompholobium virgatum* (10.7, 0.2), *Hibbertia linearis* var. *floribunda* (10.7, 0.0), *Laxmannia gracilis* (10.7, 0.4), *Lomandra confertifolia* subsp. *pallida* (10.7, 6.3), *Lomandra filiformis* subsp. *filiformis* (10.7, 0.0), *Lomandra multiflora* subsp. *multiflora* (10.7, 0.0), *Monotoca scoparia* (10.7, 0.0), *Phebalium woombye* (10.7, 1.4), *Platysace ericoides* (10.7, 4.4), *Platysace linearifolia* (10.7, 0.0), *Schizaea bifida* (10.7, 0.0), *Selaginella uliginosa* (10.7, 0.0), *Strangea linearis* (10.7, 0.0), *Styphelia leptospermoides* (10.7, 2.0), *Styphelia margarodes* (10.7, 0.0), *Acacia quadrilateralis* (7.1, 0.0), *Alphitonia excelsa* (7.1, 0.0), *Austromyrtus dulcis* (7.1, 0.0), *Baeckea frutescens* (7.1, 0.0), *Baloskion tetraphyllum* subsp. *meiostachyum* (7.1, 0.5), *Bossiaea ensata* (7.1, 4.0), *Caustis blakei* subsp. *blakei* (7.1, 4.4), *Chordifex fastigiatus* (7.1, 48.5), *Conospermum taxifolium* (7.1, 0.0), *Gahnia sieberiana* (7.1, 4.0), *Hibbertia linearis* var. *obtusifolia* (7.1, 5.0), *Lepidosperma laterale* (7.1, 2.0), *Leptocarpus tenax* (7.1, 0.8), *Monotoca* sp. (*Fraser Island P. Baxter 777*) (7.1, 0.0), *Patersonia glabrata* (7.1, 0.0), *Pimelea linifolia* subsp. *collina* (7.1, 0.0), *Schizaea dichotoma* (7.1, 0.0), *Sowerbaea juncea* (7.1, 0.2), *Sporadanthus interruptus* (7.1, 2.6), *Trachystylis stradbrokeensis* (7.1, 0.0), *Xyris juncea* (7.1, 0.0), *Acacia baueri* subsp. *baueri* (3.6, 0.0), *Acacia concurrens* (3.6, 0.0), *Acacia disparrima* subsp. *disparrima* (3.6, 0.0), *Acacia ulicifolia* (3.6, 0.0), *Aotus ericoides* (3.6, 20.0), *Aotus lanigera* (3.6, 0.0), *Astrotricha longifolia* (3.6, 0.0), *Banksia aemula* (3.6, 0.0), *Banksia oblongifolia* (3.6, 0.0), *Boronia falcifolia* (3.6, 0.0), *Brachyloma daphnoides* (3.6, 0.0), *Brachyloma scortechinii* (3.6, 0.0), *Commelina lanceolata* (3.6, 0.0), *Corunastylis conferta* (3.6, 0.0), *Corymbia intermedia* (3.6, 0.0), *Corymbia torelliana* (3.6, 0.0), *Cupaniopsis anacardioides* (3.6, 0.0), *Cyperus* (3.6, 0.5), *Dianella caerulea* (3.6, 0.0), *Dillwynia floribunda* (3.6, 0.0), *Drosera hookeri* (3.6, 0.0), *Drosera lunata* (3.6, 0.2), *Epacris pulchella* (3.6, 0.0), *Eucalyptus latisinensis* (3.6, 0.0), *Eucalyptus racemosa* subsp. *racemosa* (3.6, 0.0), *Gahnia clarkei* (3.6, 5.0), *Glochidion ferdinandi* (3.6, 0.0), *Gonocarpus micranthus* (3.6, 0.0), *Goodenia* (3.6, 0.0), *Hakea actites* (3.6, 0.0), *Heptapleurum actinophyllum* (3.6, 0.0), *Hibbertia linearis* (3.6, 0.0), *Hibbertia vestita* (3.6, 1.6), *Laxmannia compacta* (3.6, 0.0), *Leichhardtia fraseri* (3.6, 0.0), *Leptospermum polygalifolium* (3.6, 0.0), *Leptospermum semibaccatum* (3.6, 10.0), *Leptospermum trinervium* (3.6, 0.0), *Leptospermum whitei* (3.6, 0.0), *Lomandra longifolia* (3.6, 15.0), *Macarthuria complanata* (3.6, 0.0), *Machaerina muelleri* (3.6, 0.0), *Melaleuca quinquenervia* (3.6, 0.0), *Micromyrtus littoralis* (3.6, 0.0), *Mitrasacme paludosa* (3.6, 0.0), *Monotaxis macrophylla* (3.6, 0.0), *Opuntia stricta** (3.6, 0.0), *Parsonia straminea* (3.6, 0.0), *Patersonia sericea* (3.6, 0.0), *Petrophile shirleyae* (3.6, 0.0), *Philothea queenslandica* (3.6, 0.0), *Phyllota phyllicoides* (3.6, 0.0), *Pimelea linifolia* subsp. *linifolia* (3.6, 0.0), *Pomax umbellata* (3.6, 15.0), *Restio** (3.6, 2.0), *Restionaceae** (3.6, 5.0), *Sansevieria trifasciata** (3.6, 0.0), *Schoenus brevifolius* (3.6, 4.4), *Schoenus melanostachys* (3.6, 2.0), *Schoenus nitens* (3.6, 1.0), *Solanum seaforthianum** (3.6, 0.0), *Stylidium debile* (3.6, 0.0), *Stylidium graminifolium* (3.6, 0.0), *Stylidium ornatum* (3.6, 0.2), *Syagrus romanzoffiana** (3.6, 0.0), *Tricoryne anceps* (3.6, 0.0), *Tricoryne elatior* (3.6, 0.0), *Xyris complanata* (3.6, 0.0)

Species list: Frequency (percent of total sites) and cover (average of species cover across sites where that species is present). Ordered by decreasing frequency. Naturalised species have an asterisk (*) after the name. indet. after listed name if indeterminate species or genus.

12.2.11: *Corymbia tessellaris* +/- *Eucalyptus tereticornis*, *C. intermedia* and *Livistona decora* woodland on beach ridges in northern half of bioregion



Mapping data	Pre-clearing area = 27,827.9 ha; Remnant area 2019 = 20,559.2 ha; Remnant percent remaining in 2019 = 73.9 %
Species richness	total: 309 (37 sites); woody: 151 (34 sites); ground: 215 (25 sites); average spp./site: 36.9, standard deviation: 9.2 (25 sites)
Basal area	average/site: 19.3 m ² /ha; range: 1.0 - 47.0 m ² /ha; std. deviation: 9.4; (37 sites)
Ecological dominant layer (EDL) height	stratum: tree 1; average/site: 18.35m; range: 6.00 - 26.00m; (36 sites)
Ecological dominant layer (EDL) Crown Cover	stratum: tree 1; average: 41.6%; range: 1.0 - 95.0%; (36 sites)
Structural formation	Woodland: 43.2 %; Open Forest: 27.0 %; Open Woodland: 13.5 %; Tall Open Shrubland: 2.7 %; Low Woodland: 2.7 %; Tall Woodland: 2.7 %; Low Open Forest: 2.7 %; Low Closed Forest: 2.7 %; Tall Open Woodland: 2.7 %; (37 sites)
Representative site(s)	1837, 1842, 2019, 2020, 2021, 2022, 2220, 2301, 2538, 2539, 2542, 2544, 2625, 2893, 3058, 3097, 3101, 3158, 3418, 3532, 3536, 3720, 3980, 12105, 12571, 12574, 12870, 12977, 14202, 14203, 14431, 14573, 14797, 15692, 16102, 18281, 18282

Stratum: Emergent

Height: average: 21.00m; range: 20.00 - 22.00m; (2 sites)

Crown Cover: average: 2.5%; range: 2.5 - 2.5%; (1 site)

Stem Count: No data available.

Basal area: No data available.

Species list (frequency (%), average cover (%)):

Most frequent species (up to 6):

Callitris columellaris (2.7, 2.5),

Additional species:

Stratum: Tree 1 (EDL)

Height: average: 18.35m; range: 6.00 - 26.00m; (36 sites)

Crown Cover: average: 41.6%; range: 1.0 - 95.0%; (36 sites)

Stem Count: average: 512 stems/ha; range: 60 - 4,700 stems/ha; std. deviation: 979.2 stems/ha; (23 sites)

Basal area: average: 13.2 m²/ha; range: 6.0 - 24.0 m²/ha; std. deviation: 5.3 m²/ha; (36 sites)

Species list (frequency (%), average cover (%)):

Most frequent species (up to 6):

Corymbia tessellaris (70.3, 15.1), *Corymbia intermedia* (56.8, 17.6), *Eucalyptus tereticornis* (40.5, 8.9), *Melaleuca dealbata* (27.0, 8.8), *Acacia disparrima subsp. disparrima* (24.3, 6.1), *Callitris columellaris* (16.2, 12.3)

Additional species:

Banksia integrifolia (16.2, 7.4), *Livistona decora* (16.2, 3.4), *Melaleuca quinquenervia* (13.5, 13.0), *Lophostemon suaveolens* (10.8, 11.0), *Pleiogynium timorense* (10.8, 9.0), *Lophostemon confertus* (8.1, 11.3), *Acacia julifera* (5.4, 77.0), *Cupaniopsis anacardioides* (5.4, 4.0), *Eucalyptus crebra* (5.4, 4.0), *Leptospermum neglectum* (5.4, 1.0), *Archontophoenix cunninghamiana* (2.7, 13.0), *Melicope elleryana* (2.7, 13.0), *Banksia serrata* (2.7, 10.0), *Eucalyptus racemosa subsp. racemosa* (2.7, 10.0), *Drypetes deplanchei* (2.7, 5.0), *Grevillea banksii* (2.7, 5.0), *Sterculia quadrifida* (2.7, 5.0), *Polyscias elegans* (2.7, 3.0), *Allocasuarina littoralis* (2.7, 1.0), *Alphitonia excelsa* (2.7, 1.0), *Angophora leiocarpa* (2.7, 1.0), *Bridelia leichhardtii* (2.7, 1.0), *Casuarina glauca* (2.7, 1.0), *Acacia flavescens* (2.7, 0.0), *Acronychia imperforata* (2.7, 0.0), *Cymbidium suave* (2.7, 0.0)

Stratum: Tree 2

Height: average: 10.02m; range: 4.00 - 16.00m; (31 sites)

Crown Cover: average: 20.9%; range: 1.2 - 90.0%; (34 sites)

Stem Count: average: 450 stems/ha; range: 10 - 2,400 stems/ha; std. deviation: 597.0 stems/ha; (21 sites)

Basal area: average: 6.3 m²/ha; range: 1.1 - 26.0 m²/ha; std. deviation: 6.0 m²/ha; (31 sites)

Species list (frequency (%), average cover (%)):

Most frequent species (up to 6):

Acacia disparrima subsp. disparrima (43.2, 8.6), *Corymbia tessellaris* (37.8, 3.4), *Banksia integrifolia* (37.8, 1.8), *Corymbia intermedia* (29.7, 9.9), *Polyscias elegans* (21.6, 2.2), *Acronychia imperforata* (18.9, 6.7)

Additional species:

Melaleuca quinquenervia (13.5, 7.0), *Melaleuca dealbata* (13.5, 4.8), *Acacia flavescens* (13.5, 2.4), *Planchonia careya* (13.5, 2.0), *Callitris columellaris* (10.8, 6.8), *Livistona decora* (10.8, 3.0), *Alphitonia excelsa* (10.8, 2.8), *Lophostemon suaveolens* (10.8, 2.4), *Leptospermum neglectum* (10.8, 1.8), *Ficus rubiginosa* (10.8, 0.7), *Huberantha nitidissima* (8.1, 10.0), *Cryptocarya triplinervis* (8.1, 4.7), *Petalostigma pubescens* (8.1, 3.8), *Acacia julifera* (8.1, 2.0), *Pleiogynium timorense* (8.1, 0.8), *Jagera pseudorhus var. pseudorhus* (5.4, 18.0), *Cupaniopsis anacardioides* (5.4, 6.2), *Diospyros fasciculosa* (5.4, 5.5), *Glochidion lobocarpum* (5.4, 4.0), *Exocarpos latifolius* (5.4, 3.0), *Cissus hypoglauca* (5.4, 2.5), *Eucalyptus tereticornis* (5.4, 1.0), *Denhamia celastroides* (5.4, 0.8), *Halfordia kendack* (5.4, 0.8), *Glochidion ferdinandi var. ferdinandi* (5.4, 0.0), *Archontophoenix cunninghamiana* (2.7, 35.0), *Dodonaea viscosa subsp. burmanniana* (2.7, 20.0), *Melicope elleryana* (2.7, 20.0), *Acmena hemilampra* (2.7, 10.0), *Euroschinus falcatus* (2.7, 7.0), *Banksia aemula* (2.7, 6.0), *Acacia leiocalyx subsp. leiocalyx* (2.7, 5.0), *Piper hederaceum* (2.7, 4.0), *Syzygium australe* (2.7, 4.0), *Acmena smithii* (2.7, 3.0), *Alectryon coriaceus* (2.7, 3.0), *Parsonsia straminea* (2.7, 3.0), *Bridelia leichhardtii* (2.7, 2.5), *Acacia leptocarpa* (2.7, 2.0), *Banksia integrifolia subsp. integrifolia* (2.7, 2.0), *Cyclophyllum coprosmoides* (2.7, 2.0), *Elaeocarpus obovatus* (2.7, 2.0), *Glochidion sumatranum* (2.7, 2.0), *Grevillea banksii* (2.7, 2.0), *Syzygium johnsonii* (2.7, 2.0), *Capparis arborea* (2.7, 1.0), *Emmenosperma cunninghamii* (2.7, 1.0), *Eucalyptus crebra* (2.7, 1.0), *Harpullia hillii* (2.7, 1.0), *Olea paniculata* (2.7, 1.0), *Passiflora suberosa** (2.7, 1.0), *Psydrax odorata* (2.7, 1.0), *Sterculia quadrifida* (2.7, 1.0), *Trophis scandens subsp. scandens* (2.7, 1.0), *Celtis paniculata* (2.7, 0.5), *Pleogyne australis* (2.7, 0.5), *Pyrrosia rupestris* (2.7, 0.2), *Allocasuarina littoralis* (2.7, 0.0), *Banksia serrata* (2.7, 0.0), *Drypetes deplanchei* (2.7, 0.0), *Jacksonia scoparia* (2.7, 0.0), *Jasminum didymum subsp. didymum* (2.7, 0.0), *Melaleuca nervosa* (2.7, 0.0), *Monotoca sp. (Fraser Island P.Baxter 777)* (2.7, 0.0), *Planchonella chartacea* (2.7, 0.0), *Platyterium bifurcatum* (2.7, 0.0)

Stratum: Tree 3

Height: average: 5.73m; range: 2.00 - 9.00m; (15 sites)

Crown Cover: average: 15.0%; range: 0.0 - 65.0%; (20 sites)

Stem Count: average: 411 stems/ha; range: 20 - 2,680 stems/ha; std. deviation: 859.3 stems/ha; (11 sites)

Basal area: average: 2.4 m²/ha; range: 1.0 - 5.0 m²/ha; std. deviation: 1.4 m²/ha; (7 sites)

Species list (frequency (%), average cover (%)):

Most frequent species (up to 6): *Acacia disparrima* subsp. *disparrima* (29.7, 11.7), *Banksia integrifolia* (29.7, 1.0), *Alphitonia excelsa* (24.3, 3.1), *Corymbia tessellaris* (16.2, 2.0), *Corymbia intermedia* (13.5, 6.0), *Acacia flavescens* (13.5, 3.0)

Additional species:

Acacia julifera (10.8, 3.0), *Callitris columellaris* (10.8, 0.0), *Acronychia imperforata* (8.1, 4.0), *Psydrax odorata* (8.1, 3.3), *Polyscias elegans* (8.1, 3.0), *Petalostigma pubescens* (8.1, 2.5), *Jacksonia scoparia* (8.1, 1.5), *Planchonia careya* (8.1, 1.5), *Cupaniopsis anacardioides* (8.1, 1.0), *Leptospermum neglectum* (8.1, 1.0), *Diospyros fasciculosa* (5.4, 8.0), *Livistona decora* (5.4, 6.0), *Acacia leiocalyx* subsp. *leiocalyx* (5.4, 5.5), *Cyclophyllum coprosmoides* (5.4, 3.0), *Melaleuca dealbata* (5.4, 2.0), *Arytera divaricata* (5.4, 1.0), *Diospyros geminata* (5.4, 1.0), *Drypetes deplanchei* (5.4, 1.0), *Glochidion lobocarpum* (5.4, 1.0), *Monotoca* sp. (Fraser Island P.Baxter 777) (2.7, 51.0), *Dodonaea viscosa* subsp. *burmanniana* (2.7, 8.0), *Banksia aemula* (2.7, 5.0), *Allocasuarina littoralis* (2.7, 1.0), *Banksia integrifolia* subsp. *integrifolia* (2.7, 1.0), *Bridelia leichhardtii* (2.7, 1.0), *Capparis arborea* (2.7, 1.0), *Emmenosperma cunninghamii* (2.7, 1.0), *Eucalyptus crebra* (2.7, 1.0), *Ficus opposita* (2.7, 1.0), *Grevillea banksii* (2.7, 1.0), *Lophostemon suaveolens* (2.7, 1.0), *Passiflora suberosa** (2.7, 1.0), *Psychotria loniceroides* (2.7, 1.0), *Pteridium esculentum* (2.7, 1.0), *Sterculia quadrifida* (2.7, 1.0), *Alyxia ruscifolia* (2.7, 0.0), *Breynia oblongifolia* (2.7, 0.0), *Cryptocarya triplinervis* (2.7, 0.0), *Eucalyptus tereticomis* (2.7, 0.0), *Hibbertia scandens* (2.7, 0.0), *Jagera pseudorhus* var. *pseudorhus* (2.7, 0.0), *Myrsine variabilis* (2.7, 0.0), *Pleogyne australis* (2.7, 0.0)

Stratum: Shrub 1

Height: average: 2.38m; range: 0.50 - 4.50m; (33 sites)

Crown Cover: average: 11.9%; range: 0.0 - 62.0%; (35 sites)

Stem Count: average: 1,617 stems/ha; range: 20 - 6,400 stems/ha; std. deviation: 2,294.4 stems/ha; (15 sites)

Basal area: average: 2.7 m²/ha; range: 1.0 - 5.0 m²/ha; std. deviation: 1.6 m²/ha; (10 sites)

Species list (frequency (%), average cover (%)):

Most frequent species (up to 6):

Acacia disparrima subsp. *disparrima* (54.1, 3.7), *Acacia flavescens* (35.1, 2.0), *Alphitonia excelsa* (35.1, 1.4), *Livistona decora* (32.4, 5.2), *Lantana camara** (32.4, 1.5), *Acronychia imperforata* (29.7, 2.4)

Additional species:

Cupaniopsis anacardioides (29.7, 0.8), *Cyclophyllum coprosmoides* (24.3, 4.5), *Planchonia careya* (24.3, 2.5), *Glochidion lobocarpum* (24.3, 1.7), *Banksia integrifolia* (24.3, 1.3), *Ficus opposita* (21.6, 1.0), *Polyscias elegans* (18.9, 1.7), *Exocarpos latifolius* (16.2, 3.6), *Psychotria loniceroides* (16.2, 1.9), *Corymbia intermedia* (16.2, 1.3), *Myrsine variabilis* (16.2, 1.2), *Dodonaea viscosa* subsp. *burmanniana* (16.2, 1.0), *Huberantha nitidissima* (13.5, 4.7), *Petalostigma pubescens* (13.5, 2.0), *Acacia leiocalyx* subsp. *leiocalyx* (13.5, 1.8), *Arytera divaricata* (13.5, 0.9), *Corymbia tessellaris* (13.5, 0.8), *Drypetes deplanchei* (13.5, 0.7), *Cryptocarya triplinervis* (10.8, 11.0), *Lophostemon suaveolens* (10.8, 6.0), *Diospyros fasciculosa* (10.8, 4.2), *Acacia julifera* (10.8, 2.5), *Psydrax odorata* (10.8, 2.5), *Breynia oblongifolia* (10.8, 2.0), *Callitris columellaris* (10.8, 2.0), *Allocasuarina littoralis* (10.8, 1.5), *Eustrephus latifolius* (10.8, 0.8), *Ficus rubiginosa* (10.8, 0.2), *Clerodendrum floribundum* (10.8, 0.0), *Leptospermum neglectum* (10.8, 0.0), *Mallotus discolor* (10.8, 0.0), *Alyxia ruscifolia* (8.1, 6.0), *Passiflora suberosa** (8.1, 2.0), *Monotoca* sp. (Fraser Island P.Baxter 777) (8.1, 1.7), *Carissa ovata* (8.1, 1.5), *Cissus hypoglauca* (8.1, 1.1), *Jacksonia scoparia* (8.1, 1.0), *Pittosporum revolutum* (8.1, 1.0), *Pleogyne australis* (8.1, 0.8), *Embelia australiana* (8.1, 0.5), *Celtis paniculata* (8.1, 0.4), *Jasminum didymum* subsp. *didymum* (8.1, 0.0), *Glochidion ferdinandi* var. *ferdinandi* (5.4, 3.0), *Maclura cochinchinensis* (5.4, 3.0), *Styphelia margarodes* (5.4, 1.1), *Denhamia celastroides* (5.4, 1.0), *Planchonella chartacea* (5.4, 1.0), *Capparis arborea* (5.4, 0.6), *Diospyros geminata* (5.4, 0.6), *Trophis scandens* subsp. *scandens* (5.4, 0.5), *Jasminum simplicifolium* subsp. *australiense* (5.4, 0.2), *Alectryon coriaceus* (5.4, 0.0), *Banksia aemula* (5.4, 0.0), *Persoonia virgata* (5.4, 0.0), *Pleiogyne timorensis* (5.4, 0.0), *Smilax australis* (5.4, 0.0), *Archontophoenix cunninghamiana* (2.7, 15.0), *Melaleuca quinquenervia* (2.7, 6.0), *Syzygium australe* (2.7, 5.0), *Jagera pseudorhus* var. *pseudorhus* (2.7, 3.0), *Cordyline rubra* (2.7, 2.0), *Harpullia hillii* (2.7, 2.0), *Macaranga tanarius* (2.7, 2.0), *Piper hederaceum* (2.7, 2.0), *Psydrax lamprophylla* (2.7, 2.0), *Syzygium johnsonii* (2.7, 2.0), *Turraea pubescens* (2.7, 2.0), *Acmena hemilampra* (2.7, 1.0), *Acmena smithii* (2.7, 1.0), *Alectryon reticulatus* (2.7, 1.0), *Emmenosperma cunninghamii* (2.7, 1.0), *Xanthorrhoea latifolia* subsp. *latifolia* (2.7, 1.0), *Styphelia leptospermoides* (2.7, 0.6), *Aidia racemosa* (2.7, 0.5), *Auranticarpa rhombifolia* (2.7, 0.5), *Cupaniopsis* sp. (Watalgan A.R.Bean 8611) (2.7, 0.5), *Dodonaea triquetra* (2.7, 0.5), *Endiandra sieberi* (2.7, 0.5), *Glycosmis trifoliata* (2.7, 0.5), *Halfordia kendack* (2.7, 0.5), *Micromelum minutum* (2.7, 0.5), *Parsonia straminea* (2.7, 0.5), *Rhodamnia acuminata* (2.7, 0.5), *Amylotheca dictyophleba* (2.7, 0.2), *Geitonoplesium cymosum* (2.7, 0.2), *Murraya paniculata* 'Exotica'* (2.7, 0.2), *Platysace lanceolata* (2.7, 0.2), *Scolopia braunii* (2.7, 0.2), *Xylosma terrae-reginae* (2.7, 0.2), *Zieria smithii* (2.7, 0.2), *Aglaia brownii* (2.7, 0.0), *Alstonia constricta* (2.7, 0.0), *Amorphospermum antilogum* (2.7, 0.0), *Aphananthe philippinensis* (2.7, 0.0), *Asparagus africanus** (2.7, 0.0), *Austromyrtus dulcis* (2.7, 0.0), *Beilschmiedia obtusifolia* (2.7, 0.0), *Causis recurvata* (2.7, 0.0), *Cissus antarctica* (2.7, 0.0), *Clematicissus opaca* (2.7, 0.0), *Crotalaria pallida* var. *obovata** (2.7, 0.0), *Cymbidium canaliculatum* (2.7, 0.0), *Cymbidium madidum* (2.7, 0.0), *Diospyros pentamera* (2.7, 0.0), *Elaeocarpus reticulatus* (2.7, 0.0), *Eucalyptus crebra* (2.7, 0.0), *Eucalyptus tereticomis* (2.7, 0.0), *Eugenia uniflora** (2.7, 0.0), *Ficus fraseri* (2.7, 0.0), *Flindersia schottiana* (2.7, 0.0), *Grevillea banksii* (2.7, 0.0), *Litsea reticulata* (2.7, 0.0), *Melaleuca linariifolia* (2.7, 0.0), *Monotoca scoparia* (2.7, 0.0), *Notelaea longifolia* (2.7, 0.0), *Pavetta australiensis* (2.7, 0.0), *Planchonella cotinifolia* var. *pubescens* (2.7, 0.0), *Pleurostyliia opposita* (2.7, 0.0), *Psydrax odorata* forma *australiana* (2.7, 0.0), *Pyrrosia*

rupestris (2.7, 0.0), *Rhamnella vitiensis* (2.7, 0.0), *Tephrosia brachyodon* (2.7, 0.0), *Wikstroemia indica* (2.7, 0.0), *Xylomelum salicinum* (2.7, 0.0)

Stratum: Shrub 2

Height: average: 1.05m; range: 0.50 - 2.00m; (10 sites)

Crown Cover: average: 9.6%; range: 1.7 - 31.0%; (9 sites)

Stem Count: average: 435 stems/ha; range: 20 - 850 stems/ha; std. deviation: 586.9 stems/ha; (2 sites)

Basal area: No data available.

Species list (frequency (%), average cover (%)):

Most frequent species (up to 6):

Acacia disparrima subsp. *disparrima* (10.8, 3.0), *Acacia flavescens* (8.1, 4.7), *Styphelia leptospermoides* (5.4, 8.5), *Breynia oblongifolia* (5.4, 4.5), *Acacia julifera* (5.4, 3.5), *Pleogyne australis* (5.4, 3.0)

Additional species:

Alphitonia excelsa (5.4, 2.0), *Glochidion lobocarpum* (5.4, 1.0), *Livistona decora* (5.4, 1.0), *Xanthorrhoea latifolia* subsp. *latifolia* (5.4, 1.0), *Banksia integrifolia* (5.4, 0.0), *Corymbia intermedia* (5.4, 0.0), *Planchonia careya* (5.4, 0.0), *Ficus opposita* (2.7, 3.0), *Psychotria loniceroides* (2.7, 3.0), *Jacksonia scoparia* (2.7, 2.0), *Melaleuca dealbata* (2.7, 2.0), *Carissa ovata* (2.7, 1.0), *Lantana camara** (2.7, 1.0), *Psydrax odorata* (2.7, 1.0), *Arytera divaricata* (2.7, 0.5), *Ficus rubiginosa* (2.7, 0.5), *Smilax australis* (2.7, 0.5), *Cyclophyllum coprosmoides* (2.7, 0.2), *Embelia australiana* (2.7, 0.2), *Pleiogynium timorense* (2.7, 0.2), *Banksia aemula* (2.7, 0.0), *Eucalyptus crebra* (2.7, 0.0), *Leptospermum neglectum* (2.7, 0.0), *Lophostemon suaveolens* (2.7, 0.0), *Petalostigma pubescens* (2.7, 0.0), *Pityrodia salviifolia* (2.7, 0.0), *Polyscias elegans* (2.7, 0.0), *Tephrosia brachyodon* (2.7, 0.0)

Stratum: Ground

Height: average: 0.47m; range: 0.30 - 0.60m; (25 sites)

Projective foliage cover (PFC): average: 29.5%; range: 1.0 - 93.0%; (25 sites)

Species list (frequency (%), average cover (%)):

Grass - perennial:

Most frequent species (up to 6):

Imperata cylindrica (76.0, 30.7), *Themeda triandra* (40.0, 4.7), *Eriachne pallescens* (36.0, 4.9), *Cymbopogon refractus* (32.0, 3.8), *Aristida calycina* var. *calycina* (28.0, 0.0), *Entolasia stricta* (28.0, 3.0)

Additional species:

Paspalidium gausum (28.0, 0.8), *Aristida queenslandica* (16.0, 1.0), *Alloteropsis semialata* (12.0, 1.0), *Eragrostis brownii* (12.0, 0.0), *Eragrostis spartinoides* (12.0, 0.0), *Eriachne trisetata* (12.0, 15.3), *Digitaria didactyla** (8.0, 35.0), *Digitaria parviflora* (8.0, 1.0), *Zoysia macrantha* subsp. *macrantha* (8.0, 24.0), *Ancistrachne uncinulata* (4.0, 0.5), *Digitaria* (4.0, 0.0), *Digitaria breviglumis* (4.0, 0.0), *Enteropogon unispiceus* (4.0, 0.2), *Eremochloa bimaculata* (4.0, 1.0), *Megathyrsus maximus** (4.0, 0.0), *Melinis repens** (4.0, 0.0), *Oplismenus aemulus* (4.0, 0.0), *Ottochloa** (4.0, 0.2), *Ottochloa nodosa* (4.0, 0.0), *Panicum effusum* (4.0, 0.0), *Panicum simile* (4.0, 0.0), *Paspalidium albavillosum* (4.0, 1.0), *Paspalidium distans* (4.0, 0.4), *Sporobolus laxus* (4.0, 22.0), *Sporobolus virginicus* (4.0, 1.0)

Grass - annual/biennial:

Most frequent species (up to 6):

Setaria surgens (4.0, 0.0),

Additional species:

Forbs & other:

Most frequent species (up to 6):

*Passiflora suberosa** (80.0, 3.1), *Lomandra longifolia* (56.0, 0.6), *Pteridium esculentum* (56.0, 4.1), *Banksia integrifolia* (44.0, 1.0), *Cyperus eglobosus* (44.0, 1.7), *Dianella caerulea* (40.0, 1.1)

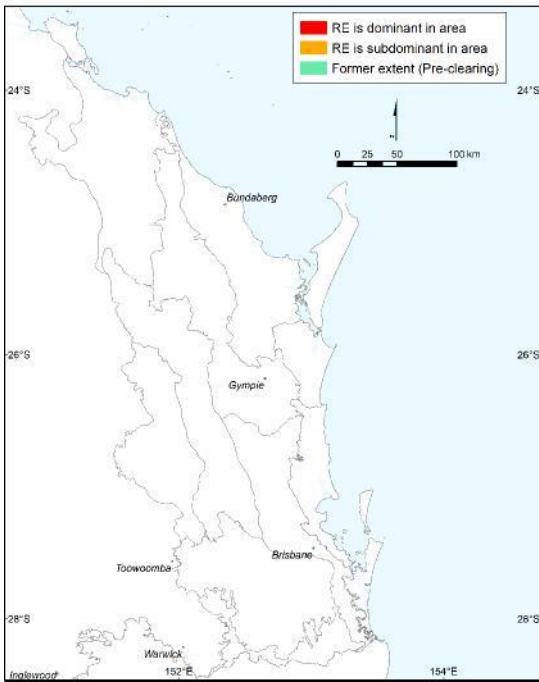
Additional species:

Eustrephus latifolius (40.0, 0.5), *Lomandra confertifolia* subsp. *pallida* (40.0, 0.8), *Alphitonia excelsa* (36.0, 0.0), *Cupaniopsis anacardioides* (36.0, 0.0), *Acacia disparrima* subsp. *disparrima* (32.0, 0.0), *Lomandra multiflora* subsp. *multiflora* (32.0, 1.2), *Corymbia intermedia* (28.0, 0.0), *Jasminum didymum* subsp. *didymum* (28.0, 0.5), *Breynia oblongifolia* (24.0, 0.0), *Livistona decora* (24.0, 0.0),

Trachystylis stradbokensis (24.0, 0.6), *Acacia flavescens* (20.0, 0.2), *Acacia julifera* (20.0, 0.0), *Clematicissus opaca* (20.0, 0.0), *Corymbia tessellaris* (20.0, 0.0), *Exocarpos latifolius* (20.0, 0.0), *Glochidion lobocarpum* (20.0, 0.0), *Glycine clandestina* var. *clandestina* (20.0, 0.0), *Leptospermum neglectum* (20.0, 0.0), *Petalostigma pubescens* (20.0, 0.0), *Planchonia careya* (20.0, 0.0), *Stephania japonica* (20.0, 0.0), *Carissa ovata* (16.0, 1.0), *Cassytha pubescens* (16.0, 0.0), *Cyanthillium cinereum* (16.0, 0.0), *Cyperus enervis* (16.0, 3.5), *Flemingia parviflora* (16.0, 0.0), *Lantana camara** (16.0, 0.0), *Lomandra leucocephala* (16.0, 0.0), *Pleiogynium timorensis* (16.0, 0.2), *Rivina humilis** (16.0, 13.2), *Smilax australis* (16.0, 0.5), *Xanthorrhoea latifolia* subsp. *latifolia* (16.0, 9.5), *Allocasuarina littoralis* (12.0, 0.0), *Commelina diffusa* (12.0, 0.4), *Desmodium rhytidophyllum* (12.0, 0.0), *Embelia australiana* (12.0, 0.8), *Emilia sonchifolia** (12.0, 0.0), *Hibbertia scandens* (12.0, 0.0), *Myrsine variabilis* (12.0, 0.0), *Opuntia stricta** (12.0, 0.0), *Pigea stellaroides* (12.0, 0.0), *Polyscias elegans* (12.0, 0.0), *Pseuderanthemum variabile* (12.0, 0.0), *Schizaea dichotoma* (12.0, 1.0), *Acacia leiocalyx* subsp. *leiocalyx* (8.0, 0.0), *Achyranthes aspera* (8.0, 0.0), *Alyxia ruscifolia* (8.0, 0.0), *Banksia aemula* (8.0, 0.0), *Bridelia leichhardtii* (8.0, 0.0), *Crotalaria montana* (8.0, 0.0), *Cyclophyllum coprosmoides* (8.0, 0.0), *Cyperus haspan* (8.0, 0.0), *Dianella longifolia* (8.0, 0.0), *Diospyros geminata* (8.0, 0.0), *Einadia hastata* (8.0, 0.0), *Erigeron* (8.0, 0.0), *Ficus opposita* (8.0, 0.0), *Ficus rubiginosa* (8.0, 0.0), *Galactia tenuiflora* (8.0, 1.0), *Geitonoplesium cymosum* (8.0, 0.5), *Glycine tomentella* (8.0, 0.0), *Hardenbergia violacea* (8.0, 0.0), *Hibbertia linearis* var. *floribunda* (8.0, 0.0), *Jacksonia scoparia* (8.0, 0.0), *Jagera pseudorhus* var. *pseudorhus* (8.0, 0.0), *Pandorea pandorana* (8.0, 0.0), *Parsonsia straminea* (8.0, 0.2), *Patersonia sericea* var. *sericea* (8.0, 1.0), *Persoonia virgata* (8.0, 0.0), *Phyllanthus virgatus* (8.0, 0.0), *Pigea monopetala* (8.0, 0.0), *Pityrodia salviifolia* (8.0, 0.0), *Planchonella cotinifolia* var. *pubescens* (8.0, 0.0), *Platysace linearifolia* (8.0, 0.0), *Poranthera microphylla* (8.0, 0.0), *Psydrax odorata* (8.0, 0.0), *Schoenus ornithopodioides* (8.0, 0.0), *Trophis scandens* subsp. *scandens* (8.0, 0.0), *Xanthorrhoea johnsonii* (8.0, 0.0), *Abildgaardia ovata* (4.0, 0.0), *Acacia leptocarpa* (4.0, 0.0), *Acianthus fornicatus* (4.0, 0.0), *Aglaia brownii* (4.0, 0.0), *Ajuga australis* (4.0, 1.0), *Alectryon tomentosus* (4.0, 0.0), *Amorphospermum antilogum* (4.0, 0.0), *Amyema conspicua* subsp. *conspicua* (4.0, 0.0), *Asparagus aethiopicus* * (4.0, 1.0), *Auranticarpa rhombifolia* (4.0, 0.0), *Austromyrtus dulcis* (4.0, 0.2), *Beilschmiedia obtusifolia* (4.0, 0.0), *Bidens pilosa** (4.0, 0.0), *Bryophyllum pinnatum** (4.0, 1.0), *Bulbostylis barbata* (4.0, 0.0), *Calanthe triplicata* (4.0, 0.2), *Callitris columellaris* (4.0, 0.0), *Capparis arborea* (4.0, 0.0), *Causis recurvata* (4.0, 1.0), *Cheilanthes sieberi* (4.0, 0.0), *Cissus antarctica* (4.0, 0.0), *Cissus hypoglauca* (4.0, 0.5), *Clerodendrum floribundum* (4.0, 0.0), *Coelospermum reticulatum* (4.0, 0.0), *Commelina ensifolia* (4.0, 0.0), *Commelina lanceolata* (4.0, 0.0), *Crotalaria pallida* var. *obovata** (4.0, 0.0), *Cryptocarya triplinervis* (4.0, 0.0), *Cymbidium madidum* (4.0, 0.0), *Cyperus* (4.0, 0.0), *Cyperus leiocaulon* (4.0, 0.0), *Cyperus scaber* (4.0, 0.0), *Cyperus tetracarpus* (4.0, 0.0), *Dianella rara* (4.0, 0.0), *Dodonaea triquetra* (4.0, 0.0), *Drynaria rigidula* (4.0, 0.2), *Elattostachys xylocarpa* (4.0, 0.0), *Erigeron sumatrensis** (4.0, 0.0), *Euphorbia hyssopifolia** (4.0, 0.0), *Evolvulus alsinoides* (4.0, 0.0), *Ficus* (4.0, 0.0), *Fimbristylis vaginata* (4.0, 10.0), *Geodorum densiflorum* (4.0, 0.0), *Glochidion* (4.0, 0.0), *Glochidion ferdinandi* var. *ferdinandi* (4.0, 0.0), *Glycine cyrtoloba* (4.0, 0.0), *Goodenia rotundifolia* (4.0, 0.0), *Grevillea banksii* (4.0, 0.0), *Gynochthodes jasminoides* (4.0, 0.0), *Harpullia pendula* (4.0, 0.0), *Heptapleurum actinophyllum* (4.0, 0.0), *Hybanthus** (4.0, 0.2), *Indigofera suffruticosa** (4.0, 0.6), *Jasminum didymum* subsp. *racemosum* (4.0, 0.0), *Jasminum simplicifolium* subsp. *australiense* (4.0, 0.0), *Leichhardtia rostrata* (4.0, 0.0), *Lepidium* (4.0, 0.0), *Lepidosperma longitudinale* (4.0, 10.0), *Lobelia purpurascens* (4.0, 0.6), *Lomandra elongata* (4.0, 0.0), *Lomandra filiformis* (4.0, 0.0), *Lomandra laxa* (4.0, 0.0), *Lophostemon suaveolens* (4.0, 0.0), *Machaerina juncea* (4.0, 0.0), *Macropitium atropurpureum** (4.0, 0.0), *Mallotus discolor* (4.0, 0.0), *Marsdenia* (4.0, 0.5), *Melia azedarach* (4.0, 0.0), *Micromelum minutum* (4.0, 0.0), *Muehlenbeckia rhyticarya* (4.0, 0.0), *Murraya paniculata* 'Exotica'* (4.0, 0.0), *Ochna serrulata** (4.0, 0.0), *Opuntia tomentosa** (4.0, 0.0), *Pandorea jasminoides* (4.0, 0.0), *Passiflora aurantia* (4.0, 0.0), *Passiflora foetida** (4.0, 0.0), *Passiflora pallida** (4.0, 0.2), *Phyllota phyllicoides* (4.0, 0.0), *Picris angustifolia* subsp. *carolorum-henricorum* (4.0, 0.0), *Pilidiostigma glabrum* (4.0, 0.0), *Pimelea linifolia* (4.0, 0.0), *Pittosporum revolutum* (4.0, 0.0), *Pleogyne australis* (4.0, 0.0), *Pomax umbellata* (4.0, 0.0), *Psychotria loniceroides* (4.0, 0.0), *Pycnospora lutescens* (4.0, 0.0), *Rhamnella vitiensis* (4.0, 0.0), *Richardia brasiliensis** (4.0, 0.0), *Schizaea bifida* (4.0, 0.2), *Schoenus calostachyus* (4.0, 1.0), *Solanum americanum** (4.0, 0.0), *Solanum seaforthianum** (4.0, 0.0), *Spermacoce multicaulis* (4.0, 0.0), *Tetrastigma nitens* (4.0, 0.0), *Tricoryne elatior* (4.0, 0.0), *Xyris juncea* (4.0, 0.0), *Zieria laxiflora* (4.0, 0.0)

Species list: Frequency (percent of total sites) and cover (average of species cover across sites where that species is present). Ordered by decreasing frequency. Naturalised species have an asterisk (*) after the name. indet. after listed name if indeterminate species or genus.

12.2.14a: *Casuarina equisetifolia* subsp. *incana* woodland to low open forest on exposed frontal areas



Mapping data	Pre-clearing area = 11.1 ha; Remnant area 2019 = 9.5 ha; Remnant percent remaining in 2019 = 85.5 %
Species richness	total: 90 (14 sites); woody: 30 (14 sites); ground: 67 (14 sites); average spp./site: 14.1, standard deviation: 8.9 (14 sites)
Basal area	average/site: 15.4 m ² /ha; range: 5.0 - 36.0 m ² /ha; std. deviation: 8.5; (9 sites)
Ecological dominant layer (EDL) height	stratum: tree 1; average/site: 10.07m; range: 6.00 - 15.00m; (14 sites)
Ecological dominant layer (EDL) Crown Cover	stratum: tree 1; average: 58.4%; range: 7.0 - 92.2%; (14 sites)
Structural formation	Woodland: 35.7 %; Low Woodland: 28.6 %; Open Woodland: 14.3 %; Low Open Forest: 7.1 %; Low Open Woodland: 7.1 %; Low Closed Forest: 7.1 %; (14 sites)
Representative site(s)	2013, 3721, 4368, 14194, 14195, 16467, 16468, 16997, 17905, 18186, 18381, 18423, 18435, 18452

Stratum: Emergent

Height: average: 14.00m; range: 14.00 - 14.00m; (1 site)

Crown Cover: average: 1.0%; range: 1.0 - 1.0%; (1 site)

Stem Count: No data available.

Basal area: No data available.

Species list (frequency (%), average cover (%)):

Most frequent species (up to 6):

Casuarina equisetifolia subsp. *incana* (7.1, 1.0),

Additional species:

Stratum: Tree 1 (EDL)

Height: average: 10.07m; range: 6.00 - 15.00m; (14 sites)

Crown Cover: average: 58.4%; range: 7.0 - 92.2%; (14 sites)

Stem Count: average: 707 stems/ha; range: 160 - 1,760 stems/ha; std. deviation: 582.7 stems/ha; (9 sites)

Basal area: average: 15.1 m²/ha; range: 4.0 - 36.0 m²/ha; std. deviation: 8.7 m²/ha; (9 sites)

Species list (frequency (%), average cover (%)):

Most frequent species (up to 6):

Casuarina equisetifolia subsp. *incana* (100.0, 56.4), *Cupaniopsis anacardioides* (14.3, 5.8), *Banksia integrifolia* (14.3, 1.5), *Celtis paniculata* (14.3, 1.0), *Acacia disparrima* subsp. *disparrima* (7.1, 5.0), *Macaranga tanarius* (7.1, 4.0)

Additional species:

Acronychia imperforata (7.1, 0.0), *Alphitonia excelsa* (7.1, 0.0), *Polyscias elegans* (7.1, 0.0)

Stratum: Tree 2

Height: average: 4.58m; range: 3.00 - 6.00m; (6 sites)

Crown Cover: average: 15.3%; range: 0.0 - 35.0%; (6 sites)

Stem Count: average: 50 stems/ha; range: 20 - 120 stems/ha; std. deviation: 47.6 stems/ha; (4 sites)

Basal area: average: 1.0 m²/ha; range: 1.0 - 1.0 m²/ha; std. deviation: 0.0 m²/ha; (2 sites)

Species list (frequency (%), average cover (%)):

Most frequent species (up to 6):

Casuarina equisetifolia subsp. *incana* (35.7, 11.3), *Macaranga tanarius* (14.3, 0.0), *Cupaniopsis anacardioides* (7.1, 21.6), *Celtis paniculata* (7.1, 13.4), *Acronychia imperforata* (7.1, 0.0),

Additional species:

Stratum: Shrub 1

Height: average: 2.08m; range: 0.70 - 5.00m; (13 sites)

Crown Cover: average: 13.8%; range: 0.0 - 51.0%; (13 sites)

Stem Count: average: 1,366 stems/ha; range: 20 - 4,760 stems/ha; std. deviation: 2,186.0 stems/ha; (7 sites)

Basal area: average: 1.0 m²/ha; range: 1.0 - 1.0 m²/ha; std. deviation: 0.0 m²/ha; (1 site)

Species list (frequency (%), average cover (%)):

Most frequent species (up to 6):

Argusia argentea (50.0, 19.6), *Casuarina equisetifolia* subsp. *incana* (35.7, 2.8), *Lantana camara** (21.4, 11.3), *Banksia integrifolia* (21.4, 2.5), *Cupaniopsis anacardioides* (14.3, 19.1), *Schinus terebinthifolius** (14.3, 4.5)

Additional species:

Senna pendula var. *glabrata** (14.3, 0.3), *Alectryon coriaceus* (7.1, 2.0), *Abutilon albescens* (7.1, 1.0), *Macaranga tanarius* (7.1, 1.0), *Exocarpos cupressiformis* (7.1, 0.5), *Melaleuca quinquenervia* (7.1, 0.5), *Acacia leiocalyx* subsp. *leiocalyx* (7.1, 0.3), *Eugenia uniflora** (7.1, 0.3), *Cyclophyllum coprosmoides* var. *coprosmoides* (7.1, 0.2), *Acacia sophorae* (7.1, 0.0), *Acronychia imperforata* (7.1, 0.0), *Alphitonia excelsa* (7.1, 0.0), *Austromyrtus dulcis* (7.1, 0.0), *Breynia oblongifolia* (7.1, 0.0), *Celtis paniculata* (7.1, 0.0), *Dodonaea viscosa* subsp. *burmanniana* (7.1, 0.0), *Ficus opposita* (7.1, 0.0), *Heptapleurum actinophyllum* (7.1, 0.0), *Leucopogon parviflorus* (7.1, 0.0), *Livistona decora* (7.1, 0.0), *Mallotus discolor* (7.1, 0.0), *Scaevola taccada* (7.1, 0.0)

Stratum: Shrub 2

Height: average: 1.50m; range: 1.50 - 1.50m; (1 site)

Crown Cover: No data available.

Stem Count: average: 120 stems/ha; range: 120 - 120 stems/ha; std. deviation: 0.0 stems/ha; (1 site)

Basal area: No data available.

Species list (frequency (%), average cover (%)):

Most frequent species (up to 6):

Abutilon albescens (7.1, 0.0), *Argusia argentea* (7.1, 0.0), *Casuarina equisetifolia* subsp. *incana* (7.1, 0.0),

Additional species:

Stratum: Ground

Height: average: 0.26m; range: 0.10 - 0.50m; (14 sites)

Projective foliage cover (PFC): average: 51.0%; range: 12.0 - 81.5%; (14 sites)

Species list (frequency (%), average cover (%)):

Grass - perennial:

Most frequent species (up to 6):

Lepturus repens (64.3, 9.0), *Thuarea involuta* (50.0, 28.4), *Eragrostis interrupta* (35.7, 5.3), *Imperata cylindrica* (21.4, 8.7), *Spinifex sericeus* (21.4, 11.7), *Stenotaphrum micranthum* (21.4, 8.2)

Additional species:

*Cenchrus echinatus** (14.3, 0.0), *Cymbopogon refractus* (14.3, 0.0), *Ischaemum triticeum* (14.3, 2.0), *Ottochloa nodosa* (14.3, 0.2), *Zoysia macrantha* subsp. *macrantha* (14.3, 49.0), *Dactyloctenium radulans* (7.1, 1.0), *Digitaria parviflora* (7.1, 0.4), *Heteropogon contortus* (7.1, 1.0), *Ischaemum australe* (7.1, 3.0), *Sacciolepis indica* (7.1, 1.0), *Setaria pumila* subsp. *subtesselata** (7.1, 0.0)

Grass - annual/biennial:

Not present

Forbs & other:

Most frequent species (up to 6):

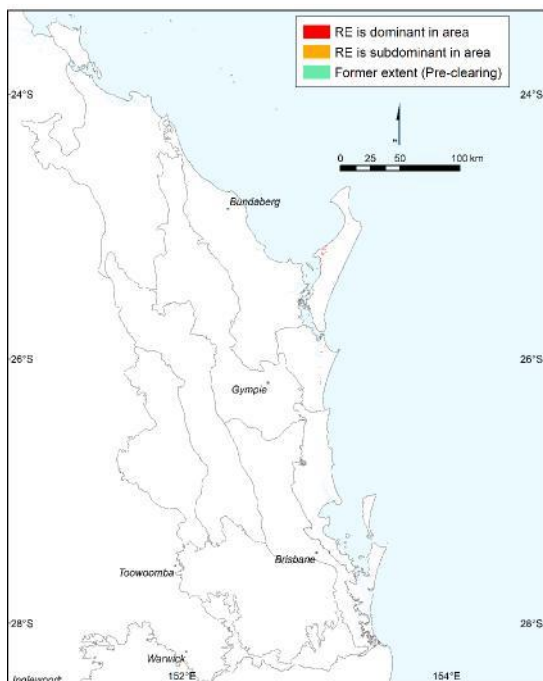
Achyranthes aspera (50.0, 6.1), *Euphorbia tannensis* subsp. *tannensis* (35.7, 1.3), *Ipomoea pes-caprae* subsp. *brasiliensis* (35.7, 5.0), *Cakile edentula** (28.6, 11.6), *Dianella caerulea* (28.6, 4.8), *Hibbertia scandens* (28.6, 5.0)

Additional species:

*Passiflora pallida** (28.6, 8.0), *Abutilon albescens* (21.4, 0.7), *Carpobrotus glaucescens* (21.4, 1.0), *Sonchus oleraceus** (21.4, 0.0), *Alphitonia excelsa* (14.3, 0.0), *Asparagus aethiopicus** (14.3, 5.7), *Boerhavia albiflora* var. *heronensis* (14.3, 0.4), *Emilia sonchifolia** (14.3, 0.0), *Gloriosa superba** (14.3, 16.0), *Oxalis rubens* (14.3, 1.2), *Passiflora suberosa** (14.3, 0.0), *Senecio pinnatifolius* var. *pinnatifolius* (14.3, 0.0), *Solanum americanum** (14.3, 0.4), *Stephania japonica* var. *discolor* (14.3, 4.6), *Wollastonia uniflora* (14.3, 30.0), *Acacia sophorae* (7.1, 0.0), *Argusia argentea* (7.1, 0.0), *Baccharis halimifolia** (7.1, 0.0), *Banksia integrifolia* (7.1, 2.0), *Bidens pilosa** (7.1, 0.0), *Boerhavia pubescens* (7.1, 0.0), *Cassipoupa filiformis* (7.1, 10.0), *Cassipoupa glabella* forma *glabella* (7.1, 3.0), *Casuarina equisetifolia* subsp. *incana* (7.1, 0.0), *Chorizandra cymbaria* (7.1, 1.0), *Cucumis althaeoides* (7.1, 0.0), *Cyperus eglobosus* (7.1, 0.0), *Cyperus stradbrokeensis* (7.1, 0.0), *Emilia sonchifolia* var. *javanica** (7.1, 0.0), *Erigeron pusillus** (7.1, 0.0), *Erigeron sumatrensis** (7.1, 0.0), *Ficinia nodosa* (7.1, 0.2), *Hydrocotyle bonariensis** (7.1, 0.0), *Jasminum didymum* subsp. *didymum* (7.1, 1.0), *Lantana camara** (7.1, 0.0), *Lepidium englerianum** (7.1, 1.0), *Lobelia anceps* (7.1, 0.0), *Passiflora foetida** (7.1, 0.0), *Pseudognaphalium luteoalbum* (7.1, 0.0), *Scaevola calendulacea* (7.1, 0.0), *Schoenus nitens* (7.1, 0.0), *Symphytichum subulatum** (7.1, 0.0), *Vigna marina* (7.1, 1.0), *Xyris complanata* (7.1, 0.0)

Species list: Frequency (percent of total sites) and cover (average of species cover across sites where that species is present). Ordered by decreasing frequency. Naturalised species have an asterisk (*) after the name. indet. after listed name if indeterminate species or genus.

12.2.15g: Swamps dominated by *Empodisma minus*, *Gahnia sieberiana*, other sedges and forbs and shrubs such as *Leptospermum liversidgei*



Mapping data	Pre-clearing area = 1,061.9 ha; Remnant area 2019 = 1,057.2 ha; Remnant percent remaining in 2019 = 99.6 %
Species richness	total: 45 (6 sites); woody: 10 (6 sites); ground: 40 (6 sites); average spp./site: 14.0, standard deviation: 4.9 (6 sites)
Basal area	average/site: 6.0 m ² /ha; range: 6.0 - 6.0 m ² /ha; std. deviation: 0.0; (1 site)
Ecological dominant layer (EDL) height	stratum: ground; average/site: 0.74m; range: 0.40 - 1.00m; (6 sites)
Ecological dominant layer (EDL) Crown Cover	stratum: ground; average: 74.5%; range: 63.2 - 82.8%; (6 sites)
Structural formation	Closed Sedgeland: 83.3 %; Sedgeland: 16.7 %; (6 sites)
Representative site(s)	16198, 16199, 18248, 18288, 18290, 18291

Stratum: Emergent

Height: average: 9.00m; range: 9.00 - 9.00m; (1 site)

Crown Cover: average: 5.0%; range: 5.0 - 5.0%; (1 site)

Stem Count: average: 167 stems/ha; range: 167 - 167 stems/ha; std. deviation: 0.0 stems/ha; (1 site)

Basal area: average: 5.0 m²/ha; range: 5.0 - 5.0 m²/ha; std. deviation: 0.0 m²/ha; (1 site)

Species list (frequency (%), average cover (%)):

Most frequent species (up to 6):

Eucalyptus robusta (16.7, 5.0), *Melaleuca quinquenervia* (16.7, 0.0),

Additional species:

Stratum: Tree 1

Height: average: 6.50m; range: 6.50 - 6.50m; (1 site)

Crown Cover: average: 3.3%; range: 3.3 - 3.3%; (1 site)

Stem Count: average: 167 stems/ha; range: 167 - 167 stems/ha; std. deviation: 0.0 stems/ha; (1 site)

Basal area: No data available.

Species list (frequency (%), average cover (%)):

Most frequent species (up to 6):

Melaleuca quinquenervia (16.7, 3.3),

Additional species:

Stratum: Tree 2

Height: average: 3.50m; range: 3.50 - 3.50m; (1 site)

Crown Cover: average: 3.3%; range: 3.3 - 3.3%; (1 site)

Stem Count: average: 100 stems/ha; range: 100 - 100 stems/ha; std. deviation: 0.0 stems/ha; (1 site)

Basal area: average: 1.0 m²/ha; range: 1.0 - 1.0 m²/ha; std. deviation: 0.0 m²/ha; (1 site)

Species list (frequency (%), average cover (%)):

Most frequent species (up to 6):

Leptospermum liversidgei (16.7, 3.3), *Banksia robur* (16.7, 0.0),

Additional species:

Stratum: Shrub 1

Height: average: 1.55m; range: 1.20 - 2.50m; (6 sites)

Crown Cover: average: 24.0%; range: 5.5 - 83.3%; (6 sites)

Stem Count: average: 1,313 stems/ha; range: 400 - 2,233 stems/ha; std. deviation: 831.9 stems/ha; (5 sites)

Basal area: No data available.

Species list (frequency (%), average cover (%)):

Most frequent species (up to 6):

Gahnia sieberiana (66.7, 27.8), *Banksia robur* (66.7, 5.7), *Epacris microphylla* (33.3, 6.2), *Leptospermum liversidgei* (16.7, 3.0),

Austromyrtus dulcis (16.7, 0.0), *Banksia integrifolia subsp. integrifolia* (16.7, 0.0)

Additional species:

Elaeocarpus reticulatus (16.7, 0.0), *Epacris obtusifolia* (16.7, 0.0), *Eucalyptus robusta* (16.7, 0.0), *Melaleuca quinquenervia* (16.7, 0.0)

Stratum: Ground (EDL)

Height: average: 0.74m; range: 0.40 - 1.00m; (6 sites)

Projective foliage cover (PFC): average: 74.5%; range: 63.2 - 82.8%; (6 sites)

Species list (frequency (%), average cover (%)):

Grass - perennial:

Most frequent species (up to 6):

Entolasia stricta (33.3, 0.2), *Imperata cylindrica* (16.7, 0.0), *Sacciolepis indica* (16.7, 0.0),

Additional species:

Grass - annual/biennial:

Not present

Forbs & other:

Most frequent species (up to 6):

Drosera binata (100.0, 0.8), *Empodisma minus* (100.0, 33.5), *Gahnia sieberiana* (83.3, 12.9), *Leptospermum liversidgei* (83.3, 10.2), *Baloskion pallens* (66.7, 6.5), *Banksia robur* (66.7, 1.6)

Additional species:

Gleichenia mendellii (66.7, 8.2), *Hibbertia salicifolia* (50.0, 2.2), *Caustis flexuosa* (33.3, 8.5), *Epacris microphylla* (33.3, 0.2), *Machaerina rubiginosa* (33.3, 21.2), *Sprengelia sprengelioides* (33.3, 3.6), *Baloskion tetraphyllum* subsp. *meiostachyum* (16.7, 0.0), *Boronia parviflora* (16.7, 0.2), *Boronia rivularis* (16.7, 0.0), *Boronia rosmarinifolia* (16.7, 0.0), *Bossiaea heterophylla* (16.7, 0.0), *Comesperma retusum* (16.7, 0.0), *Cycnogeton procerus* (16.7, 0.0), *Dianella caerulea* (16.7, 0.0), *Dianella caerulea* var. *caerulea* (16.7, 0.0), *Dillwynia glaberrima* (16.7, 0.0), *Dodonaea viscosa* subsp. *burmanniana* (16.7, 0.0), *Drosera spatulata* var. *spatulata* (16.7, 0.0), *Elaeocarpus reticulatus* (16.7, 0.2), *Gleichenia dicarpa* (16.7, 23.6), *Gonocarpus micranthus* subsp. *ramosissimus* (16.7, 0.0), *Lobelia anceps* (16.7, 0.6), *Machaerina teretifolia* (16.7, 0.0), *Pteridium esculentum* (16.7, 0.0), *Schoenoplectus** (16.7, 0.0), *Schoenoplectus tabernaemontani* (16.7, 0.0), *Schoenus scabripes* (16.7, 0.4), *Stylidium ornatum* (16.7, 0.0), *Thelionema caespitosum* (16.7, 0.0), *Utricularia* (16.7, 0.0), *Xyris juncea* (16.7, 0.2)

Species list: Frequency (percent of total sites) and cover (average of species cover across sites where that species is present). Ordered by decreasing frequency. Naturalised species have an asterisk (*) after the name. indet. after listed name if indeterminate species or genus.