cover values over the 2016 and 2017 survey periods were homogenous. Repeat Measures ANOVA applied to data for the 2016 and 2017 survey events suggests that the minor differences in cover detected between survey plots over time at both control and impact sites, is not significant and would be expected in line with natural variation ($F_{3,15}$ = 0.658, P = 0.59) (see Appendix C),.

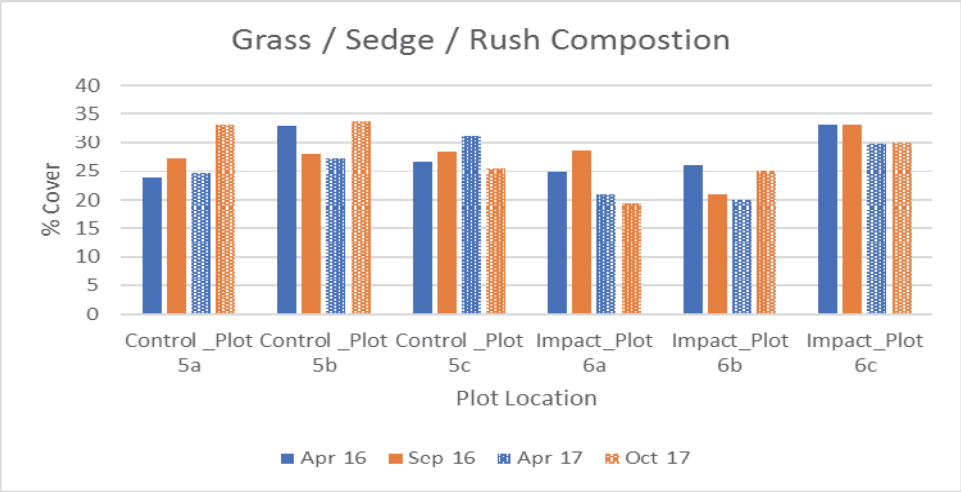

Figure 10. Cover of native grass/ sedge/ rush with comparison between survey events.

3.4.2 Groundcover shrubs

Similar to grasses/sedges/ rushes, minor variations in the abundance of native shrubs in the groundcover (i.e <0.5m) are detected between seasonal survey efforts for all plots, both impact and control. From Figure 11, there is a gradual (although variable) general trend in the reduction of the cover of groundlayer shrubs which is possibly most pronounced in at the impact site (Site 6). Application of Levene's Test indicates that Variance is homogenous between all sites. A Repeat Measures ANOVA applied to the impact site (Site 6) suggests that the observed reduction in shrub cover measured between the 2016 and 2017 survey events is statistically significant ($F_{3,6}$ =6.625, P = 0.025) although the changes are not considered statistically significant at the control site ($F_{3,6}$ =2.61, P = 0.147) (Appendix C).

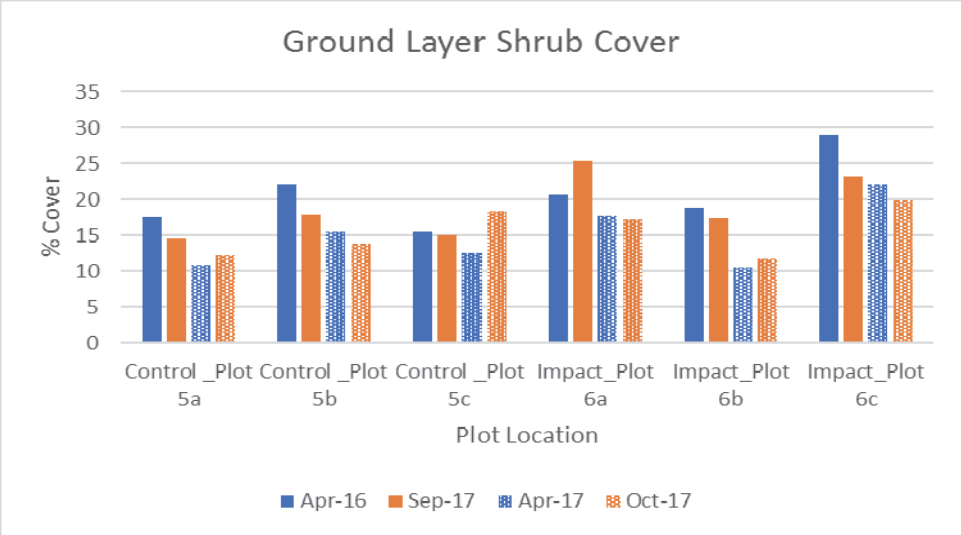

Figure 11. Composition of groundcover shrubs with a comparison made between survey events.

Table 2. Summary of groundcover contribution by various lifeforms over the 2016 and 2017 survey periods.

Plot Location / Survey Event	Forb % Cover	Sedge / Rush/ Grass % Cover	Shrub % Cover	Grasstree % Cover	Bare % Cover	Leaf % Cover	Exotics % Cover	Total % Cover
Plot 5a_April 2017	0.15	24.75	10.81	25.5	1.5	37.29		100
Plot 5a_October 2017	0.4	34	12.25	15	1.95	36.4		100
Plot 5a_April 2016	0.6	27.35	17.4	26	0.35	28.3		100
Plot 5a_September 2016	1.15	27.2	14.45	17.5	2.6	37.1		100
Plot 5b_April 2017	0.4	29.1	15.45	10.7	1.25	43.1		100
Plot 5b_October 2017	0.2	33.7	13.8	7	4.5	40.6	0.2	100
Plot 5b_April 2016	0.35	45.05	22	5.5	4	23	0.1	100
Plot 5b_September 2016	1.2	28.55	17.85	6.75	4.25	40.65	0.75	100
Plot 5c_April 2017	1.05	31.1	12.5	28	0	27.35		100
Plot 5c_October 2017	0.7	28	18.3	10.7	1.5	40.7	0.1	100
Plot 5c_April 2016	2	28.5	15.5	21.25	0.5	32.25		100
Plot 5c_September 2016	1.2	28.45	15.05	24	1.2	30.05	0.05	100
Plot 6a_April 2017	0.65	23	17.75	23.5	0	35.1		100
Plot 6a_October 2017	1.5	19.45	17.2	19.5	1	41.35		100
Plot 6a_April 2016	2.9	25.06	20.71	17.51	0	33.82		100
Plot 6a_September 2016	1.8	26.05	25.3	19.5	0.2	27.15		100
Plot 6b_April 2017	0.85	29.8	22.05	16.5	0	30.65	0.15	100
Plot 6b_October 2017	1.2	30	19.8	14.5	0.75	33.75		100
Plot 6b_April 2016	1.51	27.05	18.36	26	0	27.08		100
Plot 6b_September 2016	2.3	21.3	17.35	16	0.5	42.55		100
Plot 6c_April 2017	0.85	29.8	22.05	16.5	0	30.8		100
Plot 6c_October 2017	1.2	30	19.8	14.5	0.75	33.75		100
Plot 6c_April 2016	0.85	33.15	37.15	9.5	0.25	19.1		100
Plot 6c_September 2016	1.8	33.1	21.2	13	0.2	30.6	0.1	100

3.4.3 Groundcover forbs

The proportion of groundcover occupied by forb species is highly variable, both between survey events and across individual sites. There is also no clear indication of a strong seasonal influence on forb cover within the collected data as evidenced in Figure 12 and although there is considerable variation in cover between survey events, the reasons for this variation are obscure. It is noted that many forb species recorded in previous surveys were not evident in the 2017 surveys, in particular forbs such as *Sowerbaea juncea, Conospermum taxifolium*, *Laxmannia compacta*, *Pseudanthus orientalis* and to a lesser extent *Burchardia umbellata* were not recorded in the 2017 survey. Possible reasons for this are discussed in Section 4. A Levene's test applied to both April 2017 and October 2017 data indicates forb cover Variance is homogenous across all sites. A Repeat Measures ANOVA indicates that variation in forb cover across all sites between the 2016 and 2017 survey periods is not significant ($F_{3,15}$ = 2.82, P=0.074) although as discussed in Section 3.3.6 a considerable variation in floristic diversity is recorded between survey events, particularly in relation to forb cover.

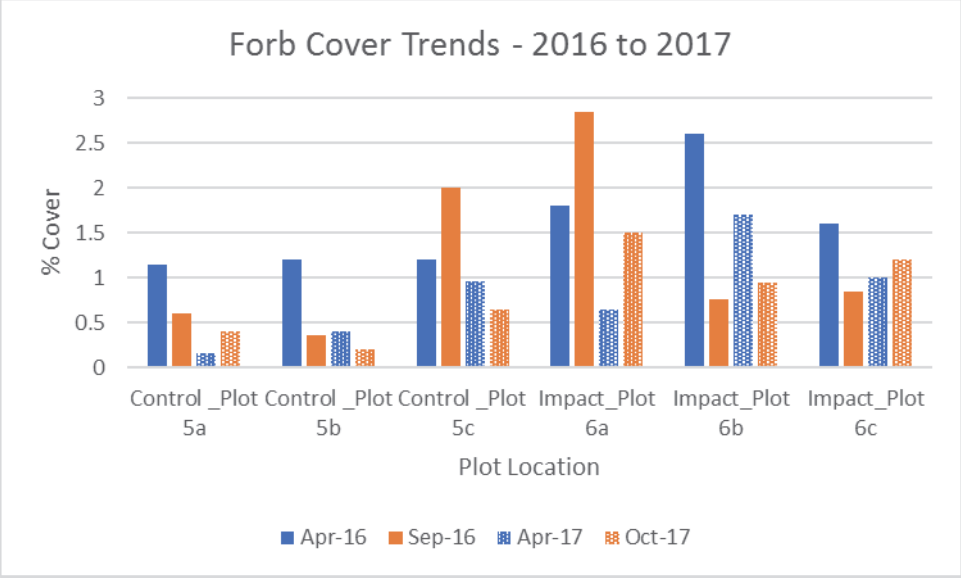

Figure 12. Comparison between native forb groundcovers for impact and control monitoring sites.

3.4.4 Grasstree cover

There is considerable variation in grasstree cover between sites as well as variation between survey events. In general, grasstree cover values increase between the September 2016 and April 2017 surveys with a subsequent fall in cover value between April 2017 and October 2017 survey events (see Figure 14). Application of a Levene's test indicates that Variance in grasstree cover values is the same for all site localities (see Appendix C) whilst a Repeat Measures ANOVA suggests that the variation in grasstree cover across the 2016 and 2017 survey periods is statistically significant suggesting that there may be some response in grasstree cover to varying seasonal conditions ($F_{3,15}$ =4.005, P=0.028).

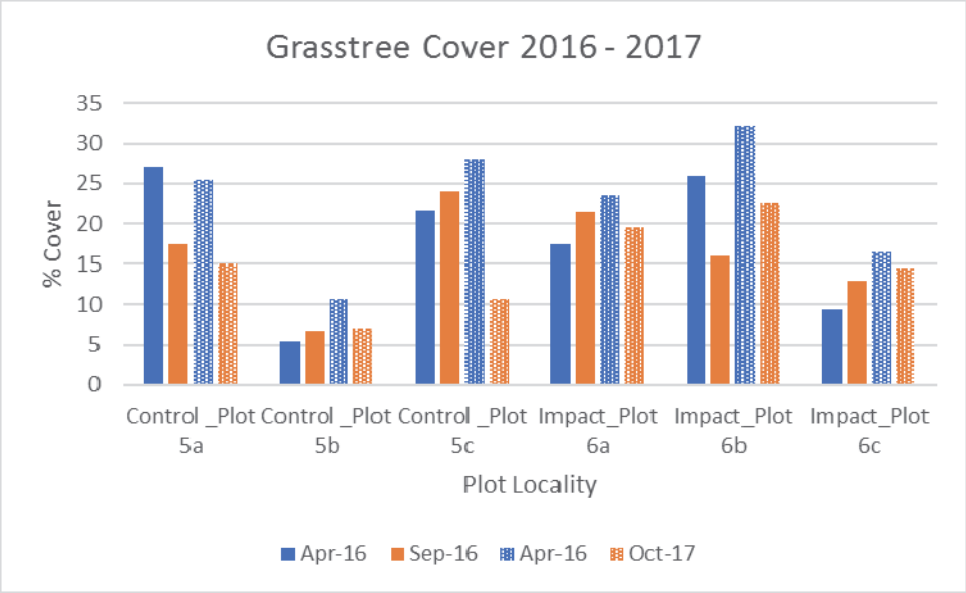

Figure 13. Xanthorrhoea cover comparisons for impact and control sites and survey events.

3.4.5 Living groundcover and leaf litter

Total living groundcover represents the portion of the groundcover that is living with capacity for photosynthesis. It excludes the dried portion of groundcover plants, particularly dead leaf mass which is included in the calculation of leaf litter. Total living groundcover can be used as a measure of the health or vigour of a vegetation community at a given point in time. The proportion (%) of living groundcover compared to leaf litter and bare ground for impact (Site 6) and control (Site 5) sites is provided in Figure 14 and Figure 15 respectively. Subtle variations occur between survey events in all survey localities with cover values ranging from 55% in the September 2016 period for Survey Plot 5b to 81% cover in Survey Plot 6a, also in the September 2016 period. Living groundcover values are balanced by leaf litter and small patches of bare ground (humic sand) which form a minor cover component of the control sites (as per Figure 15). In general, a decrease in living groundcover is offset by a commensurate increases in leaf litter considered to be indicative of a healthy ecosystem.

3.4.6 Species richness

Species richness for all sites has been calculated through combination of both April 2017 and September 2017 survey as well as survey results for the previous 2016 survey period. For all sites, both impact and control, highest species diversity was recorded in the September 2016 survey event (see Figure 16 and Figure 17) and species diversity suffered a dramatic decline through to the April 2017 survey. The decline in species diversity recorded between September 2016 and April 2017 was typically in the range of 20 to 25% with a total of 43 species recorded in Survey Plot 6c (the most floristically diverse survey plot) in the September 2016 survey period dropping to 32 species in the April 2017 survey. The decline in species diversity is attributed to a decrease in the number of forbs, shrubs and sedges / rushes all showing statistically significant reduction in species numbers as determined by application of Repeat Measures ANOVA ($F_{3, 15} = 5.36$, $P = 0.01$ for sedges and rushes; $F_{3, 15} = 24.33$, $P = 0.00$ for forbs; $F_{3, 15} = 27.59$, $P = 0.00$ for shrubs). A Levene's Test indicates that the Variance in species values is the same for all survey periods (see Appendix C). A list of species recorded during the 2016 and 2017 survey periods attributed to individual survey plots is provided in Appendix B.

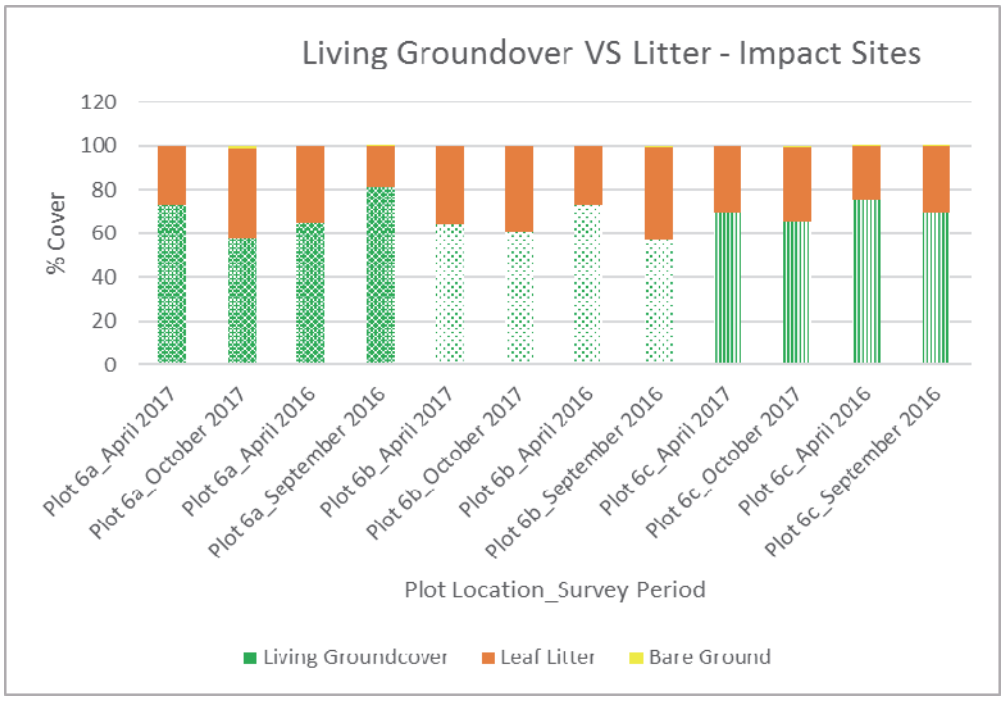

Figure 14. Total living groundcover values for all impact sites (Site 6) with comparison between survey events.

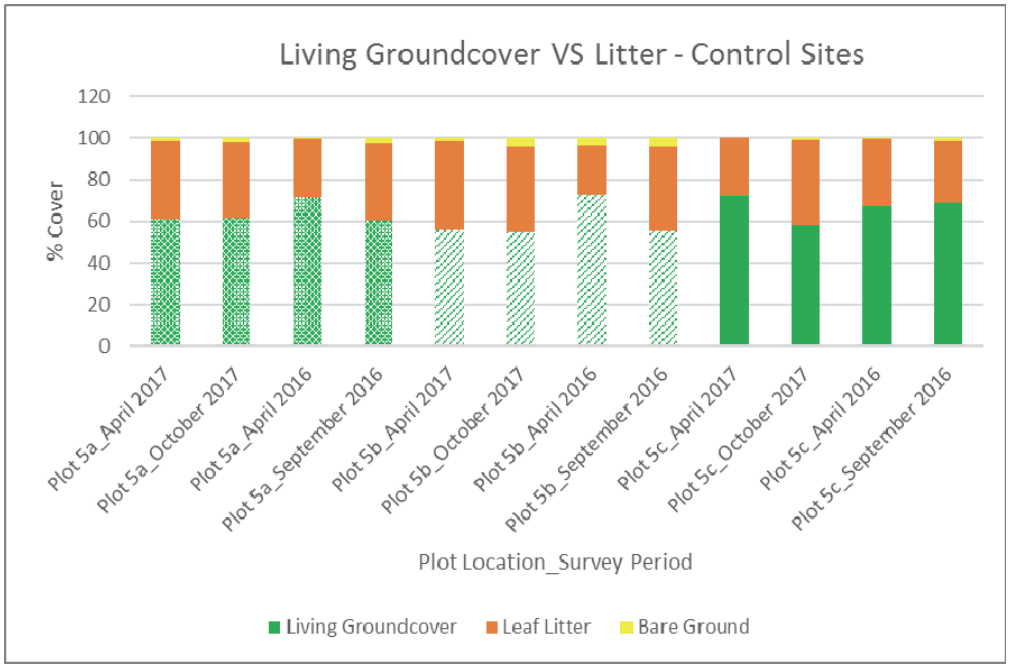

Figure 15. Total living groundcover values for all control sites (Site 5) with comparison between survey events.

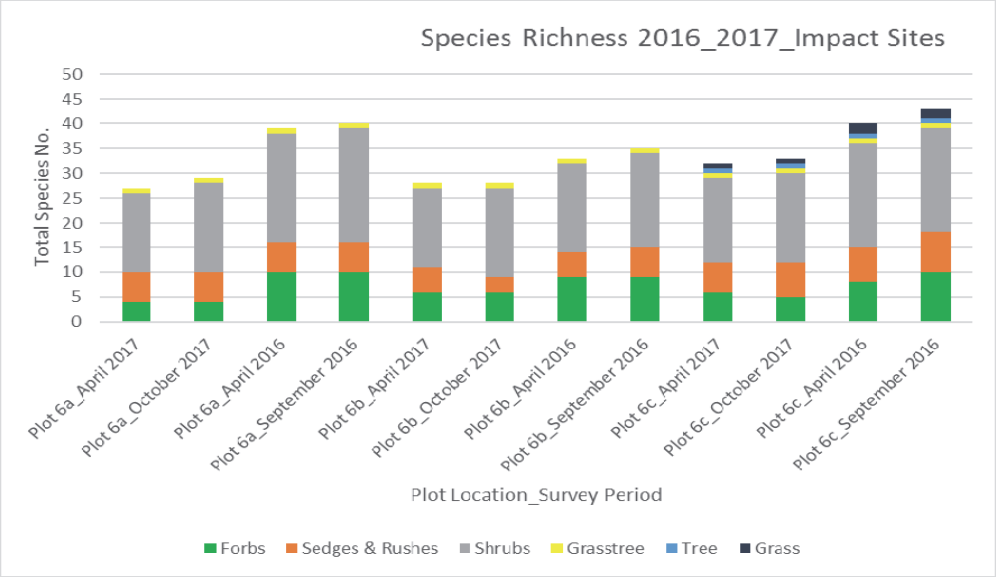

Figure 16. Species richness per life form and overall species richness for impact plots.

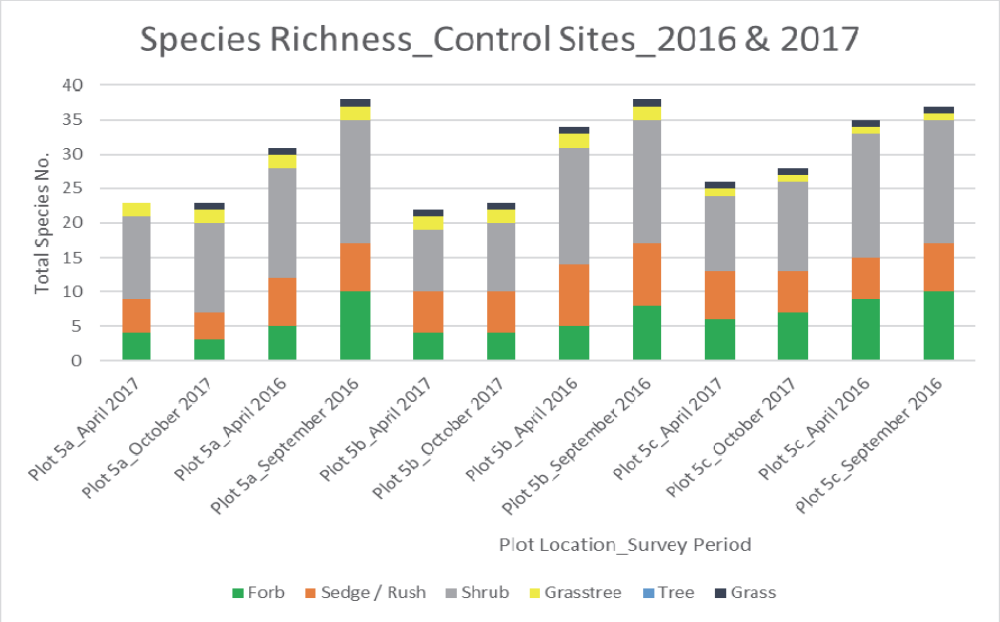

Figure 17. Species richness per life form and overall species richness for all survey plots .

4.0 Discussion and Summary

Over multiple survey efforts, it is becoming apparent that the coastal heathland ecosystem that characterises the Bribie Island Borefield is an ecologically complex system that responds floristically and structurally to a range of stimuli in an unpredictable fashion. Major stimuli are likely to be rainfall, both the amount and timing, which in turn influences the soil moisture regime and groundwater recharge. The predominant fire regime is also likely to be another major influence.

Significant Trends in Vegetation Structure and Composition: The most pronounced trend observed in the monitoring effort is the considerable reduction in floristic species diversity that has occurred subsequent to the September 2016 survey. Whilst forbs suffered the greatest attrition in species numbers, shrubs and also sedges / rushes were also significantly reduced. This most likely indicates that the loss of species diversity may be affected by more than just the transitory influence of sporadic

rainfall or changes to soil moisture and there may be more entrenched changes in species composition occurring. The largest losses in shrub diversity for example were attributed to more fragile obligate seeding species such as *Sprengelia spengelioides, Phylota phylicoides, Epacris pulchella* and *Olax retusa* which disappeared from some but not all plots. Also notable is the dissappearance of *Acacia baueri* (Vulnerable NC Act) from transect 5b between the September 2016 and April 2017 survey events. *Acacia baueri* is an obligate seeding species that is throught to prefer early successional habitats that follow disturbance such as fire (NSW Office of Environment and Heritage, 2017). Hence the loss of species diversity may result from the compounding influences of both seasonal droughting and structural changes to vegetation that may result from the long-term absence of fire. In the case of the latter, the habitat may have reached maximum biomass and floristic diversity and be in a stage of structural decline, which typically occurs at 4 to 8 years post fire (McFarland, 2000). This would also concur with the reduction in of shrub stem densities at the impact site (Site 6) as described in Section 3.2 and Figure 7.

These data suggest shrubs and forbs are impacted (through reduce species richness and density) by the dry conditions to greater extent than sedges. This may imply that shrubs and forbs would be more impacted by any water draw down than sedges.

Rainfall, Soil Moisture and Floristic Diversity: The effect of a drying soil profile on species diversity and habitat structure remains unclear. It is noted that rainfall in the summer months preceding the April 2016 survey was consistently much higher than the months preceding the April 2017 survey. Prior to the April 2016 survey, soil moisture at 350mm depth was at saturation (>40%) until at least the time of survey and saturation at 150mm depth occurred consistently throughout the preceding summer months in response to rainfall. This was clearly not the case prior to the April 2017 survey event where soil moisture at 350mm depth was well below saturation in the preceding months. Only a gentle spike in soil moisture was noted in response to a late March rainfall event and saturation at 150mm depth did not occur until rainfall events in May, well after the survey was completed (see Figure 4). It is possible that the higher rainfall and soil moisture preceding the April 2016 survey facilitated an increase in forb and shrub diversity that was sustained throughout the year beyond the September 2016 monitoring event. This diversity may have tapered off rapidly during the dry summer months preceding the 2017 survey as the soil profile dried out significantly.

NDVI Data: The relationship between NDVI signature, vegetation structure and floristic diversity remains unclear. Of particular note is that the highest average NDVI values correspond with the October 2017 survey when floristic diversity was at its lowest and the lowest average NDVI values were recorded during the September 2016 capture when floristic diversity was recorded at its highest. There is also no indication that highest NDVI values correspond to the highest recorded 'living cover' as presented in Figure 14 and Figure 15. These results suggest that the measured NDVI is responding to the 'greenness' or productivity of the living biomass or possibly one particular species rather than the total living cover. As such, it presents a significant challenge to correlate NDVI values with field based observations regarding habitat vigour and productivity.

Summary: Ecological data collected over several survey periods spanning 2014 to 2017 indicates that the control (Site 5a to 5c) and impact sites (Site 6a to 6c) are broadly similar in structural and floristic attributes. The major structural differences are a significantly higher shrub cover and stem density for

shrubs in the 0.5m to <1m size class at the impact site. There is however a general trend toward the reduction of shrub cover in the lower size class at the impact site, coupled with a statistically significant decline in stem density that spans several survey periods.

Other structural features including grasstree cover and sedge / rush cover varied between survey events although showed no strong evidence that significant changes to cover values have occurred since the monitoring program commenced in 2015. Although the 2016 survey effort indicated a significantly higher cover of forbs than the control site, data collected during the 2017 surveys suggest that this difference has moderated over time, possibly in response to drier conditions.

The major trend identified at completion of the 2017 survey is a very strong reduction in species diversity that has occurred across all sites between the 2016 and recently completed (2017) surveys. The diversity loss has impacted forb, shrub and sedge / rush lifeforms with statistically significant reductions in species numbers recorded in both the impact and control sites. This strongly suggests landscape scale influences are affecting species diversity rather than local impacts and it is postulated that the loss of species diversity is likely due to the compounding influences of a drying climatic cycle and its influence on soil moisture in the upper soil layers as well as the influence of long-term absence of fire.

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5.0 References

Bureau of Meteorology (BOM) (2017). Climate Data Online – Beerburrum Forest Station, available at:

http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=136&p_display_type=dailyDataFile&p_startYear=&p_c=&p_stn_num=040284

Department of Environment and Heritage – NSW Government (2017). Threatened Species Profile – Acacia bauera available at:
http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10005

Eyre, T.J., Kelly, A.L, Neldner, V.J., Wilson, B.A., Ferguson, D.J., Laidlaw, M.J. and Franks, A.J. (2015). BioCondition: A Condition Assessment Framework for Terrestrial Biodiversity in Queensland. Assessment Manual. Version 2.2. Queensland Herbarium, Department of Science, Information Technology, Innovation and Arts, Brisbane.

Froend R., Summer B. (2010). Pheatophytic vegetation response to climatic and abstraction induced groundwater drawdown: Examples of long-term spatial and temporal variability in community response. Ecological Engineering 36; 1191 – 1200.

Froend R, Loomes R, Horwitz P, Bertuch M, Storey A & Bamford M (2004). Study of ecological water requirements on the Gnangara and Jandakot Mounds under section 46 of the Environmental Protection Act. Task 2: determination of ecological water requirements. Report to the Water and Rivers Commission. Centre for Ecosystem Management, ECU, Joondalup.

Griffith, Stephen J.; Rutherford, Susan; Clarke, Kerri L.; Warwick, Nigel W. M. (2015). Water relations of wallum species in contrasting groundwater habitats of Pleistocene beach ridge barriers on the lower north coast of New South Wales, Australia. Australian Journal of Botany , Volume 63 (7) – Sep 14, 2015

Groom PK (2003). Groundwater-dependency and water relations of four Myrtaceae shrub species during a prolonged summer drought. Journal of the Royal Society of Western Australia 86 : 31–40.

Groom PK (2004). Rooting depth and plant water relations explain species distribution patterns within a sandplain landscape. Functional Plant Biology 31(5) : 423–428.

Groom PK, Froend RH & Mattiske EM (2000a). Impact of groundwater abstraction on a Banksia woodland, Swan Coastal Plain, Western Australia. Ecological Management and Restoration 1 : 1–12.

Groom PK, Froend RH, Mattiske EM & Koch B (2000b). Myrtaceous shrub species respond to long-term decreasing groundwater levels on the Gnangara Groundwater Mound, northern Swan Coastal Plain. Journal of the Royal Society of Western Australia 83 : 75–82.

Groom PK, Froend RH, Mattiske EM & Gurner RP (2001). Long-term changes in vigour and distribution of Banksia and Melaleuca overstorey species on the Swan Coastal Plain. Journal of the Royal Society of Western Australia 84 : 63–69.

Jacobs (2015). Bribie Island Borefield – GDE Heathland Vegetation Monitoring Survey – February 2015. Prepared for Seqwater.

McFarland D. C (1990). Flower and seed phenology of some plants in the subtropical heathlands of Cooloola National Park, Queensland, Australia. Australian Journal of Botany 38: 501 – 9.

Neldner, V.J., Wilson, B.A., Thompson, E.J. and Dillewaard, H.A. (2012). Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland. ISBN: 1-9209280-2-2

Seqwater (2015). Banksia Beach Borefield – Borefeild Environmental Management Plan (BEMP).

SKM (2013) Bribie Island Borefield Groundwater Model Refinement, GDE Assessment and Monitoring Review. Report produced for Seqwater by Sinclair Knight Merz Pty Limited.

Specht, A. and Stubbs, B.J (2011). Long-term monitoring of a coastal sandy freshwater wetland: Eighteen Mile Swamp, North Stradbroke Island, Queensland. Proceedings of the Royal Society Of Queensland 117: 201 - 223.

Tozer M. G and Bradstock R. A (2002). Fire-mediated effects of overstorey on plant species diversity and abundance in an eastern Australian heath. Plant Ecology: V164, 213 – 223.

6.0 Appendix

Appendix A - Monitoring Transects

Survey Locality 5a

Date of Assessment: 28 /04 / 2016.
Plot Size:50 m linear transect (Canopy Cover); 50 x 4m transect for S2 shrubs >0.5m; 10 x 1m x 1m quadrats for Ground Cover.
Location (Plot Centreline): *Start* -26.9942/ 153.158764; *Centre* --26.9942/ 153.1590571; *Finish* - 26.9942/ 153.15932
Structure: Heath

Shrub Cover** – Canopy Intercept (>50cm) (summarised 50 m transect)

April 2017

Intercept (m)	Species	Shrubs > 1m		Shrubs >0.5 to <1m	
		Intercept S1	Height (M)	Intercept S1	Height (M)
1.9 – 3.6	*Persoonia virgata*	1.7	2		
8.2 – 11.0	*Persoonia virgata*	2.8	1.9		
13.2 – 13.8	*Persoonia virgata*	0.6	1.1		
14.9 – 17.1	*Persoonia virgata*	2.2	1.5		
17.5 – 18.0	*Persoonia virgata*	0.5	1.1		
18.5 – 19.0	*Persoonia virgata*	0.5	1.4		
23.1 – 23.5	*Leptospermum semibaccatum*			0.4	0.5
31.8 – 32.5	*Persoonia virgata*	0.7	1.5		
37.0 – 38.1	*Persoonia virgata*	1.1	1.6		
38.5 – 39.1	*Persoonia virgata*	0.6	1.1		
40.5 - 43.8	*Persoonia virgata*	3.3	1.8		
45.0 – 45.4	*Leucopogon leptospermoides*			0.4	0.6
48.1 – 48.9	*Persoonia virgata*	0.8	1.7		
Total Cover		14.8		0.8	
Average Height			1.52		0.6

* Projected over 100 m; ** Shrubs > 1m

October 2017

Intercept (m)	Species	Shrubs > 1m		Shrubs >0.5 to <1m	
		Intercept S1	Height (M)	Intercept S1	Height (M)
2.1 – 2.5	*Persoonia virgata*	0.4	2		
2.5 – 3.7	*Persoonia virgata*	1.2	2		
9.6 – 11.1	*Persoonia virgata*	0.5	1.6		
13.4 – 13.9	*Persoonia virgata*	0.5	1.1		
16 – 16.2	*Persoonia virgata*	0.2	1.2		
23.7 – 24.4	*Agiortia pedicellata*	0.7	1		
23.2 – 23.5	*Leptospermum semibaccatum*			0.3	0.6
31.7 – 32.5	*Persoonia virgata*	0.8	1.4		
36.9 – 37.4	*Persoonia virgata*	0.5	1.1		
37.4 – 38	*Persoonia virgata*	0.6	1.6		
37.6 – 38.2	*Leucopogon leptospermoides*			0.6	0.6
39.8 – 42.2	*Leucopogon leptospermoides*	2.4	1.5		
42.4 – 42.8	*Persoonia virgata*	0.4	0.7		
44.7 – 45.7	*Persoonia virgata*	1	1.8		
47.1 – 48.1	*Persoonia virgata*	1	1.9		
Total Cover		10.2		0.9	
Average Height			1.45		0.6

* Projected over 100 m; ** Shrubs > 1m

Stem Counts (50 x 4) – Shrubs > 0.5m

April 2016

Species	50 m x 4 m Stems (50x4m) April 2017	50 m x 4 m Stems (50x4m) October 2017
	S2	
Persoonia virgata	61	52
Boronia falcifolia	1	
Leptospermum semibaccatum	1	6
Dilwynnia floribunda		
Agiortia pedicellata		
Baeckea frutescens		1
Leucopogon leptospermoides	11	7
*Pinus elliottii***		
Epacris pulchella		
Leptospermum polygalifolium	1	1
Totals	75	67

**projected count over 50 x 10m

Ground Cover %- 1 x 1m Sub-plots

April 2017

Ground Cover Type	Species	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Mean April 17
Native perennial grass / sedges	*Caustis recurvata*	15	10	5	15	5		20	5	15	15	24.65
	Sporodanthus interuptus	1					10	5	15	5	10	
	Lomandra elongata									5	5	
	Lomandra sp.									0.5	5	
	Baloskion tenuiculme	2.5	5	25	30		10	5		2.5		
Native forbs and other spp.	*Pimelea liniifolia*	1						0.5				0.15
	Cassytha glabella											
Native shrubs ,<1m	*Leucopogon leptospermoides*							0.5				10.81
	Baeckea imbricata			0.1								
	Homoranthus virgatus											
	Baeckea frutescens		2.5	2.5	2.5	2.5		0.5		10	2.5	
	Strangea linearis		2.5		0.5	5		10		1	2.5	
	Epacris pulchella			2.5		2.5						

Ground Cover Type	Species	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Mean April 17
	Leptospermum semibaccatum				0.5				40		1	
	Agiortia pedicellata						1	0.5	5			
	Persoonia virgata				1					2.5		
	Dilwynnia floribunda										1.5	
Grass Tree	*Xanthorrhoea fulva*	30	40	50	10	25	50			40	10	25.5
Cryptogams		0.5										
Bare Ground			2.5		2.5			5	5			1.5
Exotic Shrubs												0
Leaf litter		45.5	37.5	14.9	38	60	29	53	30	18.5	47.5	37.29
Timber (>/= 10cm)												
Total		100	100	100	100	100	100	100	100	100	100	100%

October 2017

Ground Cover Type	Species	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Mean April 17	Mean October 17
Native perennial grass / sedges	*Caustis recurvata*	10		10	10	10	5	25	10	10	20	24.65	34
	Sporodanthus interuptus			5	25	20	10	15	25	15	10		
	Lomandra elongata		5				5		5	10	15		
	Lomandra sp.												
	Baloskion tenuiculme	5	5	15	15	5	10						
	Eriachne pallens				1								
Native forbs and other spp.	*Pimelea liniifolia*	0.5		1	0.5		0.5					0.15	0.4
	Cassytha glabella			0.5									
	Stackhousia nuda		1										
Native shrubs ,<1m	*Homoranthus virgatus*	1	2.5		2.5		5	0.5	0.5			10.81	12.25
	Leucopogon leptospermoides	0.5			0.5		5	5	5	5			
	Leptospermum semibaccatum		5		2.5	10	10	0.5	20				
	Baeckia imbricata	0.5	2.5	0.5									
	Baeckia frutescens			0.5	1					10	2.5		
	Strangea		2.5					10			1		

Ground Cover Type	Species	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Mean April 17	Mean October 17
	linearis												
	Epacris pulchella												
	Dillwynia floribunda								0.5				
	Boronia Falcifolia	10											
Grass Tree	*Xanthorrhoea fulva*	50	20	25	10	10	10			15	10	25.5	15
Cryptogams													
Bare Ground		2.5	2.5	2.5		2.5	10	2.5	5	2.5	1	1.5	1.95
Exotic Shrubs													
Leaf litter		20.5	54	32.5	30.5	45	39.5	39	29	32.5	41.5	37.29	36.4
Timber (>/= 10cm)													
Total		100	100	100	100	100	100	100	100	100	100	100%	100%

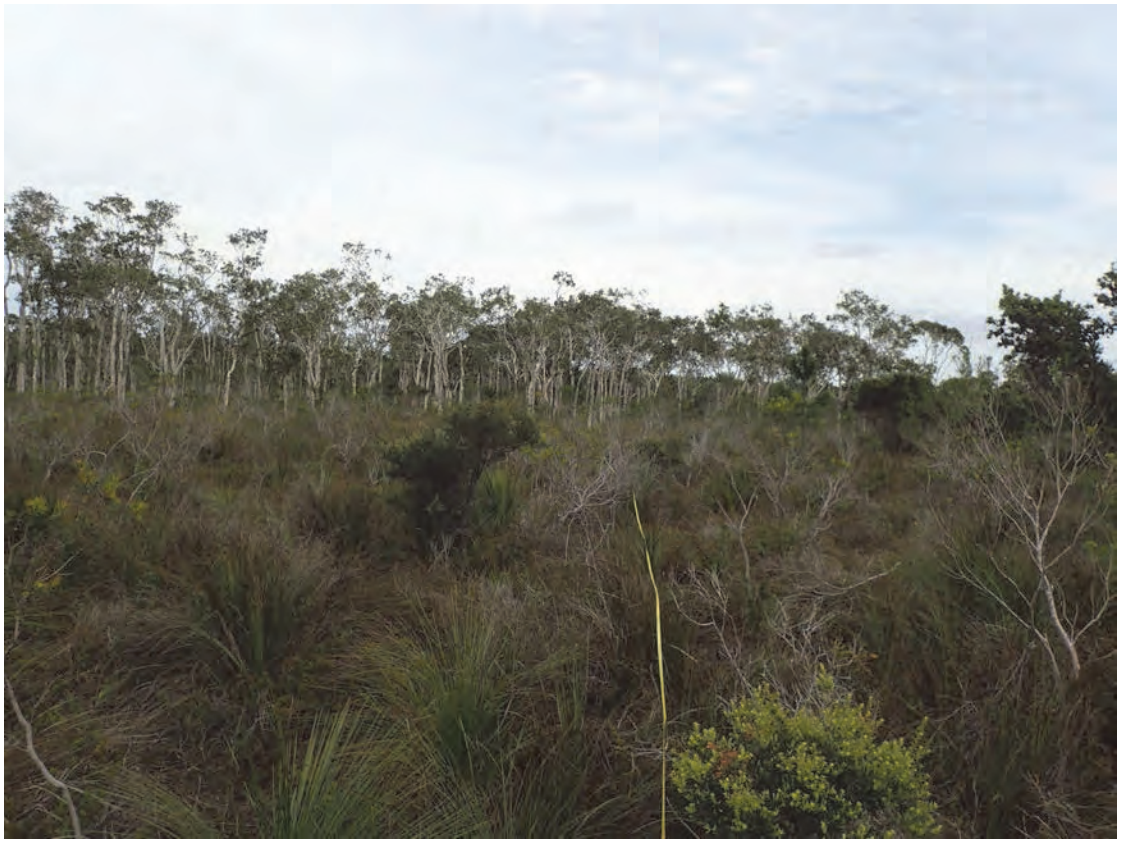
Additional Species (50 x 50m plot) recorded in April and September surveys: *Sprengelia sprengelioides, Ochrosperma lineare, Epacris pulchella, Patersonia sericea, Conospermum taxifolium, Aotus lanigera, Drosera binata*

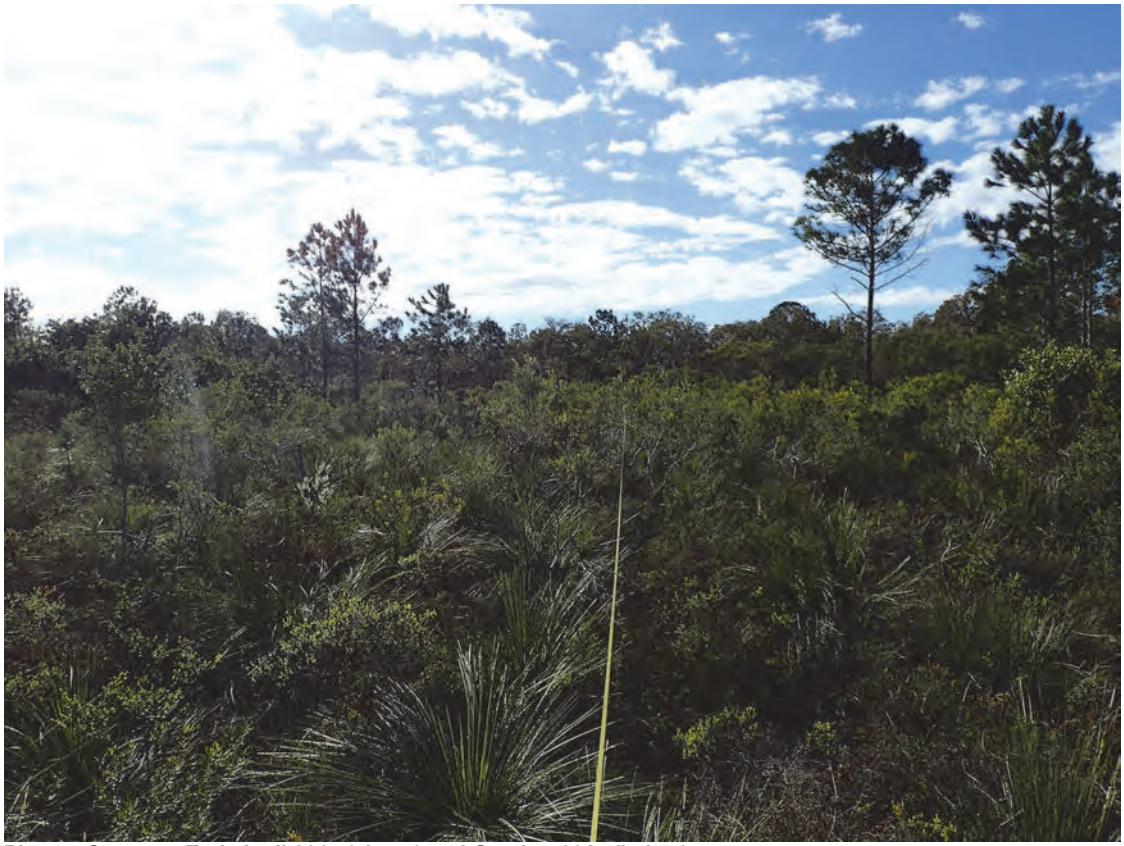
Structural / Floristic Summary

BioCondition Attribute		April 2017	October 2017
Native Plant Species Richness	Tree:		
	Shrub:	15	
	Grass Tree	2	
	Grass / Sedge / Rush	6	
	Forbs and other:	4	
Total Species No.**		26	
Native Shrubs	Projected Canopy Cover – Shrubs > 1m (%)	29.6	20.4
	Projected Canopy Cover – Shrubs >0.5 to <1m (%)	1.6	1.8
	Average Height >1m	1.52	1.45
Native Ground cover (%):	Native perennial grass / sedge cover (%):	24.75	33.1
	Native shrubs (%)	10.81	11.55
	Grass tree	25.5	15
	Organic litter cover (%):	37.29	36.85
	Native forb cover	0.15	0.4
Coarse woody debris:	Total length (m) of debris ≥ 10cm diameter and ≥0.5m in length per hectare	0	0
Non-native plant cover	Non-native Grasses	0	0
	Non-native shrubs	0	0

**Excludes Exotic Species

Plot 5a – Centre to Start; April 2017 (Above) and October 2017 (Below).





Plot 5 – Centre to End; April 2017 (above) and October 2017 (below).

Plot 5a – Centre to Left; April 2017 (Above) and October 2017 (Below).

Plot 5a – Centre to Right: April 2017 (Above) and October 2017 (Below).

Survey Locality 5b

Date of Assessment: 28.04.2017; 13:10.2017
Plot Size:50 m linear transect (Canopy Cover); 50 x 4m transect for S2 shrubs >0.5m; 10 x 1m x 1m quadrats for Ground Cover.
Location (Plot Centreline): *Start* -26.9943/ 153.1587965; *Centre -26.9944*/ 153.1589816; *Finish* - 26.9944/ 153.1593191
Structure: Heath

Shrub Cover** – Canopy Intercept (>50cm) (summarised 50 m transect)

April 2016

Intercept (m)	Species	Shrubs > 1m		Shrubs >0.5 to <1m	
		Intercept S1	Height (M)	Intercept S1	Height (M)
0.6 - 1.8	*Persoonia virgata*	1.2	1.6		
5 – 5.4	*Persoonia virgata*	0.4	1.5		
7.2 – 9.0	*Persoonia virgata*	1.8	1.5		
15.9 – 17.0	*Persoonia virgata*	1.1	1.1		
21.8 – 23.0	*Persoonia virgata*	1.2	1.5		
23.5 - 24.0	*Persoonia virgata*	0.5	1.5		
34.2 - 35.0	*Persoonia virgata*	0.8	1.5		
36.7 – 38.1	*Persoonia virgata*	1.4	1.5		
43.6 - 44.2	*Persoonia virgata*	0.6	1.2		
44.2 – 45.0	*Persoonia virgata*	0.8	2		
45.4 – 46.0	*Persoonia virgata*	0.6	2		
46.7 – 47.2	*Strangea linearis*			0.5	0.8
Total Cover		10.1		0.5	
Average Height			1.54		0.8

** Shrubs > 1m

October 2017

Intercept (m)	Species	Shrubs > 1m		Shrubs >0.5 to <1m	
		Intercept S1	Height (M)	Intercept S1	Height (M)
0.8 - 1.5	*Persoonia virgata*	1.7	1.6		
3.1 – 3.8	*Persoonia virgata*	0.7	1.5		
3.9 – 4.1	*Boronia Falcifolia*			0.2	0.6
7.4 – 9.7	*Persoonia virgata*	2.3	1.5		
11.9 – 12.9	*Leucopogon leptospermoides*			1	0.8
16 – 16.8	*Persoonia virgata*	0.8	1.2		
21.8 - 23	*virgata*	1.2	1.5		
23 – 23.4	*Leucopogon leptospermoides*			0.4	0.6
30.2 – 30.7	*Leucopogon leptospermoides*	0.5	1		
34.3- 35.5	*Persoonia virgata*	1.2	1.5		
36.5 – 38.3	*Persoonia virgata*	1.8	1.5		
43.7 – 45.0	*Strangea linearis*	1.3	2.3		
45.4 – 46.1	*Persoonia virgata*	0.7	2.3		
Total Cover		12.2		1.6	
Average Height			1.6		0.7

** Shrubs > 1m

Stem Counts (50 x 4) – Shrubs > 0.5m

Species	50 m x 4 m Stems (50x4m) April 2017	50 m x 4 m Stems (50x4m) October 2017
	S2	S2

Persoonia virgata	52	45
Leucopogon leptospermoides	3	13
Ochrosperma lineare		1
Boronia falcifolia		1
Leptospermum semibaccatum	2	3
Sprengelia sprengelioides		
Strangea linearis	5	3
Acacia flavescens	1	1
Epacris pulchella		
Agiortia pedicellata	4	2
Baeckea frutescens	1	
Xanthorrhoea johnsoni (from top of trunk	1	1
Homoranthus virgatus		2
Totals	68	72

**projected count over 50 x 10m

Ground Cover %- 1 x 1m Sub-plots

April 2017

Ground Cover Type	Species	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Mean April 17
Native perennial grass / sedges	*Caustis recurvata*	10	15	2.5	10	2.5	0	10	20	15	15	29.1
	Sporodanthus interruptus	25			15			15		15	20	
	Baloskion tenuiculme		25		10	15					10	
	Lomandra elongata	2.5	2.5								1	
	Lomandra sp.						2.5					
	Eriachne pallescens var. gracilis		1.5									
	Hypolaena fastigiata			5	10	1	2.5	5	2.5	5		
Native forbs and other spp.	*Pimelea liniifolia*				1				0.5			0.4
	Cassytha glabella											
	Pattersonia sericea		2.5									
Native shrubs ,<1m	*Leucopogon leptospermoides*		5		5		2.5	10	5		2.5	15.45
	Strangea linearis		5					2.5				
	Epacris pulchella			1.5								
	Leptospermum semibaccatum		20	15	1.5	5	15	20	10	1	2.5	
	Dilwynnia floribunda									1		
	Baeckea frutescens	2.5				10	5	2	5			
Grass Tree	*Xanthorrhoea fulva*	20	5	15	2	20	20		5	10	10	10.7

Ground Cover Type	Species	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Mean April 17
Cryptogams												
Bare Ground		5		5	2.5							1.25
Exotic Shrubs	*Pinus elliottii***											
Leaf litter		35	18.5	56	43	44	55	35.5	52	53	39	43.1
Timber (>/= 10cm)												
Total		100	100	100	100	100	100	100	100	100	100	100%

October 2017

Ground Cover Type	Species	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Mean April 17	Mean Oct 16
Native perennial grass / sedges	*Caustis recurvata*	15	5	5	20	10	5	10	25	10	10	29.1	33.7
	Sporodanthus interruptus	15	15	5	15	5	2.5	5	5	10	5		
	Baloskion tenuiculme	15	15	5			5	5		20	15		
	Hypolaena fastigiata			5	5	5	2.5	5	5	2.5	5		
	Lomandra elongata		10			2.5	2.5		1	1			
	Eriachne pallescens var. gracilis	2.5	2.5								2.5		
Native forbs and other spp.	*Pimelea liniifolia*								1		1	0.4	0.2
Native shrubs ,<1m	*Leucopogon leptospermoides*	2.5			10					1		15.5	13.8
	Strangea linearis			5		10			1				
	Epacris obtusifolia					0.5							
	Epacris pulchella						2.5						
	Ochrosperma lineare	2	1	2.5	1	2.5	2.5	2.5	1	1	5		
	Leptospermum semibaccatum			10		2.5	30	10	5	1	5		
	Persoonia virgata							5					
	Dilwynnia floribunda						0.5		0.5				
	Homoranthus virgatus			5	2.5	5	2.5						
	Strangea			5		10			1				

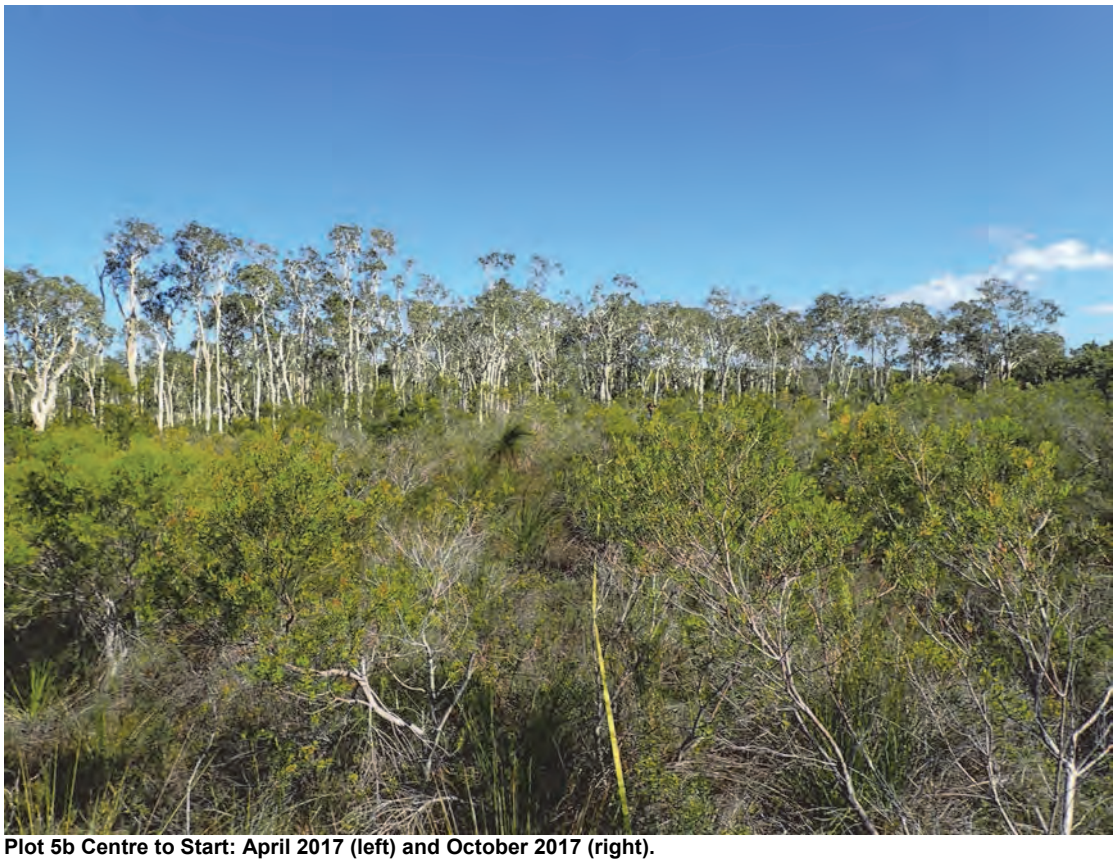
Ground Cover Type	Species	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Mean April 17	Mean Oct 16
	linearis												
Grass Tree	*Xanthorrhoea fulva*	15	10	10		10			10		15	10.7	7
Cryptogams													
Bare Ground		2.5	10		5		15	5	5	2.5		1.25	4.5
Exotic Shrubs	*Pinus elliottii***									1		0	0.1
Leaf litter		30.5	31.5	47.5	41.5	47	29.5	52.5	39.5	50	36.5	43.1	40.6
Timber (>/= 10cm)													
Total		100	100	100	100	100	100	100	100	100	100	100%	100%

Additional Species: *Epacris pulchella, Cassytha glabella, Cryptostylis erecta, Conospermum taxifolium, , Stackhousia nuda*

Structural / Floristic Summary

BioCondition Attribute		April 2017	September 2016
Native Plant Species Richness	Tree:	.0	
	Shrub:	14	
	Grass Tree	1	
	Grass / Sedge	7	
	Forbs and other:	5	
Total Species No.**		27	
Native Shrubs	Projected Canopy Cover – Shrubs > 1m (%)	10.1	12.2
	Projected Canopy Cover – Shrubs >0.5 to <1m (%)	0.5	1.6
Native Ground cover (%):	Native perennial grass / sedge cover (%):	29.1	33.7
	Native shrubs (%)	15.5	13.8
	Grass tree	10.7	7
	Organic litter cover (%):	43.1	40.6
	Native forb cover (%)	0.4	0.2
Coarse woody debris:	Total length (m) of debris ≥ 10cm diameter and ≥0.5m in length per hectare	0	0
Non-native plant cover	Non-native Grasses	0	0
	Non-native shrubs	0	0.1

** Excludes Exotic Species



Plot 5b Centre to Start: April 2017 (left) and October 2017 (right).