Australian Collaborative Rangeland Information System, Reporting Change in the Rangelands – 2007

WA Information for the National Report

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SUMMARY

This document summarises information provided by the Western Australian Department of Agriculture and Food (DAFWA) that contributed to the Australian Collaborative Rangeland Information System (ACRIS) reporting of change in Australia's rangelands for the period 1992 to 2005. A national synthesis has been compiled from relevant jurisdictional and national data and will be released in the second half of 2007 or early 2008.

The Western Australian Rangeland Monitoring System (WARMS) has provided comprehensive site-based data to support WA's reporting to the biophysical themes of the ACRIS report.

Reporting is mainly at bioregion level (version 6.1 of the Interim Biogeographic Regionalisation of Australia, IBRA). Where available data are limited spatially, reporting is confined to relevant sub IBRAs of bioregions. WARMS data are restricted to the area of pastoral tenure within bioregions.

Information in this (WA) report relates to:

- Change in landscape function (comprehensive information from WARMS compiled in Appendix 1).
- Change in critical stock forage as a component of sustainable management (WARMS results in Appendix 1).
- Change in richness of native plant species. These data were originally intended to contribute to the ACRIS biodiversity theme but were subsequently used as a component of sustainable management (WARMS data in Appendix 1). The ACRIS Biodiversity Working Group has compiled data and information for the 2007 national report based on 10 indicators. The WA Department of Environment and Conservation contributed information for WA (not included in this report).
- Change in woody cover based on WARMS data (Appendix 1).
- The percentage area of pastoral tenure by sub IBRA that is at different distance classes from sources of permanent and semi-permanent waterpoints for stock.
- Stocking density data from livestock returns to the WA Pastoral Lands Board. These data are used to validate nationally available stocking density data sourced from the Australian Bureau of Statistics.
- The percentage area of bioregions and sub IBRAs within the WA conservation estate.
- Change in pastoral land values.

ACKNOWLEDGEMENTS

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The Pastoral Lands Board of Western Australia - Sandra van Vreeswyk.

Vanessa Chewings of CSIRO produced the site seasonal quality scores and provided general GIS support and advice. Melissa Schliebs provided a number of data sets and maps for general use. Gary Bastin put an enormous effort into guiding the states and managing the production of the ACRIS report. The national synthesis would not have been produced without Gary's good humour, keen intelligence and diligence in the face of many frustrations.

Members of the ACRIS Management Committee provided more general direction and guidance with jurisdictional contributions to the 2007 national report.

WA reporting was supported by Natural Heritage Trust funding administered by the Desert Knowledge CRC. We thank the DK-CRC Secretariat, and Ange Vincent in particular, for their contribution by way of implementing and managing contractual arrangements.

INTRODUCTION

The Australian Collaborative Rangeland Information System (ACRIS) is in the final stages of compiling its national report of change in the rangelands for the period 1992 to 2005. This report will be published in the second half of 2007 or early 2008. The national report has been compiled from available jurisdictional and national datasets and this document consolidates the various reports contributed by the Western Australian Government agencies (principally the Department of Agriculture & Food WA, DAFWA) to assist ACRIS reporting. Reporting is by bioregion (IBRA v 6.1, Fig. 1).

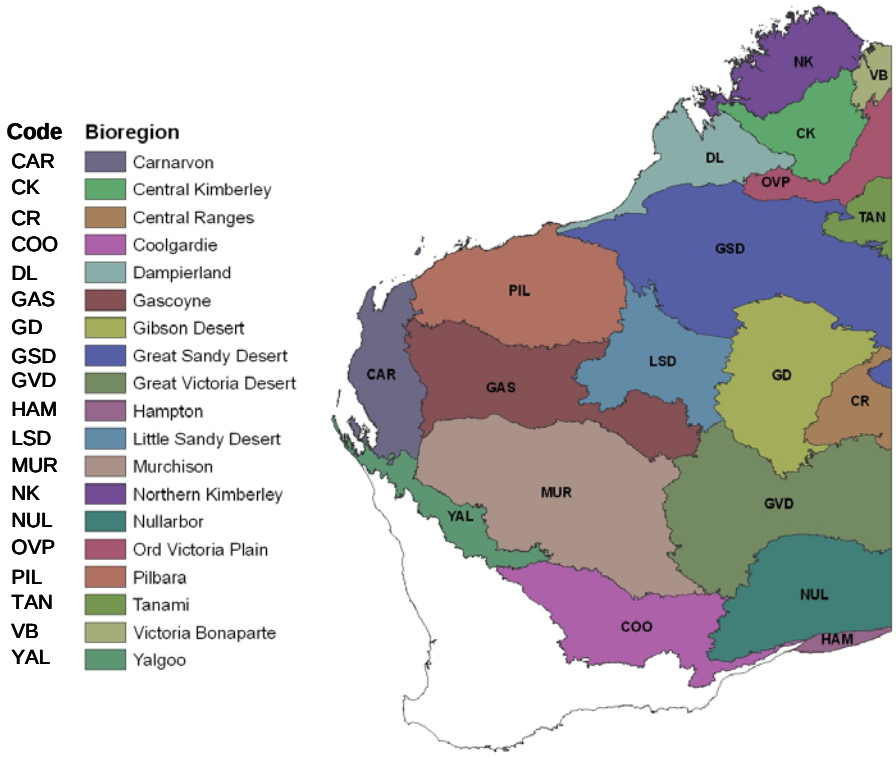


Figure 1. Western Australian rangeland bioregions (v 6.1).

The national report is based on a number of biophysical and socio-economic themes and related products. Western Australia's contribution to these themes is listed in Table 1.

Reporting Area

Western Australia is reporting principally on its grazed rangelands where WARMS monitoring sites exist. Reporting is by bioregion in the main but results are restricted to relevant sub IBRAs where site data are restricted in their spatial distribution. A location map (that also shows WARMS sites) is included as part of the bioregion summaries later in this report. Reporting of watered area and land values applies to areas of pastoral tenure. Statistics on the conservation estate apply to all of the WA rangelands.

Table 1. Reporting contribution by WA to the 2007 ACRIS national synthesis of change in the rangelands.

Theme	Product	Datasets
Landscape function	Landscape function Appendix 1 of this report	WARMS (WA Rangeland Monitoring System): Resource Capture Index; stability, infiltration & nutrient cycling indices calculated from formal landscape function assessment (LFA) Southern shrublands – population growth rate (density) & canopy area (cover) Northern grasslands – perennial grass frequency, crown cover of woody species
Sustainable management	Critical stock forage Appendix 1	WARMS: Southern shrublands – population growth rate (density) of decreaser, intermediate & increaser shrubs Northern grasslands – frequency of decreaser, intermediate & increaser perennial grasses
	Woody cover Appendix 1	WARMS: Southern shrublands – canopy area (cover) of trees & shrubs in different height classes Northern grasslands – canopy area (cover) of trees & shrubs in different height classes
	Waterpoints	Distance from water percentage of pastoral tenure area within sub IBRAs at different distance classes from sources of stock water
	Stocking density	Stock returns (sheep and cattle) compiled at regional level to validate national (ABS) data
Biodiversity	Plant species richness Appendix 1	WARMS: - Note, these data were originally intended to support ACRIS reporting of change in biodiversity but were subsequently used as part of the sustainable management theme. Southern shrublands – native shrub species richness & frequency of occurrence Northern grasslands – native perennial species richness & native species frequency of occurrence
	Conservation estate	Department of Environment & Conservation Change in percentage area of IBRA & sub IBRA conserved
Socio-economic	Land values	Change in 'lease & improvements' value of pastoral land by pastoral region
Supporting information	Photos	Time-series photos of selected rangeland monitoring sites

Report Contents

This report is structured as follows:

1. An overview of, and context for, WA's contribution to the national synthesis of change in the rangelands being compiled by ACRIS.

2. A brief description of WARMS and how to directly access data presented in Appendix 1 (i.e. WARMS results).

3. A description of the procedures used to account for seasonal variability in interpreting change using WARMS data.

4. Brief explanations of the ACRIS themes and products that WARMS data directly contribute to (noting that the data are consolidated in Appendix 1).

5. Information compiled for the additional ACRIS products that WA is contributing to.

6. Appendix 1 – WARMS data summaries

7. Appendix 2 – WARMS shrub species dynamics

8. Appendix 3 – Determination of seasonal quality categories for WARMS monitoring sites used in ACRIS.

9. Appendix 4 – GIS analysis of distance to water.

WARMS: the Western Australian Rangeland Monitoring System

WARMS consists of about 1,622 permanent ground sites on which attributes of perennial vegetation and soil surface condition are assessed (Fig 2). There are two types of WARMS sites: grassland sites are used in the Kimberley, Pilbara and northern Gascoyne, and shrubland sites are used from the southern Pilbara through to the Nullarbor. Grassland sites are assessed on a three year cycle and shrubland sites on a five year cycle. The system in its current form began in 1992, although many old monitoring sites were incorporated into the new system and some data and photo records go back to the 1970s. Further detail about site selection, layout and data collection methods is available in Watson *et al.* (2007b).

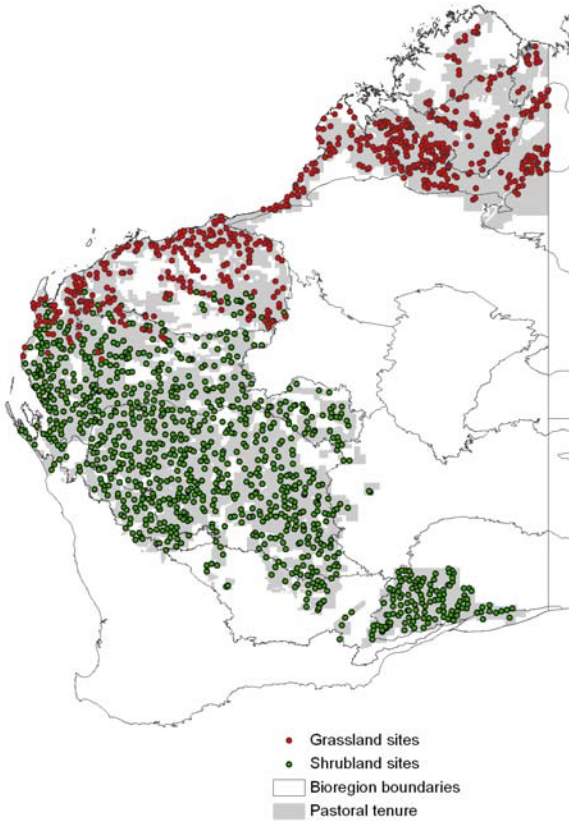


Figure 2. Location of WARMS grassland and shrubland sites.

Table 2 (following page) summarises the number of re-assessed WARMS shrubland and grassland sites by bioregion and sub IBRA available for ACRIS reporting.

Table 2. Number of re-assessed WARMS grassland and shrubland sites, by IBRA and sub-IBRA.

Region	IBRA name	IBRA code	No. of grassland sites	No. of shrubland sites	Total number of sites	sub-IBRA name	Sub-IBRA code	No. of grassland sites	No. of shrubland sites	Total number of sites
Kimberley	Central Kimberley	CK	83	0	83	Pentecost	CK1	42	0	42
						Hart	CK2	28	0	28
						Mt Eliza	CK3	13	0	13
	Dampierland	DL	171	0	171	Fitzroy Trough	DL1	112	0	112
						Pindan Land	DL2	59	0	59
	Great Sandy Desert	GSD	3	0	3	McLarty	GSD1	3	0	3
	Northern Kimberley	NK	20	0	20	Mitchell	NK1	19	0	19
						Berkeley	NK2	1	0	1
	Ord Victoria Plain	OVP	86	0	86	Ord Victoria Plain P1	OVP1	16	0	16
						South Kimberley Interzone	OVP2	70	0	70
	Tanami	TAN	5	0	5	Tanami P1	TAN1	5	0	5
	Victoria Bonaparte	VB	15	0	15	Victoria Bonaparte 1	VB1	15	0	15
Pilbara	Pilbara	PIL	179	25	204	Chichester	PIL1	82	2	84
						Fortescue	PIL2	24	12	36
						Hamersley	PIL3	25	10	35
						Roebourne	PIL4	48	1	49
Southern Rangelands										
	Avon Wheatbelt	AW	0	3	3	Avon Wheatbelt P1	AW1	0	3	3
	Carnarvon	CAR	55	127	182	Cape Range	CAR1	48	13	61
						Wooramel	CAR2	7	114	121

Region	IBRA name	IBRA code	No. of grassland sites	No. of shrubland sites	Total number of sites	sub-IBRA name	Sub-IBRA code	No. of grassland sites	No. of shrubland sites	Total number of sites
	Coolgardie	COO	0	40	40	Mardarbilla	COO1	0	2	2
						Southern Cross	COO2	0	9	9
						Eastern Goldfields	COO3	0	29	29
	Gascoyne	GAS	16	200	216	Ashburton	GAS1	13	30	43
						Carnegie	GAS2	0	52	52
						Augustus	GAS3	3	118	121
	Geraldton Sandplains	GS	0	2	2	Geraldton Hills	GS1	0	2	2
	Great Victoria Desert	GVD	0	10	10	Shield	GVD1	0	8	8
						Central	GV2	0	2	2
	Hampton	HAM	0	2	2	Hampton	HAM	0	2	2
	Mallee	MAL	0	1	1	Eastern Mallee	MAL1	0	1	1
	Murchison	MUR	0	392	392	Eastern Murchison	MUR1	0	274	274
						Western Murchison	MUR2	0	118	118
	Nullarbor	NUL	0	122	122	Northern Band	NUL1	0	6	6
						Central Band	NUL2	0	116	116
	Yalgoo	YAL	0	65	65	Edel	YAL1	0	10	10
						Tallering	YAL2	0	55	55
Total			**633**	**989**	**1622**	**Total**		**633**	**989**	**1522**

24 sites not reassessed to December 2005. These 24 sites are in the Pilbara (6), Gascoyne (5), Great Victoria Desert (2), Murchison (6) and Yalgoo (5) bioregions.

Appendix 1 data

Appendix 1 contains all the WARMS results compiled for ACRIS. It has its own table of contents with page numbers prefixed by '1-'. Tabulated results are presented for IBRAs and sub-IBRAs within the Kimberley, Pilbara and southern shrublands pastoral regions.

The same structure (see below) is repeated throughout the appendix for each IBRA or sub-IBRA, although there are some differences in structure between grassland sites and shrubland sites. Where both grassland and shrubland sites occur within the same IBRA or sub-IBRA, separate sections for grassland or shrubland are contained within each of the three themes; change in landscape function, change in management of the pastoral estate and change in vegetation richness and occurrence.

Structure of Appendix 1 reporting:

Pastoral region
- Bioregion
  - Site and seasonal summary
  - Change in landscape function
    - Population growth rate (i.e. density) of shrubland sites or perennial grass frequency (grassland sites)
    - Canopy area (shrubland sites) or crown cover (grassland sites)
    - Resource Capture Index (shrubland and grassland sites)
    - Proportional landscape function – stability, infiltration & nutrient cycling indices (shrubland and grassland sites)
  - Change in sustainable management of the pastoral estate
    - Population growth rate (i.e. density, shrubland sites) or perennial grass frequency (grassland sites) of decreaser, intermediate and increaser species
    - Canopy area (shrubland sites) of decreaser, intermediate and increaser species
  - Change in vegetation richness and occurrence
    - Native shrub species richness (shrubland sites) or native perennial species richness (grassland sites)
    - Frequency of occurrence – native species (shrubland and grassland sites)

SEASONAL QUALITY AS CONTEXT FOR REPORTING CHANGE

Rainfall (amount, timing and follow-up) is the principal driver of vegetation change. In northern Australia, frequent and extensive fire also affects the vegetation. ACRIS filters the effect of prior seasonal conditions on change recorded at monitoring sites (to the extent possible) so that the effects of grazing management are better understood. ACRIS uses the phrase 'seasonal quality' to represent seasonal conditions.

Assigning Causality to Change

ACRIS is using a 'quality of preceding seasons' by 'direction of change' matrix (see Fig. 3) to filter shorter-term seasonal influences from possible changes due to grazing management.

Seasonal quality is based on the ranked amount of rainfall in the growth season(s) prior to the monitoring period compared with the long-term record and is calculated as described below (see Appendix 3).

Columns report the percentage of monitoring sites where reported attributes of vegetation (or landscape) declined, were unchanged or improved.

Seasonal Quality	Change in Reported Attribute		
	Decline	No change	Improvement
Above average	XX	X	~
Average	X	~	√
Below average	~	√	√√

Figure 3. Matrix for filtering seasonal effects on change.

√√ shows improvement although seasonal conditions were below average. XX is of concern because sites declined when seasonal conditions indicated no change or improvement.

The value of this matrix for reporting change is increased where vegetation data are selected that either enhance management effects or further dampen seasonal influences. For example, focussing on longer-lived perennial species filters many ephemeral species that are directly affected by timing of rainfall. Grazing effects, both positive and negative, are sharpened by reporting change for those species known to decline with heavy and prolonged grazing. This assumes that seasonal conditions alone have the same impact on species that decrease, increase or are unaffected by grazing. The method used for assigning seasonal quality to each WARMS site in Western Australia is described in Appendix 3.

LANDSCAPE FUNCTION

Landscape function describes the capacity of landscapes to regulate (i.e. capture and retain, not leak) rainwater and nutrients, the vital resources for plant growth (Ludwig et al. 1997). Functional landscapes have a good cover and arrangement of persistent vegetation patches (typically perennial vegetation) for their type. This means that much of the rain soaks into the soil and is available for plant growth. There is generally minimal runoff and so there is limited loss of plant nutrients in transported sediment. Reduced overland flow also limits loss of organic matter (litter) and seeds. Similarly, a good cover and arrangement of vegetation patches minimises wind erosion and loss of nutrients in dust.

Change in the functionality of landscapes provides a sound basis from which to judge the effects of management on the rangelands. Functional landscapes are likely to recover quickly from disturbance (e.g. grazing, fire or drought), and to maintain a consistent vegetation cover through variable seasonal conditions. Dysfunctional landscapes may not recover, take longer to recover or change to a less desirable vegetation state.

Western Australia is reporting change in landscape function through (i) formal LFA data and (ii) perennial species frequency (northern grasslands) or (iii) shrub density (southern shrublands) collected at WARMS sites (data in Appendix 1). Although formal LFA data are the most rigorous, the latter two data types (frequency or density of perennial species) are being used for consistency with reporting by other jurisdictions. Change in landscape function within the pastoral estate of each bioregion indicated by the Resource Capture Index is included in the bioregion summaries.

Change in Landscape Function

Change in landscape function is reported in two mapsets for rangeland bioregions that have suitable data for reporting. Changes in perennial grass frequency (grassland sites) and shrub density (population growth rate, shrubland sites) beyond a threshold are used as the basis for reporting.

1. A mapped score for each bioregion showing **gross** change (Fig. 4). This is the percentage of monitoring sites reassessed in each bioregion that had either stable or increased landscape function during the 1992-2005 period.

   Note:

   i. Mapping is confined to pastoral land tenure within bioregions.
   ii. Bioregions are excluded from reporting if they do not have at least 10 sites which have been reassessed. This particularly applies when interpreting the effects of prior seasonal conditions (i.e. *seasonal quality*).

2. Seasonally adjusted change in landscape function (Fig. 5). This pair of maps shows:

   i. The percentage of sites that had **increased** landscape function following below-average seasonal conditions (top panel). Here (a) a higher percentage (i.e. bluer mapping) is better and (b) any value above 0% (coloured red) would be a positive result, even though red immediately looks like a negative result.

ii. The percentage of sites that had **decreased** landscape function following above-average seasonal conditions (bottom panel). This indicates loss of function because an increase would, reasonably, have been expected given prior seasonal conditions. Here, a lower percentage (i.e. bluer mapping) is the better result.

Gross change – all seasons

Most bioregions where grazing is the principle land use had a high proportion of monitoring sites (> ~60%) that had stable or increased landscape function (Fig. 4). Greater than 50% of sites reassessed in the Yalgoo (WA) bioregion had decreased landscape function. Some of this reduction is due to below-average seasonal conditions.

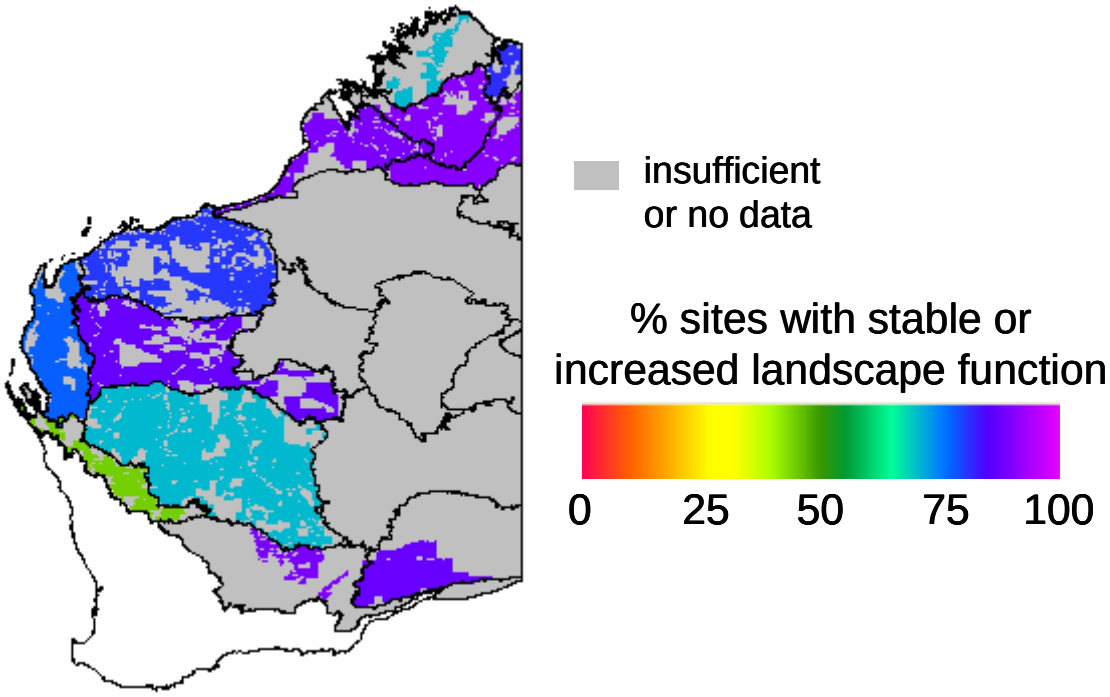


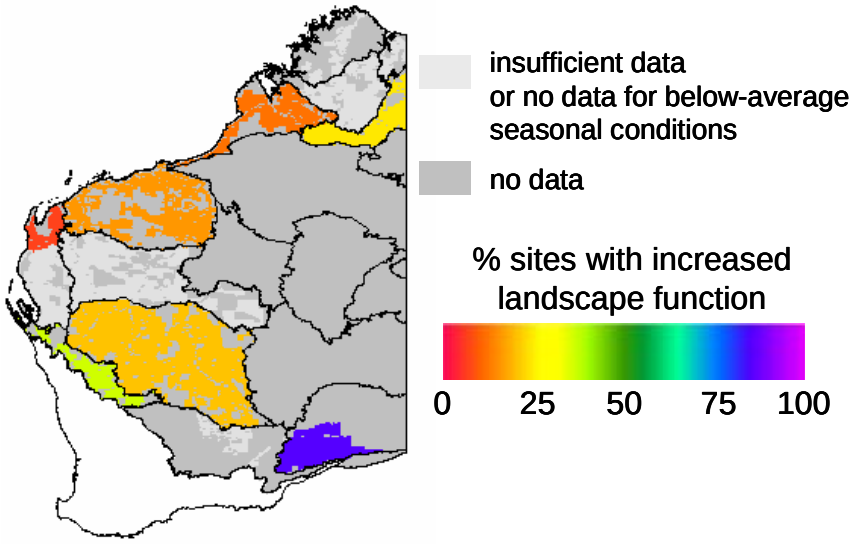
Figure 4. Gross change in landscape function based on perennial grass frequency or shrub density at WARMS sites.

The map shows the percentage of sites in each bioregion where landscape function was maintained or increased. Non-pastoral areas in each bioregion are masked out. Reporting is by sub IBRA where sites within some bioregions are confined to particular sub IBRAs.

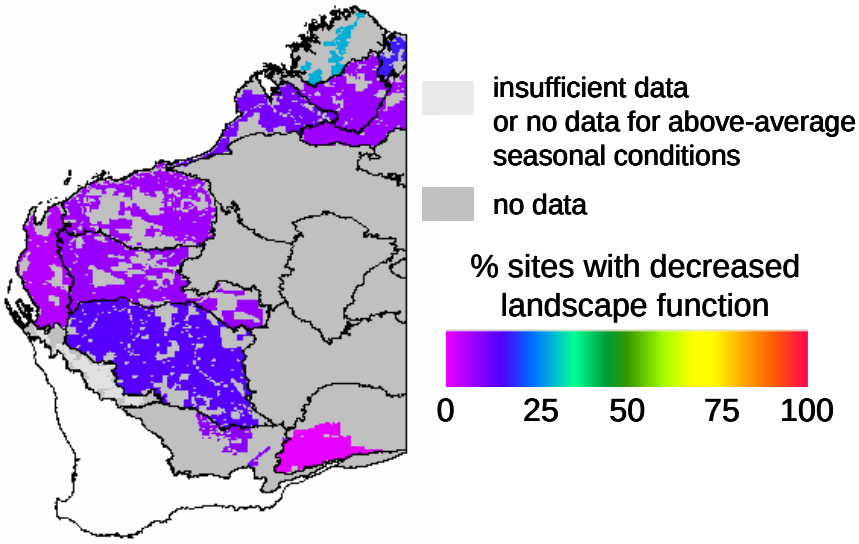
Seasonally adjusted change

Landscape function **increased** against the seasonal trend (i.e. decrease expected; Fig. 5, top panel) at a large proportion of sites in the Nullarbor 2 sub IBRA (NUL2, Nullarbor bioregion) in WA. Lesser increases occurred in the Dampierland, Ord Victoria Plain, Pilbara, Murchison and Yalgoo bioregions. Increased landscape function following poorer seasons was also recorded in the Carnarvon 1 sub IBRA (CAR1, Carnarvon bioregion). (Note that several regions had too few sites sampled during below average seasonal conditions to make a judgement.)

Landscape function **decreased** following above-average seasonal conditions (i.e. increase expected at this time) at a significant percentage of reassessed sites (>25%) in the Northern Kimberley 1 (NK1) sub IBRA (Fig.5, bottom panel). A lower percentage of reassessed sites had **decreased** landscape function following better seasons in most pastoral bioregions where ground-based monitoring occurs. Extensive wildfire following wetter years probably contributed to decreased landscape function in the NK1 sub IBRA.



Increase in landscape function following below-average seasonal conditions



Decrease in landscape function following above-average seasonal conditions

Figure 5. Seasonally-adjusted change in landscape function from WARMS monitoring.

Maps show the percentage of sites in each bioregion where there was (top) an *improvement* in perennial grass frequency or shrub density despite antecedent *below-average* seasonal conditions; and (bottom) a *decline* in perennial grass frequency or shrub density despite antecedent *above-average* seasonal conditions. The colour scheme is reversed between the two maps so that in each case, the blue-purple end of the colour scheme represents the more desirable outcome. For the top map, any value above 0% (coloured red) would be a positive result, even though red immediately looks like a negative result.

SUSTAINABLE MANAGEMENT

Grazing of native pastures is the most extensive commercial land use in the WA rangelands. The landscape function results above indicate that the ability of some rangeland environments to regulate resources (rain water, plant nutrients, litter, seeds etc) has been altered. It is important that current grazing management practices are sustainable (and remain so) because:

1. We shouldn't degrade natural systems (as a matter of principle).
2. Repairing degraded ecosystems is expensive and where degradation has occurred, restoration is often not economically viable or sensible on a large scale.
3. That will assist future marketing of meat and wool by maintaining the image of Australia's rangeland products as "clean" and "green".
4. It will prevent further loss of biodiversity, particularly those components vulnerable to standard agricultural practices.

ACRIS is reporting a number of components under 'sustainable management'. These include critical stock forage, plant species richness (where suitable data are available), woody cover change and distance from stock water. Allied reporting covers components of total grazing pressure (domestic stock, kangaroos and feral herbivores), fire and dust.

Western Australia is contributing data to the national reporting of change in critical stock forage, change in woody cover and distance from water.

Critical stock forage

Critical stock forage refers to those pasture species within broad regions (e.g. group of bioregions), that underpin or support longer-term livestock production. In the WA pastoral lands these palatable and perennial species are called 'decreasers'. Change is reported as for landscape function, i.e.:

1. A mapped score for each bioregion showing **gross** change as the percentage of monitoring sites reassessed in each bioregion that had either stable or increased levels of critical stock forage during the ACRIS reporting period (Fig. 6). As for landscape function, mapping is confined to pastoral land tenure within bioregions and bioregions are excluded from reporting if they do not have at least 10 sites which have been reassessed. This particularly applies when interpreting the effects of prior seasonal conditions.
2. Seasonally adjusted change in critical stock forage (Fig. 7). This pair of maps shows:
    - The percentage of sites that had **increased** levels of critical stock forage following below-average seasonal conditions (top panel). This is an encouraging result and suggests positive management as a decrease would reasonably have been expected at this time. Here (a) a higher percentage (i.e. bluer mapping) is better and (b) any value above 0% (coloured red) would be a positive result, even though red immediately looks like a negative result.
    - The percentage of sites that had **decreased** levels of critical stock forage following above-average *seasonal quality* (bottom panel). This indicates that

grazing management has retarded seasonal recovery because an increase would have been expected at this time. Here, a lower percentage (i.e. bluer mapping) is the better result.

Gross change – all seasons

Most bioregions where grazing is the principle land use had a high proportion of monitoring sites (> ~70%) that had stable or increased levels of critical stock forage based on monitoring at fixed sites (Fig. 6). Greater than 40% of sites reassessed in the Yalgoo and NK1 sub IBRA of the Northern Kimberley bioregions had decreased levels of critical stock forage through the 1992-2005 reporting period. At least some of this reduction was due to poorer seasonal conditions towards the end of the 14-year period and this is reported in more detail in the following section.

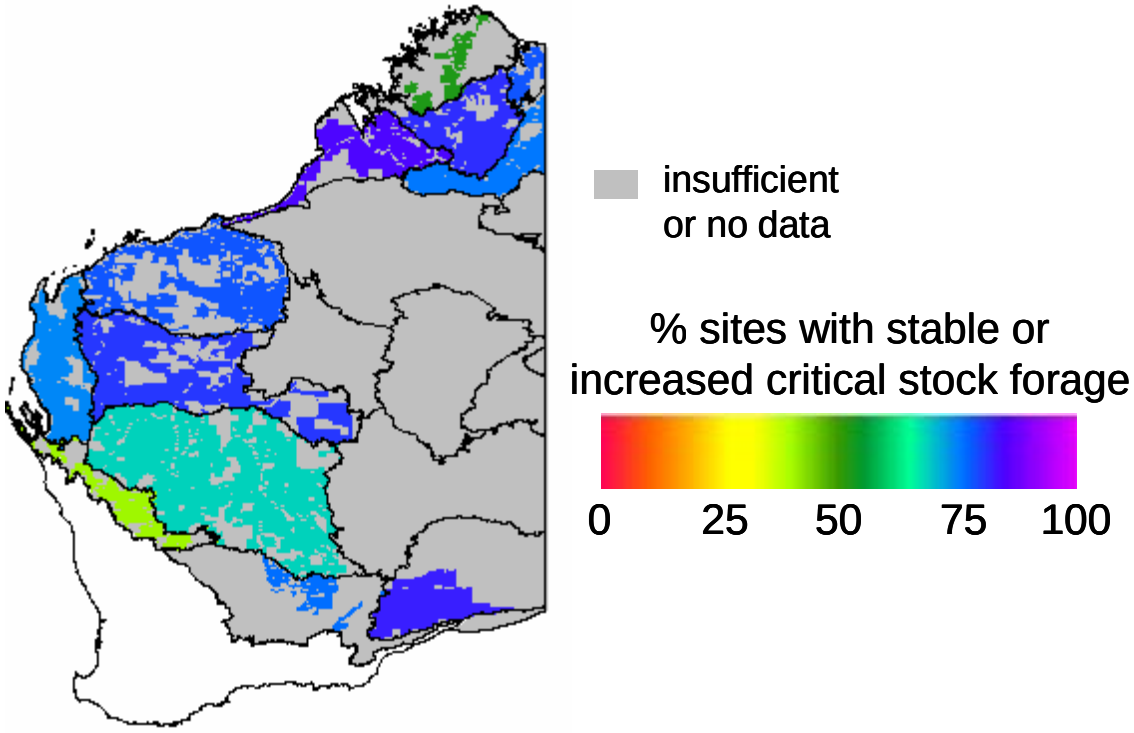


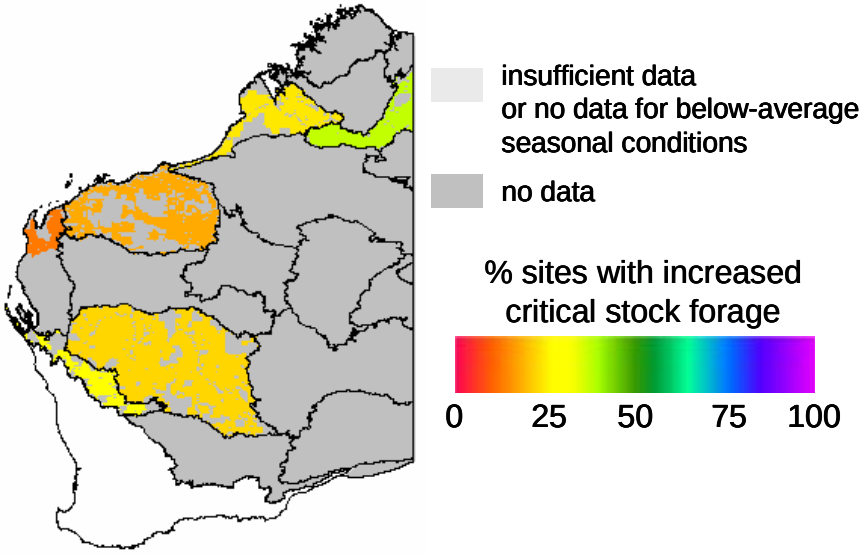
Figure 6. Gross change in plant species, from site-based monitoring records, that support long-term livestock production.

The map shows the percentage of sites in each bioregion where critical stock forage species were maintained or increased between the 1990s and 2005. Non-pastoral areas in each bioregion are masked out. Reporting is by sub IBRA where sites within some bioregions are confined to particular sub IBRAs.

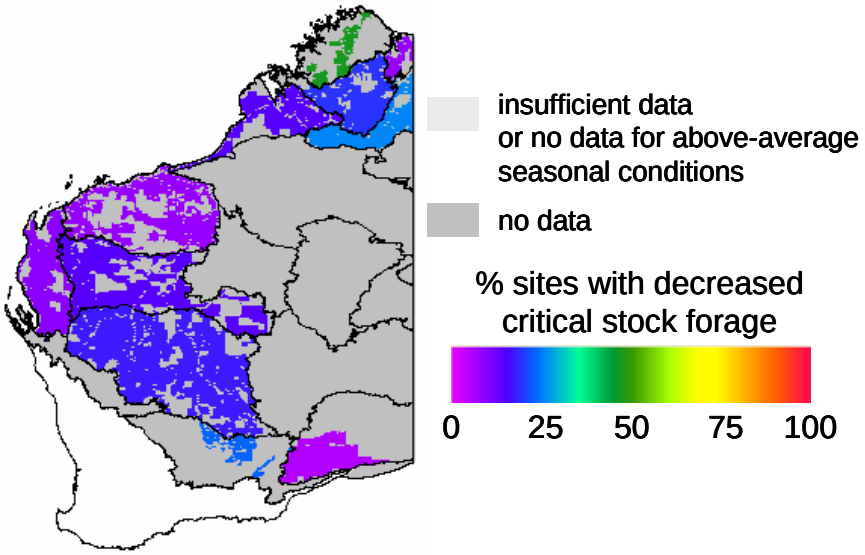
Seasonally adjusted change

Critical stock forage **increased** against the seasonal trend (i.e. decrease expected; Fig. 7, top panel) at greater than 20% of sites reassessed at different times in the Dampierland, Ord Victoria Plain, Murchison and Yalgoo bioregions. (Note that most regions had too few sites sampled during below average seasonal conditions to make a judgement.).

The largest increases, in terms of percentage of sites reassessed following below-average seasonal conditions, were in the Ord Victoria Plain and Yalgoo bioregions. Several grazed bioregions lacked suitable data to report change following poorer seasonal conditions, either because there was limited occurrence of sites showing this change through the 1992-2005 reporting period (much of the northern pastoral area) or too few sites were assessed to allow reliable reporting (some bioregions elsewhere).



Increase in critical stock forage following below-average seasonal conditions



Decrease in critical stock forage following above-average seasonal conditions

Figure 7. Seasonally-adjusted change in plant species that support long term livestock production.

Maps show the percentage of sites in each bioregion where there was (top) an *improvement* in decreaser perennial grass frequency or shrub density despite antecedent *below-average* seasonal conditions; and (bottom) a *decline* in decreaser perennial grass frequency or shrub density despite antecedent *above-average* seasonal conditions. The colour scheme is reversed between the two maps so that in each case, the blue-purple end of the colour scheme represents the more desirable outcome. For the top map, any value above 0% (coloured red) would be a positive result, even though red immediately looks like a negative result.

Critical stock forage **decreased** (Fig. 7, bottom panel) following above-average seasonal conditions (i.e. increase expected at this time) at a significant percentage (>20%) of sites reassessed in the Northern Kimberley NK1 sub IBRA, Ord Victoria Plain bioregion and Eastern Goldfield sub IBRA (COO3 of the Coolgardie bioregion). Smaller percentages of WARMS sites (10-20%) had deceased levels of critical stock forage in the Central Kimberley, Dampierland, Gascoyne and Murchison bioregions.

Woody Cover

Average change in woody cover (either crown cover or canopy cover) by bioregion recorded at WARMS sites is summarised in Table 3. All pastoral bioregions with sufficient WARMS sites to report, apart from Yalgoo, showed an increase in woody cover (range = 13 to 55 percent). Again apart from the Yalgoo bioregion, >60% of sites had stable or increased woody cover. (Note: reporting at sub IBRA level in the case of the Coolgardie, Northern Kimberley, Nullarbor and Victoria Bonaparte bioregions.)

Table 3. Woody cover change at bioregion level recorded at WARMS sites.

Bioregion	sub IBRA	Mean percentage cover change	% sites where cover remained stable or increased	% sites where cover decreased by >50%	Comments
Carnarvon		+55	94	0	
Central Kimberley		+18	70	2	
Coolgardie	COO3	+28	93	0	
Central Ranges					No sites
Dampierland		+16	62	7	
Gascoyne		+23	94	1	
Gibson Desert					No sites
Great Sandy Desert					No sites
Great Victoria Desert					No sites
Hampton					No sites
Little Sandy Desert					No sites
Murchison		+28	68	3	
Northern Kimberley	NK1				Insufficient sites
Nullarbor	NUL2	+33	83	1	
Ord Victoria Plain		+18	62	10	
Pilbara		+15	66	10	
Tanami					No sites
Victoria Bonaparte	VB1	+13	82	0	
Yalgoo		-7	40	5	

Distance from Water

Distance from water is used as a surrogate of grazing pressure imposed by herbivore species dependent on water. Essentially, areas closer to water are presumed to be more impacted (disturbed) by grazing while (relatively) water-remote areas are presumed to be largely intact. Stock waterpoints can also have an adverse impact on biodiversity. This component is being reported separately by the Biodiversity Working Group as part of the biodiversity theme in the 2007 ACRIS report.

The Euclidean distance from the digitised locations of waterpoints (bores, tanks on pipelines, dams and natural sources of water) was calculated for pastoral leases. These calculations were made without regard for fencelines and other natural barriers (e.g. salt lakes) that restrict grazing access. This method is appropriate for WA because (i) many waters are near a fence, especially a corner, and water is typically available in all adjoining paddocks and (ii) some fences in the southern rangelands are now in disrepair and no longer provide an effective barrier to stock movement.

Distance from water data for the WA pastoral rangelands are tabulated in Appendix 4. These data have been used to produce the following summary maps.

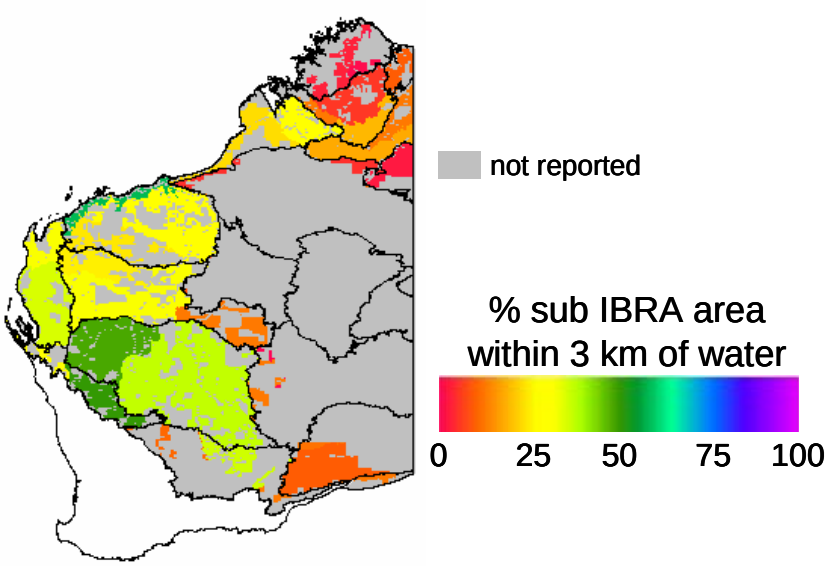
Distance from water: status

There is a gradient of decreasing density of permanent and semi-permanent sources of stock water towards the more marginal (i.e. less productive "desert") bioregions and towards the wetter north where natural sources of stock water are more abundant (Fig. 8, top panel). Of note:

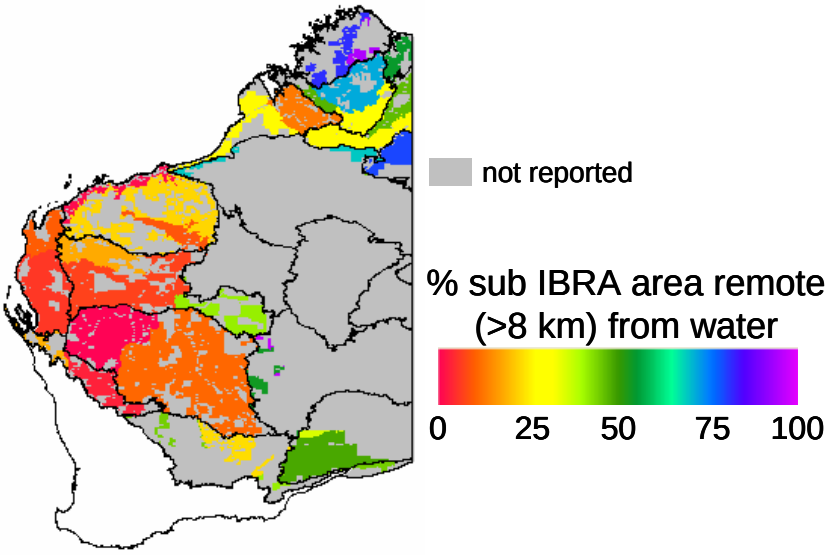
- The pastoral tenure of sub IBRAs within the Pilbara (Roebourne, PIL4; 59.2% of area analysed), Yalgoo (Tallering, YAL2; 51.0%), Murchison (Western Murchison, MUR2; 48.6% and Eastern Murchison, MUR1; 38.3%), Coolgardie (Eastern Goldfield, COO3; 37.0%) and Carnarvon (Wooramel, CAR2; 36.1%) bioregions have the highest percentage areas within 3 km of water.
- Waterpoint density decreases towards the eastern deserts (e.g. the Nullarbor, ~11% of pastoral lease area within 3 km of water for both NUL1 and NUL2 sub IBRAs; Gascoyne, Carnegie [GAS2] sub IBRA, 12.8% of area within 3 km) and the Kimberley (<20% of lease area for Central Kimberley sub IBRAs within 3 km).
- Northern bioregions have a greater abundance of natural water so a higher proportion of Kimberley bioregions (and especially Northern Kimberley IBRA) and the Dampierland IBRA are within 3 km of all waterpoint sources.

The reverse situation generally applies when remoteness from water (i.e. >8 km) is used to indicate the percentage area of each bioregion that is only intermittently grazed: i.e. the less pastorally productive bioregions tend to have a greater percentage of their area >8 km from water (Fig. 8, bottom panel).

- Water-remote areas on pastoral leases form a higher percentage of total sub IBRA area in the Tanami P1 (61.7% analysed, 79.3% >8 km from water) and Carnegie (GAS2; 57.5% analysed, 42.1% >8 km from water) sub IBRAs.



Percentage of sub IBRA area within 3 km of stock watering points



Percentage of sub IBRA area >8 km from stock watering points

Figure 8. Percentage of sub IBRA area at different distance classes from permanent and semi-permanent sources of stock water in pastorally-tenured WA.

- Hampton (HAM1 sub IBRA; 38.2% of area analysed, 44.6% >8 km from water) and Nullarbor (NUL2; 53.1% analysed, 49.3% >8 km from water) have a higher percentage area remote from stock water because finding suitable groundwater is very difficult and the limestone karst makes it difficult and expensive to sink dams. These areas are pastorally productive and were only developed in the 1960s.
- The Northern Kimberley, Victoria Bonaparte and Central Kimberley bioregions also have ≥50% of their pastoral lease area beyond 8 km from artificial water sources but

the presence of natural surface waters means that these northern IBRAs are not as water-remote.

Note that a much greater proportion of the pastoral country in northern and southern bioregions is accessible to grazing stock when water is plentiful during the wet season (i.e. summer months in the north and winter months in the south).

Distance from water: change

During the Second World War the (then) Department of Lands and Surveys collated information on pastoral leasehold infrastructure. Maps showing this infrastructure were then released through the 1950s at a scale of 1 inch to 10 mile, i.e. 1:633,600. These maps provide an opportunity to compare waterpoint distribution from around 1950 with current waterpoint distribution. The following example is taken from Watson *et al.* (2005), the pilot project report for ACRIS on the Gascoyne-Murchison region.

For an example area in the Gascoyne-Murchison region, there was less land at greater distances from water and more land close to water in the 1990s compared to the 1950s (Fig. 9). (This example is for the sample area in Fig. 10.) This pattern was found across all land types although the change was most pronounced in the more highly productive and fragile systems. On only one land type, the resilient and low productivity 'Sandplains & occasional dunes with spinifex grasslands' was the watering point distribution largely unchanged since the 1950s (Watson *et al*. 2005).

Figure 10 maps waterpoint distribution for the example area in the Gascoyne Murchison region that the Fig. 9 data are compiled from.

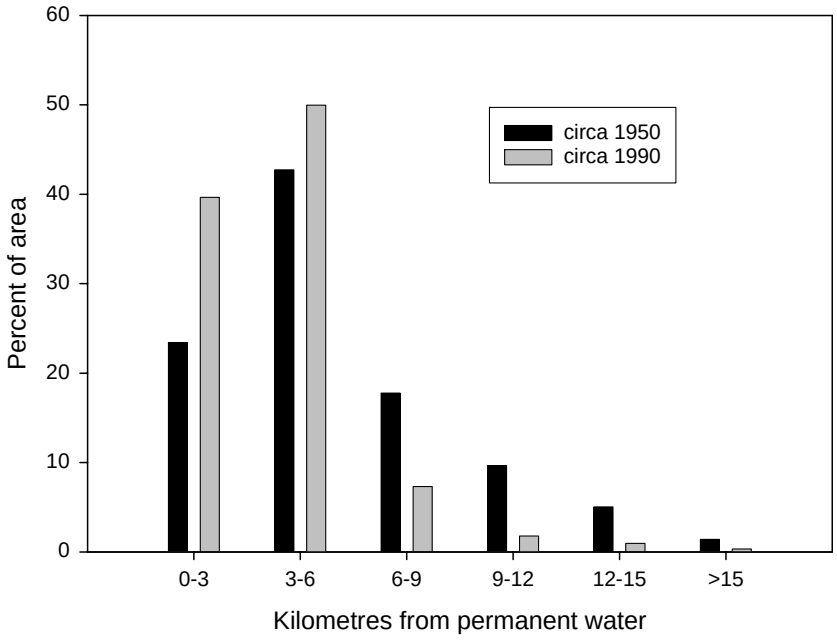
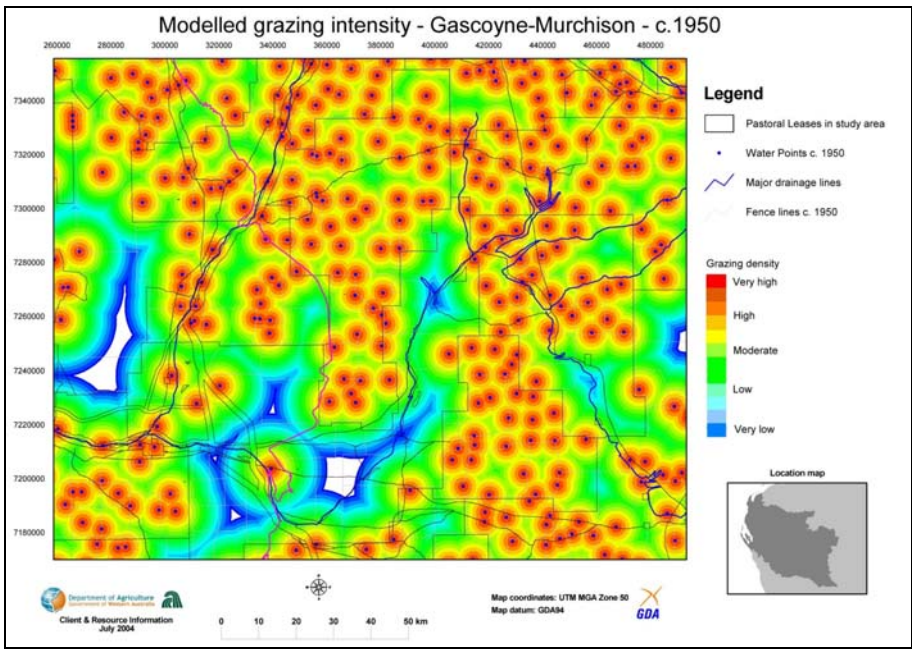
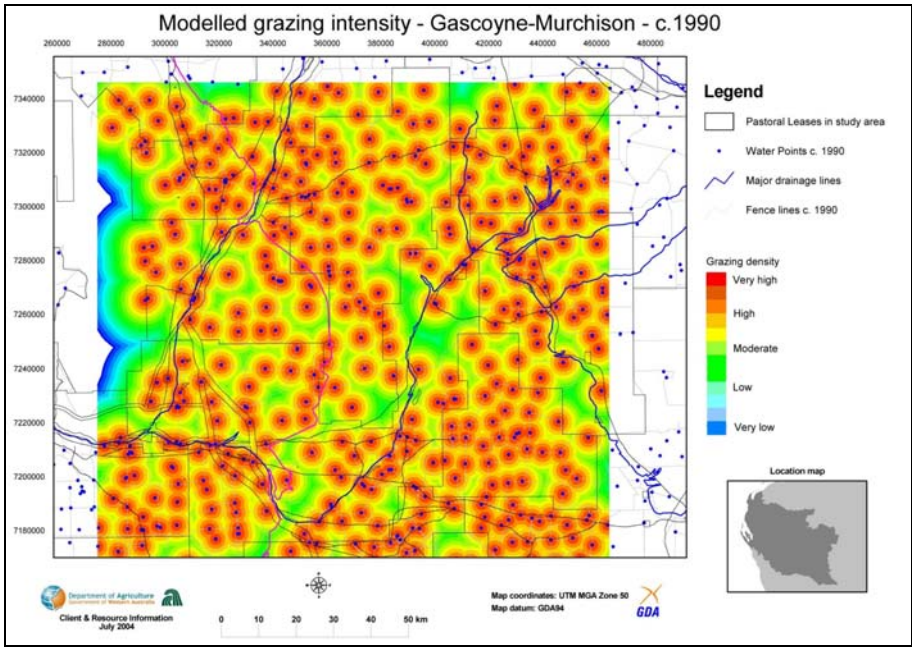


Figure 9. Frequency histogram of distance from water for the sample area of the Gascoyne Murchison region shown in Figure 10 circa 1950 and circa 1990.



Distance from permanent water circa 1950 for a sample of the Gascoyne Murchison region



Distance from permanent water circa 1990 for the area shown above

Figure 10. Change in waterpoint density and distance from water between circa 1950 and circa 1990 for a sample area in the Gascoyne Murchison region.

Domestic Stocking Density

Stocking density (i.e. the number of sheep and/or cattle units per land area) is the one component of total grazing pressure that is most directly under the influence of pastoral management. Stocking at the correct density (i.e. stock units per unit area) is a useful indicator of sustainable management. There are two components to appropriate stocking density: the inherent productivity or capacity of the land to carry stock (i.e. long term average carrying capacity) and the correct number at each location for the seasonal conditions experienced and anticipated. For example, under dry conditions, stocking density should decrease from the long term average.

ACRIS has sourced estimates of domestic stock numbers (sheep and beef cattle) from the Australian Bureau of Statistics (via the Queensland Department of Natural Resources and Water who use the data in its Aussie-GRASS simulations of pasture growth). The Australian Bureau of Statistics (ABS) conducts periodic assessments of domestic stock numbers via complete Agricultural Census (every five years) and sample surveys in intervening years. The ABS compiles and reports data by Statistical Local Area (SLA). These data have been concorded to the IBRA regions for reporting by ACRIS in its national report. Stocking density is not reported for bioregions where less than 25% of the area is grazed or there are fewer than five pastoral leases.

There are known issues of data reliability related to surveys where SLAs contain large and few properties (i.e. small sample size). There are also separate reliability issues related to concordance procedures (e.g. a large pastoral lease in one SLA but split between two bioregions). Western Australia (DAFWA) has provided its own estimates of stock numbers to ACRIS to guide it in judging the reliability of the national (ABS-sourced) data. The WA data come from annual stock returns at lease level reported to the WA Pastoral Lands Board.

Comparison of stock numbers

The average annual stocking density of sheep and cattle per sq km (on a Dry Sheep Equivalent basis, DSE/km^2) by bioregion for all years between 1992 and 2004 sourced from ABS and DAFWA data is summarised in Table 4. In most cases the ABS data provide a more conservative (i.e lower) estimate of stocking density, and particularly so for the Dampierland and Ord Victoria Plain bioregions. For the Yalgoo, Northern Kimberley, Coolgardie and Victoria Bonaparte bioregions, the reverse applies with the ABS-sourced data indicating a much higher stocking density compared with that sourced from annual stock returns (i.e. DAFWA data). Note that where bioregions cross into the NT or SA, the ABS data are for the whole IBRA.

Table 4. Average annual stock numbers (as DSEs) per rangeland bioregion between 1992 and 2004 sourced from ABS and DAFWA data.

Bioregion	Average DSE/km^2 (ABS)	Average DSE/km^2 (DAFWA)	Ratio (DAFWA/ABS)
Carnarvon	8.0	10.0	1.2
Central Kimberley	15.4	19.4	1.3
Coolgardie	9.5	4.1	0.4
Dampierland	15.2	28.1	1.9
Gascoyne	4.5	6.3	1.4
Murchison	3.6	4.1	1.1
Northern Kimberley	29.5	11.8	0.4
Nullarbor	3.1 (part SA)	4.5	1.4
Ord Victoria Plain	18.3 (part NT)	29.1	1.6
Pilbara	10.1	12.0	1.2
Victoria Bonaparte	38.0 (part NT)	23.7	0.6
Yalgoo	15.9	6.2	0.4

Time traces of annual stocking density for the pastorally most important bioregions show the extent to which the differences between the two data sources are consistent or variable (Fig. 11).

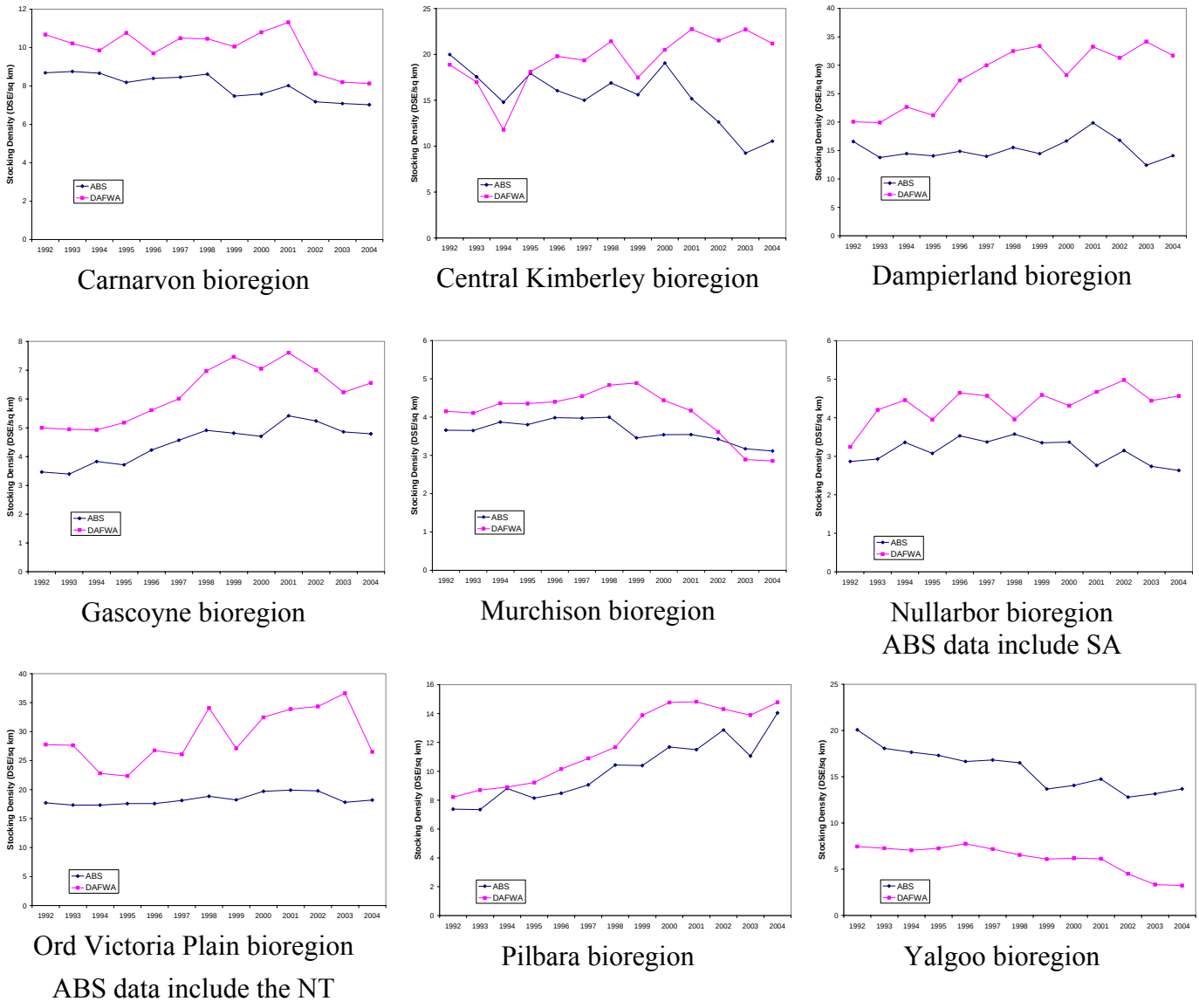


Figure 11. Comparisons of ABS- and DAFWA-sourced trends in stocking density (DSE/km^2) between 1992 and 2004 for WA pastoral bioregions.

As for Table 4 data, the ABS-sourced data often understate stocking density compared with the DAFWA data (Yalgoo is the exception where the ABS-derived stocking density was more than twice that indicated by the DAFWA data throughout the 1992-2004 period, probably due to the inclusion of agricultural area farms in the ABS-derived data).

More importantly, the stocking density trends during the 1992-2004 period differed in the case of:

- the Central Kimberley bioregion (ABS data decreased from 2000 to 2004),
- Dampierland bioregion (no real increase shown by the ABS data),
- Murchison bioregion (larger decrease in the DAFWA data from 1999 onwards), and
- Nullarbor bioregion (divergent trends from about 1998 onwards, inclusion of the SA part of the bioregion in the ABS data may partly account for differences).

These non-systematic differences suggest that care should be taken when interpreting stocking density trends over time from the nationally available ABS data.

BIODIVERSITY

Perennial native plant species richness at WARMS sites

Pastoral monitoring data have some capacity to report change in plant species richness as a small contribution to reporting change in biodiversity. The heritage value of WARMS data alone is of some importance. In making this statement, it is fully acknowledged that WARMS sites are deliberately biased in their location to represent vegetation important for pastoral purposes and that restricted habitats important for biodiversity conservation (e.g. wetlands) are rarely, if ever, sampled (Watson *et al.* 2007b).

An index of site species richness was calculated from WARMS data as:

(number of species found on the site at Date 2) / (number of species at Date 1).

All species included in the analysis are native so an increase in species richness represents an increase in this component of biodiversity, except in cases where contributing species may be less desirable native woody species.

Note: perennial native plant species richness data from WARMS sites are reported here (and in Appendix 1) as a contribution to the ACRIS biodiversity theme. In the 2007 national report, these (WARMS) data were used to assist reporting of sustainable management.

Change in species richness

As for landscape function and critical stock forage, change in richness of native plant species is shown with two mapsets.

1. A mapped score for each bioregion showing **gross** change in the percentage of reassessed sites that had either stable or increased plant species richness (Fig. 12), noting that.
    - That sites in some bioregions are confined to a sub IBRA and where this is so, reporting is for that part of the bioregion only,
    - Mapping is confined to pastoral land tenure within bioregions, and
    - Bioregions are excluded from reporting if they do not have at least 10 sites which have been reassessed.

2. Seasonally adjusted change in plant species richness (Fig. 13). This pair of maps shows:
    - The percentage of sites that had **increased** species richness following below-average seasonal conditions (top panel, decreased richness reasonably expected at this time).
    - The percentage of sites that had **decreased** species richness following above-average seasonal conditions (bottom panel, increase expected).

Gross change – all seasons

Where there were sufficient data to report change, native plant species richness was maintained or increased at ≥75% of reassessed sites in all bioregions (or sub IBRAs) apart

from the VB1 sub IBRA of Victoria Bonaparte (where 70% of sites were either stable or had increased species richness; Fig. 12).

Some of the reduction was due to poorer seasonal conditions and is reported in more detail in the following section.

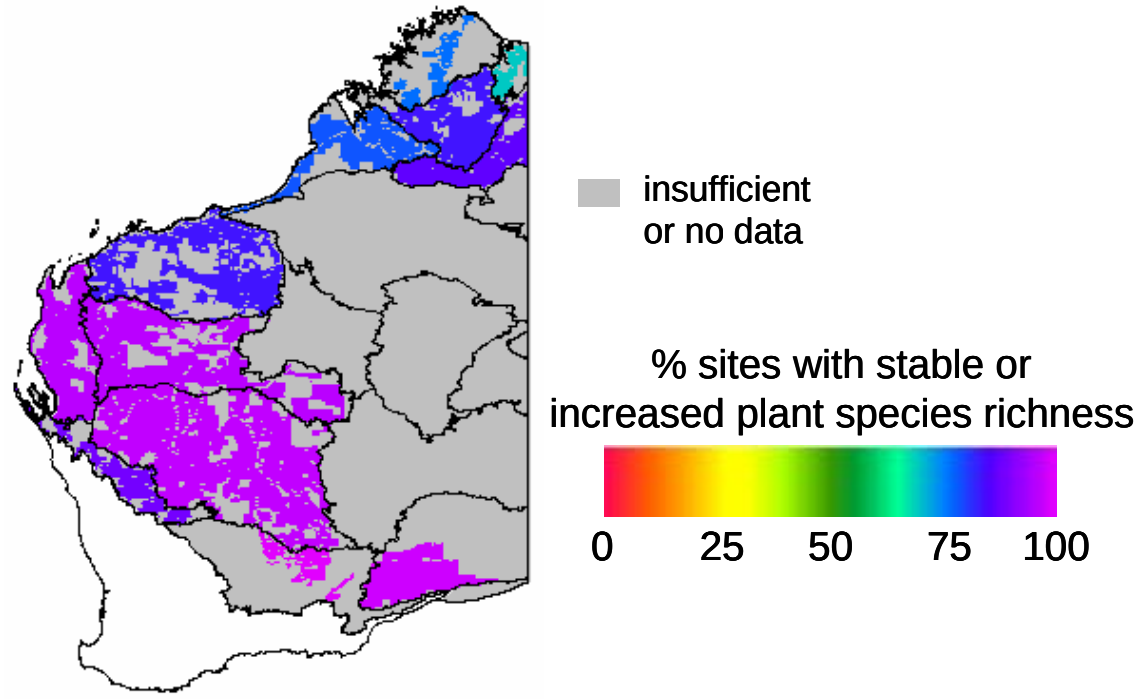


Figure 12. Gross change in species richness of native plant species from WARMS monitoring data.

The map shows the percentage of sites in each bioregion where species richness was maintained or increased. Non-pastoral areas in each bioregion are masked out. Reporting is by sub IBRA where sites within some bioregions are confined to particular sub IBRAs.

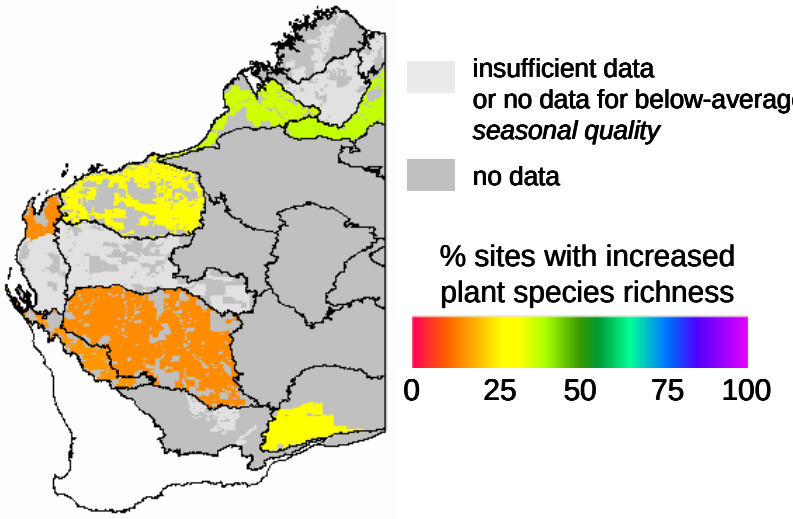
Seasonally interpreted change

Native plant species richness **increased** against the seasonal trend (i.e. decrease expected; Fig. 13, top panel) at a substantial percentage (≥20%) of reassessed sites in the Dampierland, Ord Victoria Plain, Pilbara and Nullarbor (NUL2 sub IBRA) bioregions. (Note that several bioregions had insufficient [or no] sites reassessed following poorer seasons so it is not possible to report change here.)

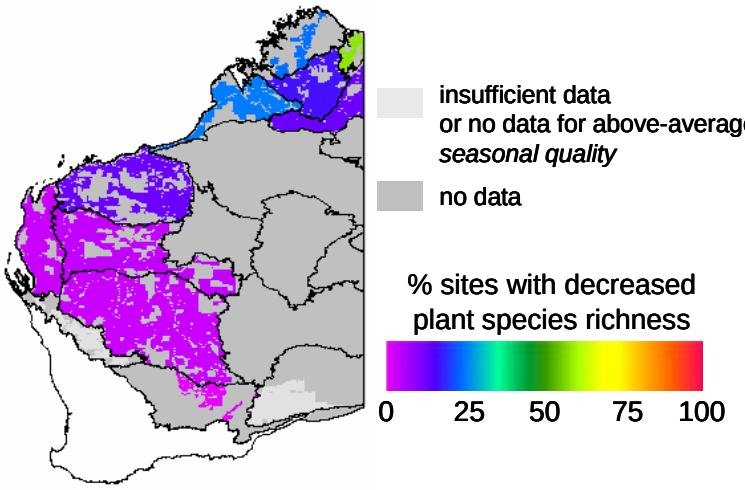
The Murchison and Yalgoo bioregions had a lower percentage of reassessed sites with increased species richness following poorer seasons.

There was a large **decrease** in plant species richness following above-average seasonal conditions (i.e. increase expected at this time) in the Victoria Bonaparte (VB1 sub IBRA) bioregion (Fig.13, bottom panel). A lower percentage (≤25%) of reassessed sites had **decreased** species richness following better seasons in several other bioregions (with the

Dampierland and Northern Kimberley [NK1 sub IBRA] being the most significant bioregions to show a decrease below the 25% threshold).



Increase in plant species richness following below-average seasonal conditions



Decrease in plant species richness following above-average seasonal conditions

Figure 13. Seasonally-interpreted change in native plant species richness from WARMS monitoring data.

Maps show the percentage of sites in each bioregion where there was (top) an *improvement* in species richness despite antecedent *below-average* seasonal conditions; and (bottom) a *decline* in species richness measure despite antecedent *above-average* seasonal conditions. (Note: (a) reporting is by sub IBRA where sites within some bioregions are confined to particular sub IBRAs; (b) the colour scheme is reversed between the two maps so that in each case, the blue-purple end of the colour scheme represents the more desirable outcome; (c) for the top map, any value above 0% (coloured red) would be a positive result, even though red immediately looks like a negative result.) Non-pastoral areas are masked out.

Protected Areas

As part of its Biodiversity theme, ACRIS is reporting on changes to the area of the conservation estate. Table 5 summarises the percentage area of bioregions and sub IBRAs within the WA rangelands that are reserved. These areas are those that meet the IUCN categories I to IV[1] plus pastoral leases recently purchased for conservation purposes (particularly in the Gascoyne-Murchison region).

IUCN I-IV refers to an international categorisation system for protected areas that the WA government has adopted for its reserve system (see http://www.iucn.org/themes/wcpa/wcpa/protectedareas.htm). CALM Act section 33(2) is used for recently purchased or acquired ex pastoral leases that have reverted back to UCL and are pending reservation as a protected area. Because they are pending reservation they are not covered under IUCN categories.

Table 5. Percentage area of WA rangeland bioregions and sub IBRAs that are conserved.

Bioregion	% bioregion area conserved	Sub IBRA	% sub IBRA area conserved
Carnarvon	11.4	CAR1	15.5
		CAR2	9.8
Central Kimberley	4.4	CK1	6.0
		CK2	0.0
		CK3	7.9
Coolgardie	13.3	COO1	12.8
		COO2	21.5
		COO3	3.8
Central Ranges	0.0	CR1	0.0
Dampierland	1.0	DL1	1.7
		DL2	0.6
Gascoyne	10.3	GAS1	10.7
		GAS2	9.9
		GAS3	10.3
Gibson Desert	11.8	GD1	14.5
		GD2	0.0
Great Sandy Desert	2.7	GSD1	0.1
		GSD2	4.5
Great Victoria Desert	8.5	GVD1	7.0
		GVD2	9.1
		GVD3	9.6
		GVD4	0.0
Hampton	11.0	HAM	11.0
Little Sandy Desert	4.6	LSD1	37.4
		LSD2	1.4
Murchison	6.7	MUR1	7.5
		MUR2	4.1
North Kimberley	14.9	NK1	14.2
		NK2	16.5
Nullarbor	16.1	NUL1	35.9
		NUL2	4.5
Ord Victoria Plain	5.9	OVP1	15.0
		OVP2	0.0
Pilbara	8.3	PIL1	6.5

[1]

		PIL2	0.9
		PIL3	14.2
		PIL4	6.6
Tanami	0.0	TAN1	0.0
Victoria Bonaparte	6.2	VB1	6.0
Yalgoo	22.8	YAL1	37.9
		YAL2	15.9

These data were kindly provided by Mark Cowan, Department of Environment and Conservation Western Australia.

SOCIO-ECONOMIC THEME

Land Values

ACRIS is reporting change in pastoral land values as one of the indicators for its socio-economic theme. Western Australia is reporting change in 'lease and improvement value' (also known as 'bare' lease value; i.e. lease and all fixed improvements) by pastoral area on an annual basis between 1992 and 2006. Values represent estimates of average levels of value on either a Dry Sheep Equivalent (DSE) or Large Stock Unit (LSU, 1 LSU = 7 DSE) basis. The following information was provided by Chris Olsen, District Valuer in the Pastoral and Remote Section, Country North, Landgate Valuation Services.

Lease and Improvement Values

The supplied values represent estimates only on average levels of value on either a DSE (Dry Sheep Equivalent) or a LSU (Large Stock Unit) basis. A 'lease and Improvement' value is also sometimes referred to as a 'bare' lease value and comprises of the lease and all fixed improvements including buildings, fences, yards and water supply. The value of stock and equipment is excluded.

There is a relatively low turn over rate of viable size leases that quite often show a range of disclosed values. The following values are 'broad based estimates' only of Lease and Improvement market values for pastoral leases in various areas of the state and should be used for general economic analysis only. These lease and improvement values assume an economic size lease with improvements in an average 'fair' condition and the rangeland in 'good condition'.

Values after 1999 are from a combination of desktop and inspected analysed sales whilst values prior to 1999 are from file data based on desk top analysis only. Some of this information is sketchy with interpolated values for intervening years where no sales took place. Historically, in times of low commodity prices there may be few if any sales for a number of years in individual areas. Traditionally the average turnover rate of pastoral leases (since 2000) is 3% to 5% (15 to 25 sales/annum). The majority of sales are sheep properties in the southern rangelands. There is a steady turnover of smaller non viable leases for the primary purpose of rural residence where the majority of income is from off the property. These types of leases are not represented in the above schedule. High or low sales, eg (Mining company purchases or family transfers) have also been excluded.

In the southern rangelands some traditional sheep properties are converting to cattle. Traditional differences in values between areas are becoming somewhat blurred or at least narrowing. The last few years has seen a shortage of supply of viable size cattle properties available on the market. Strong positive market sentiment has pushed up market values for cattle properties significantly. Over the same period sheep properties have also seen increased market values, but at lower rates.

Table 6. 1992-2006 'Lease and Improvements' values for Western Australian Pastoral leases ($ / DSE or LSU)

Note that these Lease and Improvement values assume an economic size lease with improvements in an average 'fair' condition and the rangeland in 'good' condition

Region	Stock	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
West Kimberley	Cattle $/LSU	$70	$70	$70	$80	$100	$100	$100	$100	$170	$220	$300	$350	$450	$550	$625
East Kimberley	Cattle $/LSU	$70	$70	$70	$80	$100	$100	$100	$100	$170	$220	$300	$350	$450	$550	$625
Pilbara	Cattle $/LSU	$60	$70	$70	$70	$80	$90	$90	$90	$150	$200	$250	$300	$400	$450	$500
Pilbara coastal	Cattle $/LSU	$70	$90	$90	$90	$100	$100	$100	$100	$170	$220	$250	$300	$350	$475	$575
Ashburton	Cattle $/LSU	$60	$70	$70	$70	$80	$90	$90	$90	$150	$200	$250	$300	$400	$450	$500
Carnarvon-Gascoyne Murchison	Sheep $/DSE	$25	$25	$25	$25	$30	$30	$30	$35	$60	$60	$60	$70	$75	$80	$100
Kalgoorlie	Sheep $/DSE	$25	$25	$25	$25	$25	$25	$30	$30	$60	$60	$65	$70	$75	$80	$90
Nullarbor	Sheep $/DSE	$25	$25	$25	$25	$25	$25	$25	$25	$60	$60	$65	$75	$75	$80	$90

Pastoral lease sales by region

The spread of sales by area (Table 7) is typical for Western Australia with the Carnarvon-Gascoyne- Murchison area having the highest turnover. These sales exclude purchases by government agencies, inter-company transfers, in-family transfers and purchases by mining companies. These sales figures include smaller non viable leases.

Table 7. Pastoral lease sales by region.

Region	Sales 2006	Sales 2005
West Kimberley	1	2
East Kimberley	4	1
Pilbara	2	2
Pilbara coastal	-	-
Ashburton	2	1
Carnarvon-Gascoyne-Murchison	15	16
Kalgoorlie	5	-
Nullarbor	1	4
TOTAL	**20**	**26**

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LIST OF APPENDICES

Appendix 1 – WARMS results by IBRA or sub-IBRA

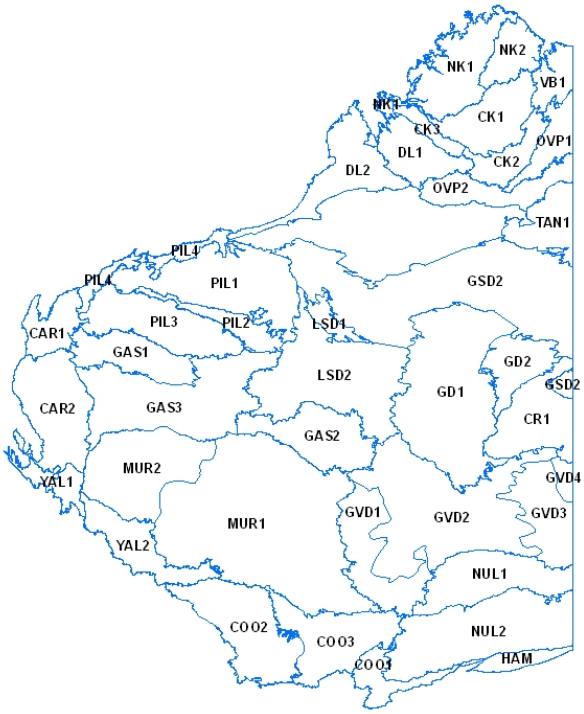
Contents

Background

Reporting by IBRA and sub-IBRA

The reporting of WARMS data in this appendix is based on IBRAs and sub-IBRAs (Version 6.1). Whole IBRAs are used where there are a substantial number of WARMS sites within all sub-IBRAs in that IBRA. Reporting by sub-IBRAs is used where the majority of WARMS sites within an IBRA are within specific sub-IBRAs while other sub-IBRAs have nil or very few sites. The Kimberley IBRAs are reported first, followed by the Pilbara IBRA and then the southern shrubland IBRAs.

Figure 1:1. Sub-IBRAs within the rangelands of Western Australia (V 6.1)



Cycles and assessments

For the majority of grassland sites in the Kimberley, installation occurred over the period 1994-1995-1996. Subsequent assessments were made in 1997-1998-1999, 2000-2001-2002 and 2003-2004-2005. That is, there have been three cycles of assessment following installation.

While the aim is to record all sites in each of these three year assessment periods, some sites are missed in some periods because of recent fire or lack of access or some other constraint. Therefore, the data have been filtered to include comparisons between sites which were recorded in consecutive assessment periods of each cycle.

There is a first and second date of assessment for each of three cycles:

- cycle 1, assessment 1 and cycle 1, assessment 2 (coded as c1a1, c1a2)
  c1a1 = 1994-1995-1996 and c1a2 = 1997-1998-1999
- cycle 2, assessment 1 and cycle 2, assessment 2 (coded as c2a1, c2a2)
  c2a1 = 1997-1998-1999 and c2a2 = 2000-2001-2002
- cycle 3, assessment 1 and cycle3, assessment 2 (coded as c3a1, c3a2)
  c3a1 = 2000-2001-2002 and c3a2 = 2003-2004-2005

Consider a site installed in 1995, re-assessed in 1998, missed in 2001, and re-assessed in 2004. Data used in this report would include 1995 and 1998 (i.e. complete first cycle, c1a1 and c1a2) but not 1998 and 2001 (i.e. incomplete data for second cycle; c2a1 present but not c2a2) and similarly for 2001 and 2004 (i.e. incomplete data for third cycle; c3a1 not available but c3a2 present).

The same convention has been retained for grassland sites in the Pilbara and southern rangelands, although many of the sites were not installed until after the 1994-1996 period.

For all grassland sites, the data from multiple cycles were averaged (weighted by the number of sites assessed in each cycle) to give an overall measure of change for the 1992-2005 reporting period.

For shrubland sites, there has been one cycle of assessment following installation and the descriptive terminology used is simply Date 1 and Date 2.

Species response categories

Individual species in the WARMS database were categorised as Decreaser, Increaser, Intermediate, or "not categorised". These reflect broad responses to grazing impacts under pastoralism.

Decreaser species are sensitive to grazing and decline in abundance under pastoral land use. Increaser species increase in response to grazing. In some situations, some Increaser species are termed woody weeds. Increaser species may decrease in abundance as a result of extremely heavy grazing and consequent decline in landscape functioning, such as massive scalding. Intermediate species include both those defined as Intermediates and those defined as having no indicator value by Payne *et al.* (1998; p 132). Intermediate species may increase in abundance in response to low or moderate grazing but often decline as grazing pressure increases, partly because of landscape dysfunction and partly because they are grazed by livestock.

Some species were not categorised, largely because their grazing response is unknown or disputed. These species tend to be less commonly found on WARMS sites.

Contents structure of this Attachment

The same structure is used throughout this Attachment for each IBRA or sub-IBRA, although there are some differences in structure between grassland sites and shrubland sites. Where both grassland and shrubland sites occur within the same IBRA or sub-IBRA, separate sections for grassland or shrubland are contained within each of the three themes; change in landscape function, change in management of the pastoral estate and vegetation richness and occurrence.

Grassland site structure

- Site and seasonal summary
  Graph showing location of IBRA or sub-IBRA and location of WARMS sites
  Table showing number of sites and dates assessed
  Table of number of sites in each cycle and percentage within each seasonal category

- Change in landscape function
  - Perennial grass frequency
    Summary table
    Graph showing change over three sampling cycles
    Cause table – cycle 1
    Cause table – cycle 2
    Cause table – cycle 3
    Cause table – weighted average of three cycles

  - Crown cover, woody species taller than 1m
    Summary table
    Graph showing change over three sampling cycle
    Cause table –cycle 3

  - Resource capture index
    Summary table
    Graph showing change over cycle 3
    Cause table –cycle 3

  - Proportional landscape function; stability, infiltration and nutrient cycling indices
    Summary table
    Graph showing change in the three indices over cycle 3
    Cause table – cycle 3 – stability index
    Cause table – cycle 3 – infiltration index
    Cause table – cycle 3 – nutrient cycling index

- Change in sustainable management of the pastoral estate
  - Frequency of decreaser, intermediate and increaser perennial grass species

Summary table
Graph showing change over cycle 3 - decreasers, intermediates & increasers
Cause table – cycle 1
Cause table – cycle 2
Cause table – cycle 3
Cause table – weighted average of three cycles

- Change in vegetation richness and occurrence
  - Native perennial species richness
    Summary table
    Graph showing change over three sampling cycles
    Cause table –cycle 1
    Cause table – cycle 2
    Cause table – cycle 3
    Cause table – weighted average of three cycles

  - Frequency of occurrence – native species
    Summary table
    List of species found on at least five sites at all four samplings
    Graph showing change over three sampling cycles

Shrubland site structure

- Site and seasonal summary
  Graph showing location of IBRA or sub-IBRA and location of WARMS sites
  Table showing number of sites, dates assessed and seasonal quality

- Change in landscape function
  - Population growth rate (i.e. density)
    Summary table
    Graph showing change between date 1 and date 2
    Cause table – date 1 and date 2

  - Canopy area
    Summary table
    Graph showing change between date 1 and date 2
    Cause table – date 1 and date 2

  - Canopy area but restricted to plants less than 1.5 m in height
    Summary table
    Graph showing change between date 1 and date 2
    Cause table – date 1 and date 2

  - Resource capture index
    Summary table

Graph showing change between date 1 and date 2
Cause table – date 1 and date 2

- Proportional landscape function; stability, infiltration and nutrient cycling indices
  Summary table
  Graph showing change in the three indices between date 1 and date 2
  Cause table – date 1 and date 2 – stability index
  Cause table – date 1 and date 2 – infiltration index
  Cause table – date 1 and date 2 – nutrient cycling index

- Change in sustainable management of the pastoral estate
  - Population growth rate (i.e. density) decreaser, intermediate and increaser species
    Summary table
    Graph of date 1 and date 2 change – decreasers, intermediates & increasers
    Cause table – date 1 and date 2 – decreasers, intermediates, increasers

  - Canopy area - less than 1.5 m in height – decreasers, intermediates & increasers
    Summary table
    Graph of date 1 and date 2 change – decreasers, intermediates & increasers
    Cause table – date 1 and date 2 – decreasers, intermediates and increasers

- Change in vegetation richness and occurrence
  - Native shrub species richness
    Summary table
    Graph showing change – date 1 and date 2
    Cause table – date 1 and date 2

  - Frequency of occurrence – native shrub species
    Summary table
    List of species with occurrence ratio >1.0 or < 0.90 on at least ten sites
    Graph showing change – date 1 and date 2

Explanatory notes

- In all tables "n/a" is used where the number of sites was less than 10.

- The term "shrubs" is used generically to refer to woody species, including shrubby trees and trees.

- All WARMS data were assumed to be collected on the pastoral estate, even though some sites are now on land recently purchased for the conservation estate and managed by the Department of Environment and Conservation Western Australia.

- The following non-native species were filtered out before calculating native perennial species richness or frequency of occurrence on grassland sites; *Aerva* spp.*, Calotropis*

spp., *Cenchrus* spp., *Chloris barbata, Citrullus lanatus, Corchorus olitorius, Cynodon dactylonium, Heliotropium europaeum, Malvastrum americanum, Parkinsonia aculeate, Prosopis, Sida acuta, Sida subcordata, Stylosanthes* spp., *Vigna radiata* and any plants that could only be identified to genera (i.e. Like *SPP*).

- For native species richness, sites with zero species at either the first or second of the two sampling dates were filtered out. This was in order to remove situations where the denominator of a ratio was zero (i.e. n/0), or where a ratio was zero (i.e. 0/n) disproportionally affecting the calculation of an average, which would typically be around 1.0. Native species richness could be zero if the only perennial species on a site was non-native, usually buffel or Birdwood grass.

- The following species were filtered out of the shrubland data set because they are considered to be too short-lived for their demography to be tracked over five year periods; *Abutilon geranioides, Chenopodium gaudichaudianum, Commicarpus sp., Corchorus walcottii, Diplolaena* sp., *Dipteracanthus australasicus* subsp. *Corynothecus, Dissocarpus paradoxus, Enchylaena tomentosa, Glycine* spp., *Leichardtia australis, Maireana lanosa, M. radiata, M. tomentosa, M. triptera, Porana sericea, Rhyncharrhena linearis, Sida fibulifera, Zygophyllum* species,

Kimberley region

The Kimberley region is a general term for the Central Kimberley, Dampierland, Northern Kimberley, Ord-Victoria Plain and Victoria Bonaparte IBRAs.

Central Kimberley IBRA

For grassland sites, data from all three Central Kimberley sub-IBRAs were pooled and the complete Central Kimberley IBRA is reported.

Figure 1:2. Location of Central Kimberley IBRA (left) and WARMS sites in the IBRA (right). Greyed areas are pastoral tenure.

Site and seasonal summary

Table 1:1. Central Kimberley IBRA – grassland sites – total number of sites and dates assessed.

Number of grassland sites assessed in all sub-IBRAs	83
Number of grassland sites assessed in CK1 (Pentecost)	42
Number of grassland sites assessed in CK2 (Hart)	28
Number of grassland sites assessed in CK3 (Mt Eliza)	13
First assessment (installation)	06/05/94 to 09/08/96
Second assessment	09/06/97 to 15/07/99
Third assessment	13/06/00 to 17/07/02
Fourth assessment	17/06/03 to 12/10/05

Table 1:2. Central Kimberley IBRA – grassland sites – seasonal category and number of sites assessed in each cycle.

	Cycle1	Cycle 2	Cycle 3
Number of grassland sites assessed	68	60	68
Above average seasonal quality - – percentage of sites	100%	90%	37%
Average seasonal quality - – percentage of sites	0%	10%	51%
Below average seasonal quality – percentage of sites	0%	0%	12%

Change in landscape function

Perennial grass frequency

Table 1:3. Central Kimberley IBRA – summary of perennial grass frequency.

	Cycle 1	Cycle 2	Cycle 3
Average frequency: first assessment of cycle +/- standard error of the mean	74.7 +/- 3.10	79.7 +/- 3.01	86.1 +/- 2.14
Average frequency: second assessment of cycle +/- standard error of the mean	79.1 +/- 2.83	84.5 +/- 2.39	86.7 +/- 1.82
Average frequency ratio between the two assessments +/- standard error of the mean	1.16 +/- 0.06	1.13 +/- 0.04	1.03 +/- 0.02
Frequency ratio at least 1.0 – percentage of sites	78%	72%	59%
Frequency ratio <0.90 – percentage of sites	10%	5%	12%
Frequency ratio <0.50 – percentage of sites	0%	0%	0%

Figure 1:3. Change in perennial grass frequency between each sampling cycle (C) – Central Kimberley IBRA.

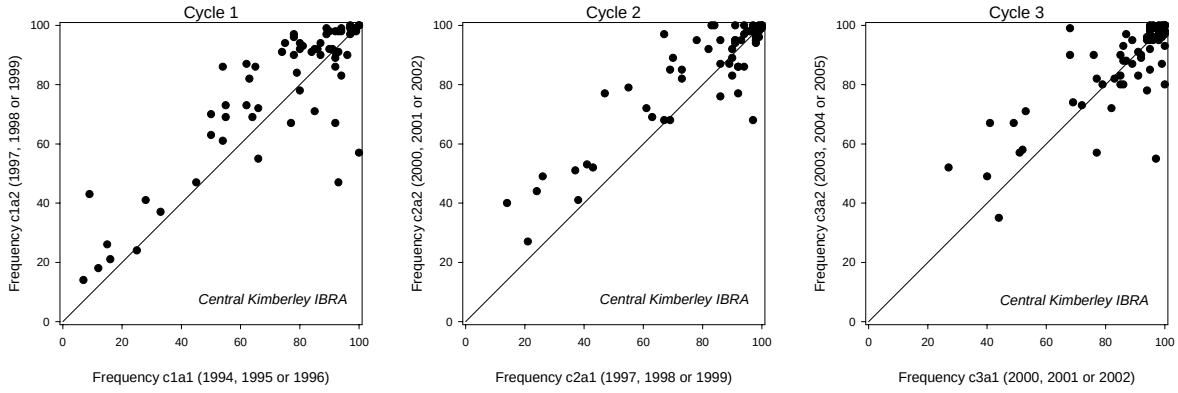


Table 1:4. Cycle 1 - percentage of sites in each seasonal category showing change in perennial grass frequency - Central Kimberley IBRA.

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency < 1.10	Increase. frequency ≥ 1.10	Number of sites
All years	All	10%	51%	38%	68
Above average	All	10%	51%	38%	68
Average	All	n/a	n/a	n/a	0
Below average	All	n/a	n/a	n/a	0

Table 1:5. Cycle 2 - percentage of sites in each seasonal category showing change in perennial grass frequency - Central Kimberley IBRA.

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency < 1.10	Increase. frequency ≥ 1.10	Number of sites
All years	All	5%	62%	33%	60
Above average	All	6%	61%	33%	54
Average	All	n/a	n/a	n/a	6
Below average	All	n/a	n/a	n/a	0

Table 1:6. Cycle 3 - percentage of sites in each seasonal category showing change in perennial grass frequency - Central Kimberley IBRA.

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency < 1.10	Increase. frequency ≥ 1.10	Number of sites
All years	All	12%	72%	16%	68
Above average	All	8%	88%	4%	25
Average	All	14%	57%	29%	35
Below average	All	n/a	n/a	n/a	8

Table 1:7. Weighted average across all three cycles - percentage of sites in each seasonal category showing change in perennial grass frequency. Only cycles containing at least 10 sites in each seasonal quality category were used. Central Kimberley IBRA.

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency < 1.10	Increase. frequency ≥ 1.10	Number of site by year combinations	Cycles used
All years	All	9%	62%	29%	196	1,2,3
Above average	All	8%	61%	30%	147	1,2,3

Average	All	14%	57%	29%	35	3
Below average	All	n/a	n/a	n/a	n/a	n/a

Crown cover, woody species taller than 1m

Averages of frequency ratios can not be calculated because of the large number of crown cover estimates of zero (i.e. denominator = zero).

Table 1:8. Central Kimberley IBRA – summary of crown cover

Average crown cover cycle 3, assessment1 (c3a1)	6.10
Average crown cover cycle 3, assessment2 (c3a2)	7.22
* Crown cover: ratio c3a2 to c3a1, percentage of sites at least 1.0	70%
* Crown cover: ratio c3a2 to c3a1, percentage of sites <0.90	10%
* Crown cover: ratio c3a2 to c3a1, percentage of sites <0.50	2%

* Sites with zero crown cover at both c3a1 and c3a2 have not been included

Figure 1:4. Change in crown cover between each sampling cycle (C) – Central Kimberley IBRA.

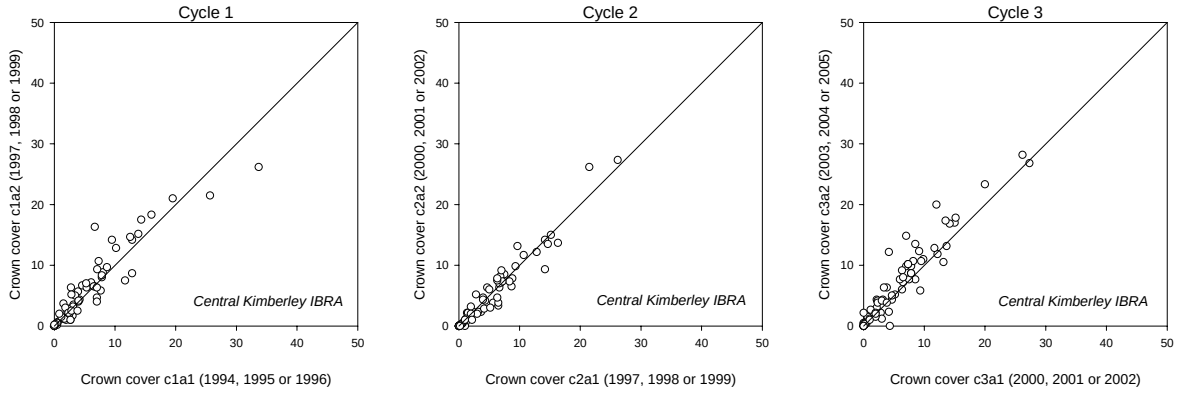


Table 1:9. Cycle 3 – percentage of sites in each seasonal quality category showing change in crown cover - Central Kimberley IBRA. Sites with zero crown cover have not been included.

Seasonal Quality	Species group	Crown cover < 0.90	No change. 0.90 ≤ crown cover < 1.10	Crown cover ≥ 1.10	Number of sites
All years	All	10%	28%	62%	60
Above average	All	14%	45%	41%	22
Average	All	10%	23%	68%	31
Below average	All	n/a	n/a	n/a	7

Resource Capture Index

Table 1:10. Central Kimberley IBRA – summary of resource capture index.

Number of sites assessed in cycle 3, assessment 1 (c3a1) and cycle 3, assessment 2 (c3a2)	68
Average Resource Capture Index - c3a1	0.08
Average Resource Capture Index – c3a2	0.06
Average ratio of Resource Capture Index – c3a2 to c3a1 +/- standard error of the mean	0.90 +/- 0.07
Resource Capture Index: ratio c3a2 to c3a1, percentage of sites at least 1.0	43%
Resource Capture Index: ratio c3a2 to c3a1, percentage of sites <0.90	53%
Resource Capture Index: ratio c3a2 to c3a1, percentage of sites <0.50	19%
Average Resource Capture Index: ratio c3a2 to c3a1 for above average seasonal quality	0.81
Average Resource Capture Index: ratio c3a2 to c3a1 for average seasonal quality	0.92
Average Resource Capture Index: ratio c3a2 to c3a1 for below average seasonal quality	n/a

Figure 1:5. Change in Resource Capture Index, cycle 3 – Central Kimberley IBRA.

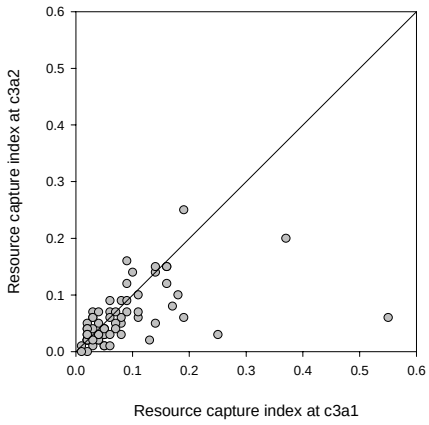


Table 1:11. Resource capture index – percentage of sites in each seasonal category showing change in the index - Central Kimberley IBRA, cycle 3.

Seasonal Quality	Species group	Decline. RCI < 0.90	No change. 0.90 ≤ RCI <1.10	Increase. RCI >=1.10	Number of sites
All years	All	53%	21%	26%	68
Above average	All	60%	16%	24%	25
Average	All	49%	29%	23%	35

Below average	All	n/a	n/a	n/a	8

Proportional landscape function - stability, infiltration and nutrient cycling indices

Table 1:12. Proportional landscape function indices – Central Kimberley IBRA, cycle 3.

	Stability index	Infiltration index	Nutrient cycling index
Number of sites assessed in c3a1 and c3a2	68	68	68
c3a1 average +/- standard error of the mean	51.4 +/- 1.08	43.3 +/- 0.83	22.7 +/- 0.83
c3a2 average +/- standard error of the mean	52.5 +/- 1.13	43.1 +/- 0.92	23.1 +/- 0.92
Ratio of index: average +/- standard error of the mean	1.05 +/- 0.03	1.02 +/- 0.03	1.06 +/ 0.04
Ratio of index: c3a2 to c3a1 percentage of sites at least 1.0	49%	47%	50%
Ratio of index: c3a2 to c3a1 percentage of sites <0.90	22%	28%	38%
Ratio of index: c3a2 to c3a1 percentage of sites <0.50	0%	0%	2%
Average of index ratio: c3a2 to c3a1 for above average seasonal quality	1.02 +/- 0.06	1.05 +/- 0.06	1.06 +/- 0.07
Average of index ratio: c3a2 to c3a1 for average seasonal quality	1.05 +/- 0.04	0.98 +/- 0.03	1.02 +/- 0.06
Average of index ratio: c3a2 to c3a1 for below average seasonal quality	n/a	n/a	n/a

Figure 1:6. Proportional landscape function - stability, infiltration and nutrient cycling indices, cycle3 – Central Kimberley IBRA. The top panes show all data, the lower panes show expanded views over limited ranges.

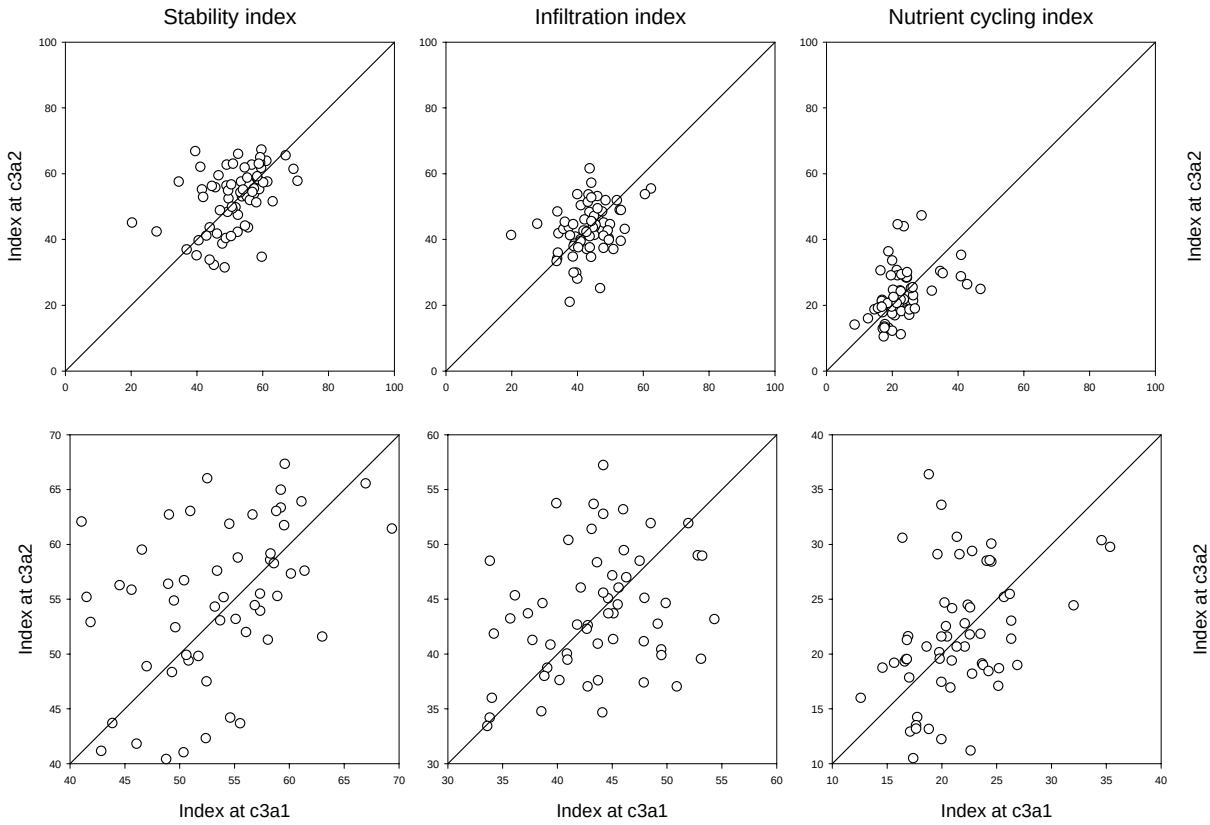


Table 1:13. Proportional landscape function - stability index – Central Kimberley IBRA. Ratio of stability index (RSI) at cycle 3, assessment 2 (c3a2) to index at cycle 3, assessment 1 (c3a1).

Seasonal Quality	Species group	Decline. RSI < 0.90	No change. 0.90>= RSI <1.10	Increase. RSI >=1.10	Number of sites
All years	All	22%	50%	28%	68
Above average	All	32%	48%	20%	25
Average	All	17%	54%	29%	35
Below average	All	n/a	n/a	n/a	8

Table 1:14. Proportional landscape function - infiltration index – Central Kimberley IBRA. Ratio of infiltration index (RII) at cycle 3, assessment 2 (c3a2) to index at cycle 3, assessment 1 (c3a1).

Seasonal Quality	Species group	Decline. RII < 0.90	No change. 0.90>= RII <1.10	Increase. RII >=1.10	Number of sites
All years	All	28%	47%	25%	68
Above average	All	36%	36%	28%	25
Average	All	26%	54%	20%	35
Below average	All	n/a	n/a	n/a	8

Table 1:15. Proportional landscape function – nutrient cycling index – Central Kimberley IBRA. Ratio of nutrient cycling index (RNCI) at cycle 3, assessment 2 (c3a2) to index at cycle 3, assessment 1 (c3a1).

Seasonal Quality	Species group	Decline. RNCI < 0.90	No change. 0.90>= RNCI <1.10	Increase. RNCI >=1.10	Number of sites
All years	All	38%	12%	50%	68
Above average	All	36%	24%	40%	25
Average	All	46%	20%	34%	35
Below average	All	n/a	n/a	n/a	8

Change in sustainable management of the pastoral estate – grassland sites

Frequency of Decreaser, Intermediate and Increaser perennial grass species

Table 1:16. Summary of frequency of decreaser, intermediate and increaser perennial grass species, Central Kimberley IBRA, cycle 3.

Average change in frequency +/- standard error of the mean	1.02 +/- 0.03	1.17 +/- 0.10	1.16 +/- 0.11
Frequency: ratio c3a2 to c3a1, percentage of sites ≥ 1.0	54%	46%	55%
Frequency: ratio c3a2 to c3a1, percentage of sites <0.90	18%	43%	40%
Frequency: ratio c3a2 to c3a1, percentage of sites <0.50	3%	11%	17%
Average change in frequency: c3a2 to c3a1, above average seasonal quality	0.93	1.01	1.33
Average change in frequency: c3a2 to c3a1, average seasonal quality	1.09	1.40	1.03
Average change in frequency: c3a2 to c3a1, below average seasonal quality	n/a	n/a	n/a

Figure 1:7. Change in perennial grass frequency between, cycle 3 – decreaser, intermediate and increaser species

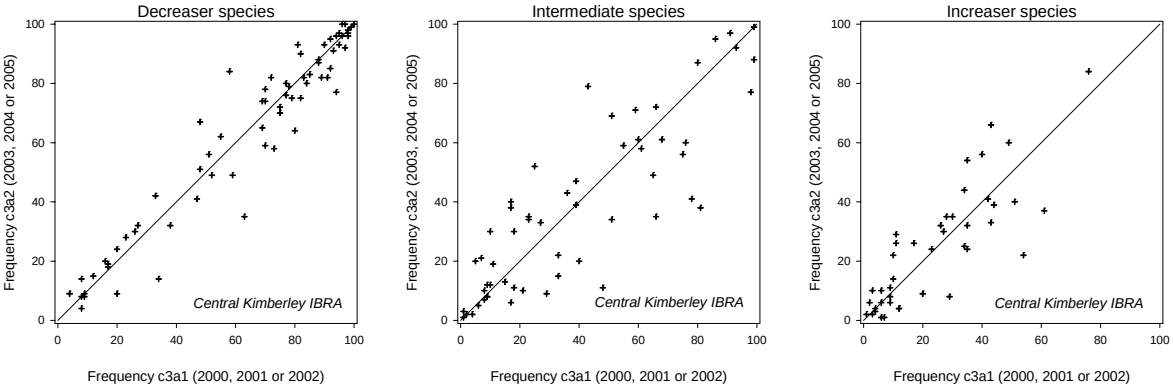


Table 1:17. Change in frequency of decreaser, intermediate and increaser perennial grass species – percentage of sites in each seasonal category - Central Kimberley IBRA, cycle 1

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency <1.10	Increase. frequency ≥1.10	Number of sites
All years	Decreaser	22%	41%	37%	68
	Intermediate	12%	24%	64%	50
	Increaser	33%	13%	54%	46
Above average	Decreaser	22%	41%	37%	68
	Intermediate	12%	24%	64%	50
	Increaser	33%	13%	54%	46
Average	Decreaser	n/a	n/a	n/a	0
	Intermediate	n/a	n/a	n/a	0
	Increaser	n/a	n/a	n/a	0
Below average	Decreaser	n/a	n/a	n/a	0
	Intermediate	n/a	n/a	n/a	0
	Increaser	n/a	n/a	n/a	0

Table 1:18. Change in frequency of decreaser, intermediate and increaser perennial grass species – percentage of sites in each seasonal category - Central Kimberley IBRA, cycle 2

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency <1.10	Increase. frequency ≥1.10	Number of sites
All years	Decreaser	12%	45%	43%	60
	Intermediate	19%	19%	62%	47
	Increaser	42%	21%	37%	43
Above average	Decreaser	13%	43%	44%	54
	Intermediate	18%	20%	62%	45
	Increaser	41%	22%	37%	41
Average	Decreaser	n/a	n/a	n/a	6
	Intermediate	n/a	n/a	n/a	2
	Increaser	n/a	n/a	n/a	2
Below average	Decreaser	n/a	n/a	n/a	0
	Intermediate	n/a	n/a	n/a	0

	Increaser	n/a	n/a	n/a	0

Table 1:19. Change in frequency of decreaser, intermediate and increaser perennial grass species – percentage of sites in each seasonal category - Central Kimberley IBRA, cycle 3

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency <1.10	Increase. frequency ≥1.10	Number of sites
All years	Decreaser	18%	59%	24%	68
	Intermediate	43%	20%	38%	56
	Increaser	40%	12%	48%	42
Above average	Decreaser	24%	68%	8%	25
	Intermediate	42%	32%	26%	19
	Increaser	42%	12%	47%	17
Average	Decreaser	14%	46%	40%	35
	Intermediate	33%	13%	53%	30
	Increaser	39%	13%	48%	23
Below average	Decreaser	n/a	n/a	n/a	8
	Intermediate	n/a	n/a	n/a	7
	Increaser	n/a	n/a	n/a	2

Table 1:20. Weighted average across all three cycles - change in frequency of decreaser, intermediate and increaser perennial grass species – percentage of sites in each seasonal category - Central Kimberley IBRA.

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency <1.10	Increase. frequency ≥1.10	Number of sites	Cycles used
All years	Decreaser	18%	48%	34%	196	1,2,3
	Intermediate	25%	21%	54%	153	1,2,3
	Increaser	38%	15%	46%	131	1,2,3
Above average	Decreaser	19%	52%	29%	147	1,2,3
	Intermediate	19%	24%	57%	114	1,2,3
	Increaser	38%	16%	46%	104	1,2,3
Average	Decreaser	14%	46%	40%	35	3
	Intermediate	33%	13%	53%	30	3
	Increaser	39%	13%	48%	23	3
Below average	Decreaser	n/a	n/a	n/a	n/a	n/a
	Intermediate	n/a	n/a	n/a	n/a	n/a
	Increaser	n/a	n/a	n/a	n/a	n/a

Change in vegetation richness and occurrence

Native perennial species richness

Table 1:21. Central Kimberley IBRA – summary of native perennial species richness, cycle 3

Number of sites assessed in cycle 3, assessment 1 and cycle3 assessment 2 (c3a1 & c3a2)	68
Average number of native perennial species per site at c3a1 – for sites assessed in both c3a1 and c3a2: +/- standard error of the mean	7.4 +/- 0.29
Average number of native perennial species per site in c3a2 – for sites assessed in both c3a1 and c3a2: +/- standard error of the mean	7.6 +/- 0.30
Average ratio of species richness: c3a2 to c3a1: +/- standard error of the mean	1.07 +/- 0.03
Species richness: ratio c3a2 to c3a1, percentage of sites at least 1.0	71%
Species richness: ratio c3a2 to c3a1, percentage of sites <0.90	24%
Species richness: ratio c3a2 to c3a1, percentage of sites <0.50	0%

Figure 1:8. Change in species richness on each site between each sampling cycle – Central Kimberley IBRA. Bubble size represents number of sites at each x,y point.

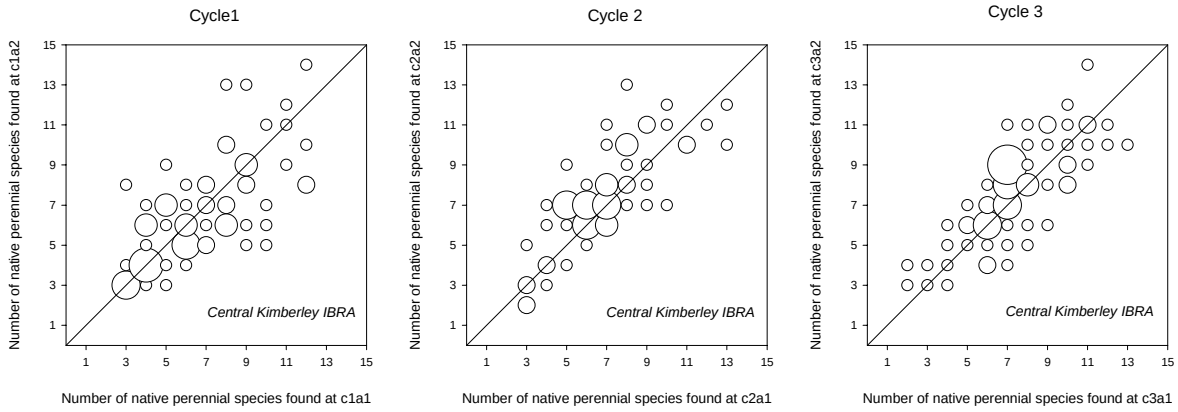


Table 1:22. Cycle 1 - native perennial species richness Central Kimberley IBRA- c1a2 divided by c1a1.

Seasonal Quality	Species group	Decline. Richness index < 0.80	No change. 0.80 ≤ Richness index <1.20	Increase. Richness index ≥1.20	Number of sites
All years	All	22%	53%	25%	68
Above average	All	22%	53%	25%	68
Average	All	n/a	n/a	n/a	0
Below average	All	n/a	n/a	n/a	0

Table 1:23. Cycle 2 - native perennial species richness Central Kimberley IBRA- c2a2 divided by c2a1.

Seasonal Quality	Species group	Decline. Richness index <	No change. 0.80 ≤ Richness	Increase. Richness index	Number of sites

		0.80	index <1.20	≥1.20	
All years	All	10%	62%	28%	60
Above average	All	9%	65%	26%	54
Average	All	n/a	n/a	n/a	6
Below average	All	n/a	n/a	n/a	0

Table 1:24. Cycle 3 - native perennial species richness Central Kimberley IBRA- c3a2 divided by c3a1.

Seasonal Quality	Species group	Decline. Richness index < 0.80	No change. 0.80 ≤ Richness index <1.20	Increase. Richness index ≥1.20	Number of sites
All years	All	13%	54%	32%	68
Above average	All	12%	52%	36%	25
Average	All	9%	57%	34%	35
Below average	All	n/a	n/a	n/a	8

Table 1:25. Weighted average across all three cycles - native perennial species richness Central Kimberley IBRA.

Seasonal Quality	Species group	Decline. Richness index < 0.80	No change. 0.80 ≤ Richness index <1.20	Increase. Richness index ≥1.20	Number of sites	Cycles used
All years	All	15%	56%	28%	196	1,2,3
Above average	All	16%	57%	27%	147	1,2,3
Average	All	9%	57%	34%	35	3
Below average	All	n/a	n/a	n/a	n/a	n/a

Frequency of occurrence – native species

Table 1:26. Central Kimberley IBRA – species found on at least five sites at either the first or second assessment of each cycle and on at least one site at the first assessment date of each cycle.

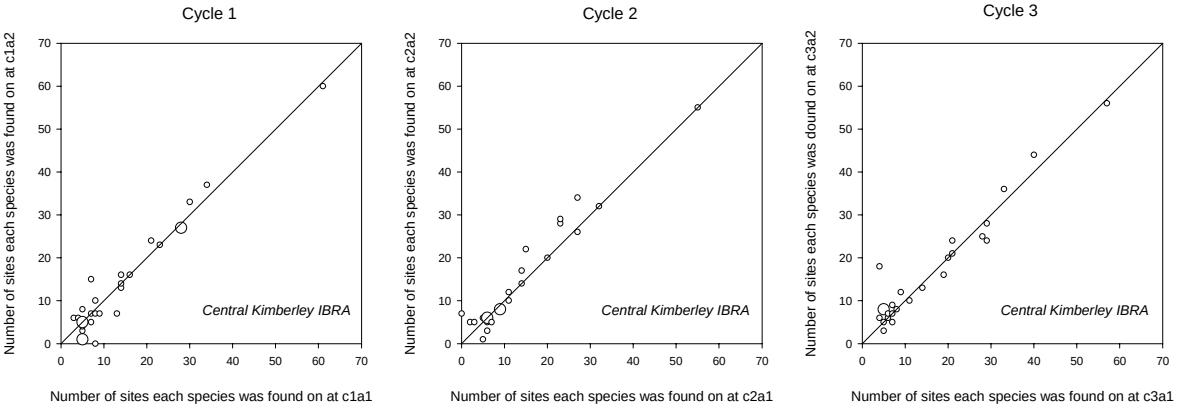
	c1a1 & c1a2	c2a1 & c2a2	c3a1 & c3a2
Number of species	28	23	25
Average number of sites each species was found on	14.0 +/- 2.43	14.6 +/- 2.57	16.0 +/- 2.72
Average number of sites each species was found on	13.8 +/- 2.55	15.5 +/- 2.78	16.8 +/- 2.66
Occurrence ratio at least 1.0 – percentage of species	54%	65%	64%
Occurrence ratio >1.10 – percentage of species	29%	35%	32%
Occurrence ratio < 0.90 – percentage of species	32%	26%	20%

Occurrence ratio < 0.50 – percentage of species	11%	4%	0%
Average occurrence ratio +/- standard error of the mean	0.98 +/- 0.09	1.08 +/- 0.09	1.20 +/- 0.15

Table 1:27. Native species found on WARMS sites within the Central Kimberley IBRA. Data were filtered to include only those species found on at least five sites at any of the assessments, and on at least one site at the first assessment of each of the three sampling cycles. The table shows the number of sites each species was found on and the number of sites assessed at the first and second assessment of each cycle.

SPECIES_NAME	c1a1 & c1a2	c2a1 & c2a2	c3a1 & c3a2	ratio c1a2/ c1a1	ratio c2a2/ c2a1	ratio c3a1/ c3a2
Acacia farnesiana	4 then 2 of 68	2 then 5 of 60	5 then 8 of 68	0.50	2.50	1.60
Aristida inaequiglumis	28 then 27 of 68	27 then 26 of 60	29 then 24 of 68	0.96	0.96	0.83
Aristida latifolia	23 then 23 of 68	20 then 20 of 60	20 then 20 of 68	1.00	1.00	1.00
Atalaya hemiglauca	5 then 5 of 68	4 then 4 of 60	4 then 3 of 68	1.00	1.00	0.75
Bauhinia cunninghamii	7 then 7 of 68	7 then 5 of 60	6 then 6 of 68	1.00	0.71	1.00
Carissa lanceolata	14 then 16 of 68	14 then 17 of 60	19 then 16 of 68	1.14	1.21	0.84
Chrysopogon fallax	61 then 60 of 68	55 then 55 of 60	57 then 56 of 68	0.98	1.00	0.98
Corchorus sidoides	13 then 7 of 68	6 then 6 of 60	7 then 7 of 68	0.54	1.00	1.00
Crotalaria novae-hollandiae	5 then 3 of 68	3 then 5 of 60	5 then 5 of 68	0.60	1.67	1.00
Cymbopogon bombycinus			7 then 9 of 68			1.29
Dichanthium fecundum	28 then 27 of 68	23 then 28 of 60	28 then 25 of 68	0.96	1.22	0.89
Digitaria brownii	3 then 6 of 68	6 then 6 of 60	6 then 7 of 68	2.00	1.00	1.17
Dichrostachys spicata	3 then 2 of 68	2 then 4 of 60	4 then 6 of 68	0.67	2.00	1.50
Dolichandrone heterophylla	8 then 10 of 68	9 then 8 of 60	9 then 12 of 68	1.25	0.89	1.33
Eriachne obtusa	34 then 37 of 68	32 then 32 of 60	40 then 44 of 68	1.09	1.00	1.10
Eucalyptus brevifolia	4 then 6 of 68	4 then 4 of 60	4 then 4 of 68	1.50	1.00	1.00
Eucalyptus tectifica	1 then 2 of 68	2 then 4 of 60	5 then 3 of 68	2.00	2.00	0.60
Eulalia aurea	9 then 7 of 68	6 then 5 of 60	5 then 8 of 68	0.78	0.83	1.60
Gossypium australe	7 then 15 of 68	14 then 14 of 60	14 then 13 of 68	2.14	1.00	0.93
Heteropogon contortus	30 then 33 of 68	27 then 34 of 60	33 then 36 of 68	1.10	1.26	1.09
Melhania oblongifolia	8 then 0 of 68			0.00		
Neptunia dimorphantha	5 then 5 of 68	5 then 1 of 60	2 then 1 of 68	1.00	0.20	0.50
Panicum decompositum	21 then 24 of 68	23 then 29 of 60	29 then 28 of 68	1.14	1.26	0.97
Rhynchosia minima	8 then 7 of 68	5 then 6 of 60	7 then 5 of 68	0.88	1.20	0.71
Sehima nervosum	16 then 16 of 68	15 then 22 of 60	21 then 24 of 68	1.00	1.47	1.14
Sida fibulifera	7 then 5 of 68	6 then 3 of 60	4 then 18 of 68	0.71	0.50	4.50
Sorghum plumosum	14 then 14 of 68	11 then 10 of 60	11 then 10 of 68	1.00	0.91	0.91
Tephrosia supina	5 then 8 of 68	9 then 8 of 60	8 then 8 of 68	1.60	0.89	1.00
Themeda triandra	5 then 4 of 68	3 then 4 of 60	3 then 4 of 68	0.80	1.33	1.33
Triodia bitextura	14 then 13 of 68	11 then 12 of 60	21 then 21 of 68	0.93	1.09	1.00
Waltheria indica	5 then 1 of 68	1 then 2 of 60	2 then 4 of 68	0.20	2.00	2.00
Xerochloa laniflora	5 then 1 of 68	1 then 1 of 60	1 then 1 of 68	0.20	1.00	1.00

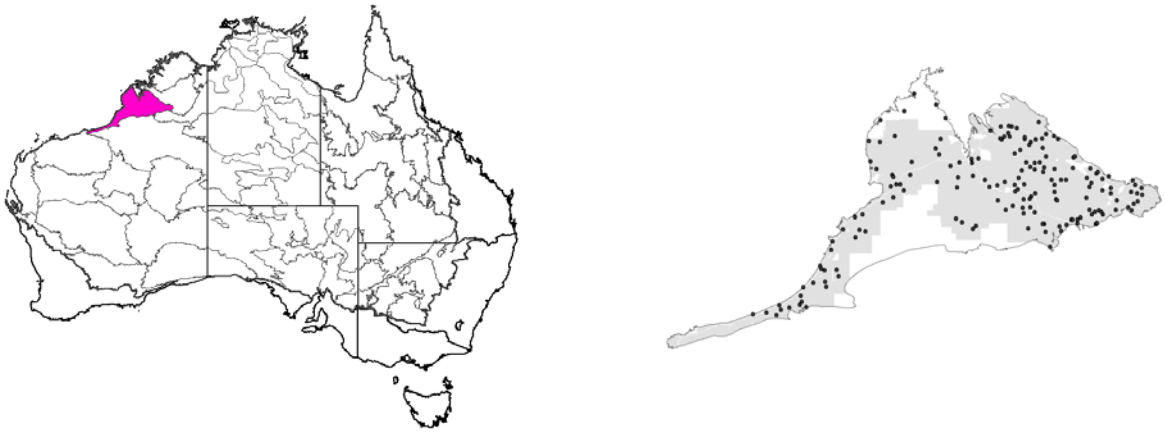
Figure 1:9. Frequency of occurrence for all native species found on at least five sites at either the first or second sampling, for each cycle – Central Kimberley IBRA. Bubble size represents number of sites at each x,y point. .



Dampierland IBRA

For grassland sites, data from both Dampierland sub-IBRAs were pooled and the complete Dampierland IBRA is reported.

Figure 1:10. Location of Dampierland IBRA (left) and WARMS sites in the IBRA (right). Greyed areas are pastoral tenure.



Site and seasonal summary

Table 1:28. Dampierland IBRA – grassland sites – total number of sites and dates assessed.

Number of grassland sites assessed	170
Number of grassland sites assessed in DL1 (Fitzroy Trough)	112
Number of grassland sites assessed in DL2 (Pindan Land)	59
First assessment (installation)	06/04/94 to 01/10/96
Second assessment	14/07/97 to 08/09/99
Third assessment	31/05/00 to 03/09/02
Fourth assessment	05/05/03 to 13/10/05

Table 1:29. Dampierland IBRA – grassland sites – seasonal category and number of sites assessed in each cycle.

	Cycle1	Cycle 2	Cycle 3
Number of grassland sites assessed	158	135	136
Above average seasonal quality - – percentage of sites	100%	75%	21%
Average seasonal quality - – percentage of sites	0%	25%	41%
Below average seasonal quality – percentage of sites	0%	0%	38%

Change in landscape function

Perennial grass frequency

Table 1:30. Dampierland IBRA – summary of perennial grass frequency.

	Cycle 1	Cycle 2	Cycle 3
Average frequency: first assessment of cycle +/- standard error of the mean	81.8 +/- 1.64	88.0 +/- 1.59	88.8 +/- 1.58
Average frequency: second assessment of cycle +/- standard error of the mean	88.1 +/- 1.45	89.3 +/- 1.49	86.7 +/- 1.71
Average frequency ratio between the two assessments +/- standard error of the mean	1.19 +/- 0.06	1.06 +/- 0.03	1.01 +/- 0.02
Frequency ratio at least 1.0 – percentage of sites	79%	74%	58%
Frequency ratio <0.90 – percentage of sites	7%	10%	14%
Frequency ratio <0.50 – percentage of sites	2%	1%	3%

Figure 1:11. Change in perennial grass frequency between each sampling cycle (C) – Dampierland IBRA.

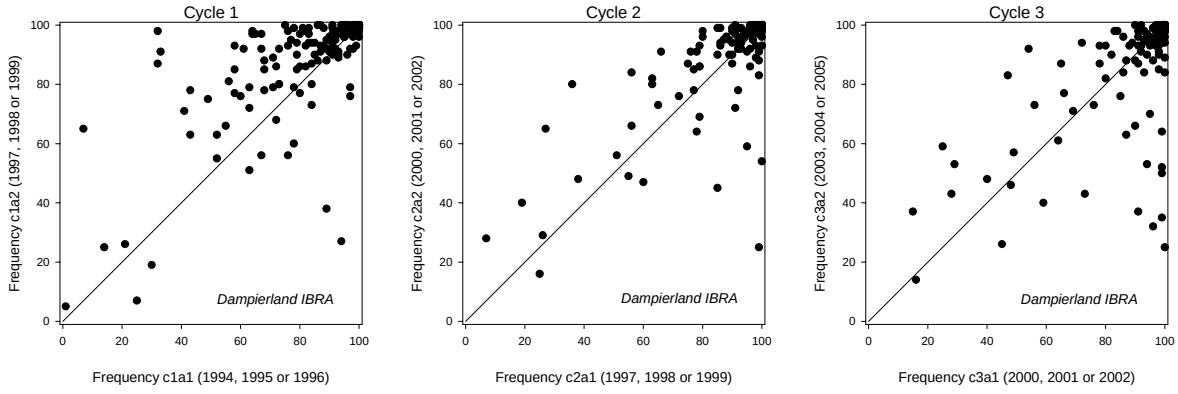


Table 1:31. Cycle 1 - percentage of sites in each seasonal category showing change in perennial grass frequency - Dampierland IBRA.

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency < 1.10	Increase. frequency ≥ 1.10	Number of sites
All years	All	7%	60%	33%	158
Above average	All	7%	60%	33%	158
Average	All	n/a	n/a	n/a	0
Below average	All	n/a	n/a	n/a	0

Table 1:32. Cycle 2 - percentage of sites in each seasonal category showing change in perennial grass frequency - Dampierland IBRA.

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency < 1.10	Increase. frequency ≥ 1.10	Number of sites
All years	All	10%	73%	16%	135
Above average	All	14%	69%	17%	101
Average	All	0%	85%	15%	34
Below average	All	n/a	n/a	n/a	0

Table 1:33. Cycle 3 - percentage of sites in each seasonal category showing change in perennial grass frequency - Dampierland IBRA.

Seasonal Quality	Species group	Decline. frequency <0.90	No change. ≤ 0.90 frequency <1.10	Increase. frequency ≥1.10	Number of sites
All years	All	14%	72%	14%	136
Above average	All	18%	57%	25%	28
Average	All	11%	79%	11%	56
Below average	All	15%	73%	12%	52

Table 1:34. Weighted average across all three cycles - percentage of sites in each seasonal category showing change in perennial grass frequency. Only cycles containing at least 10 sites in each seasonal quality category were used. Dampierland IBRA.

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency < 1.10	Increase. frequency ≥ 1.10	Number of site by year combinations	Cycles used
All years	All	10%	68%	22%	429	1,2,3
Above average	All	11%	63%	27%	287	1,2,3
Average	All	7%	81%	13%	90	2,3
Below average	All	15%	73%	12%	52	3

Crown cover, woody species taller than 1m

Averages of frequency ratios can not be calculated because of the large number of crown cover estimates of zero (i.e. denominator = zero).

Table 1:35. Dampierland IBRA – summary of crown cover

Average crown cover cycle 3, assessment1 (c3a1)	5.56
Average crown cover cycle 3, assessment2 (c3a2)	6.43
* Crown cover: ratio c3a2 to c3a1, percentage of sites at least 1.0	62%
* Crown cover: ratio c3a2 to c3a1, percentage of sites <0.90	26%
* Crown cover: ratio c3a2 to c3a1, percentage of sites <0.50	7%

* Sites with zero crown cover at both c3a1 and c3a2 have not been included

Figure 1:12. Change in crown cover between each sampling cycle (C) – Dampierland IBRA.

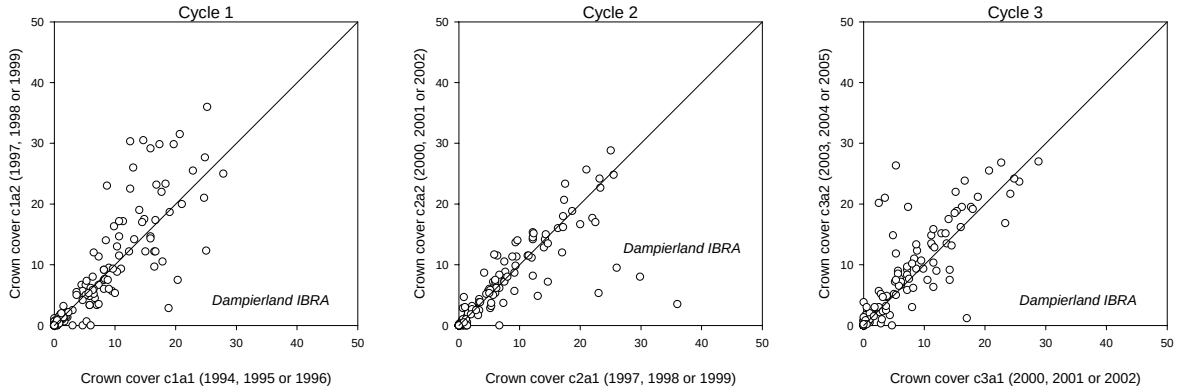


Table 1:36. Cycle 3 – percentage of sites in each seasonal quality category showing change in crown cover - Dampierland IBRA. Sites with zero crown cover have not been included.

Seasonal Quality	Species group	Crown cover <0.90	No change. ≤0.90 crown cover <1.10	Crown cover ≥1.10	Number of sites
All years	All	26%	20%	54%	95
Above average	All	25%	8%	67%	12
Average	All	26%	28%	47%	43
Below average	All	28%	15%	58%	40

Resource Capture Index

Table 1:37. Dampierland IBRA – summary of resource capture index.

Number of sites assessed in cycle 3, assessment 1 (c3a1) and cycle 3, assessment 2 (c3a2)	133
Average Resource Capture Index - c3a1	0.10

Average Resource Capture Index – c3a2	0.12
Average ratio of Resource Capture Index – c3a2 to c3a1 +/- standard error of the mean	1.45 +/- 0.16
Resource Capture Index: ratio c3a2 to c3a1, percentage of sites at least 1.0	62%
Resource Capture Index: ratio c3a2 to c3a1, percentage of sites <0.90	34%
Resource Capture Index: ratio c3a2 to c3a1, percentage of sites <0.50	14%
Average Resource Capture Index: ratio c3a2 to c3a1 for above average seasonal quality	1.41
Average Resource Capture Index: ratio c3a2 to c3a1 for average seasonal quality	1.33
Average Resource Capture Index: ratio c3a2 to c3a1 for below average seasonal quality	1.60

Figure 1:13. Change in Resource Capture Index, cycle 3 – Dampierland IBRA.

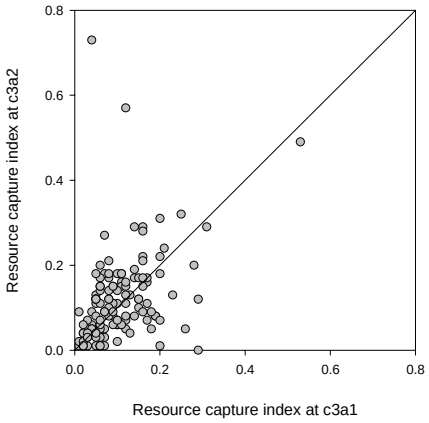


Table 1:38. Resource capture index – percentage of sites in each seasonal category showing change in the index - Dampierland IBRA, cycle 3.

Seasonal Quality	Species group	Decline. RCI < 0.90	No change. 0.90 ≤ RCI <1.10	Increase. RCI >=1.10	Number of sites
All years	All	35%	15%	50%	133
Above average	All	31%	15%	54%	26
Average	All	38%	15%	47%	55
Below average	All	33%	15%	52%	52

Proportional landscape function - stability, infiltration and nutrient cycling indices

Table 1:39. Proportional landscape function indices – Dampierland IBRA, cycle 3.

	Stability index	Infiltration index	Nutrient cycling index
Number of sites assessed in c3a1 and c3a2	134	134	134
c3a1 average +/- standard error of the mean	48.1 +/- 0.71	44.4 +/- 0.56	23.3 +/- 0.53
c3a2 average +/- standard error of the mean	49.6 +/- 0.72	43.4 +/- 0.62	22.9 +/- 0.56
Ratio of index: average +/- standard error of the mean	1.05 +/- 0.02	0.99 +/- 0.01	1.02 +/- 0.03
Ratio of index: c3a2 to c3a1 percentage of sites at least 1.0	60%	46%	45%
Ratio of index: c3a2 to c3a1 percentage of sites <0.90	22%	27%	43%
Ratio of index: c3a2 to c3a1 percentage of sites <0.50	1%	2%	3%
Average of index ratio: c3a2 to c3a1 for above average seasonal quality	0.97 +/- 0.03	1.03 +/- 0.02	1.05 +/- 0.05
Average of index ratio: c3a2 to c3a1 for average seasonal quality	1.07 +/- 0.04	1.00 +/- 0.02	1.04 +/- 0.05
Average of index ratio: c3a2 to c3a1 for below average seasonal quality	1.08 +/- 0.04	0.95 +/- 0.02	0.99 +/- 0.05

Figure 1:14. Proportional landscape function - stability, infiltration and nutrient cycling indices, cycle3 – Dampierland IBRA. The top panes show all data, the lower panes show expanded views over limited ranges.

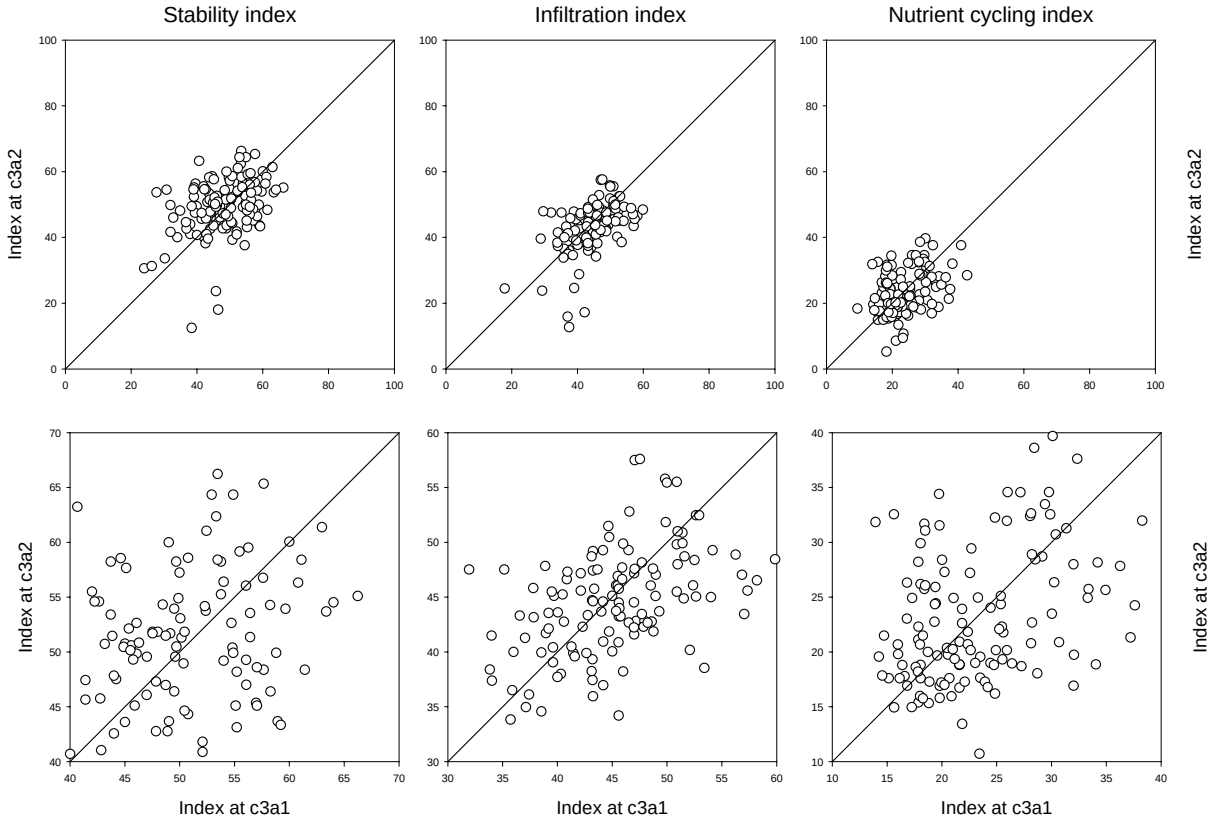


Table 1:40. Proportional landscape function - stability index – Dampierland IBRA. Ratio of stability index (RSI) at cycle 3, assessment 2 (c3a2) to index at cycle 3, assessment 1 (c3a1).

Seasonal Quality	Species group	Decline. RSI < 0.90	No change. 0.90>= RSI <1.10	Increase. RSI >=1.10	Number of sites
All years	All	22%	40%	37%	134
Above average	All	31%	50%	19%	26
Average	All	22%	40%	38%	55
Below average	All	19%	36%	45%	53

Table 1:41. Proportional landscape function - infiltration index – Dampierland IBRA. Ratio of infiltration index (RII) at cycle 3, assessment 2 (c3a2) to index at cycle 3, assessment 1 (c3a1).

Seasonal Quality	Species group	Decline. RII < 0.90	No change. 0.90>= RII <1.10	Increase. RII >=1.10	Number of sites
All years	All	27%	51%	22%	134
Above average	All	12%	58%	31%	26
Average	All	29%	49%	22%	55
Below average	All	32%	49%	19%	53

Table 1:42. Proportional landscape function – nutrient cycling index – Dampierland IBRA. Ratio of nutrient cycling index (RNCI) at cycle 3, assessment 2 (c3a2) to index at cycle 3, assessment 1 (c3a1).

Seasonal Quality	Species group	Decline. RNCI < 0.90	No change. 0.90>= RNCI <1.10	Increase. RNCI >=1.10	Number of sites
All years	All	43%	23%	34%	134
Above average	All	35%	23%	42%	26
Average	All	40%	27%	33%	55
Below average	All	49%	19%	32%	53

Change in sustainable management of the pastoral estate – grassland sites

Frequency of Decreaser, Intermediate and Increaser perennial grass species

Table 1:43. Summary of frequency of decreaser, intermediate and increaser perennial grass species, Dampierland IBRA, cycle 3.

Average change in frequency +/- standard error of the mean	1.06 +/- 0.04	1.22 +/- 0.13	1.17 +/- 0.10
Frequency: ratio c3a2 to c3a1, percentage of sites ≥ 1.0	62%	48%	64%
Frequency: ratio c3a2 to c3a1, percentage of sites <0.90	17%	42%	30%
Frequency: ratio c3a2 to c3a1, percentage of sites <0.50	4%	14%	13%
Average change in frequency: c3a2 to c3a1, above average seasonal quality	1.06	2.10	n/a
Average change in frequency: c3a2 to c3a1, average seasonal quality	1.03	1.11	0.99
Average change in frequency: c3a2 to c3a1, below average seasonal quality	1.10	1.06	1.44

Figure 1:15. Change in perennial grass frequency, cycle 3 – decreaser, intermediate and increaser species

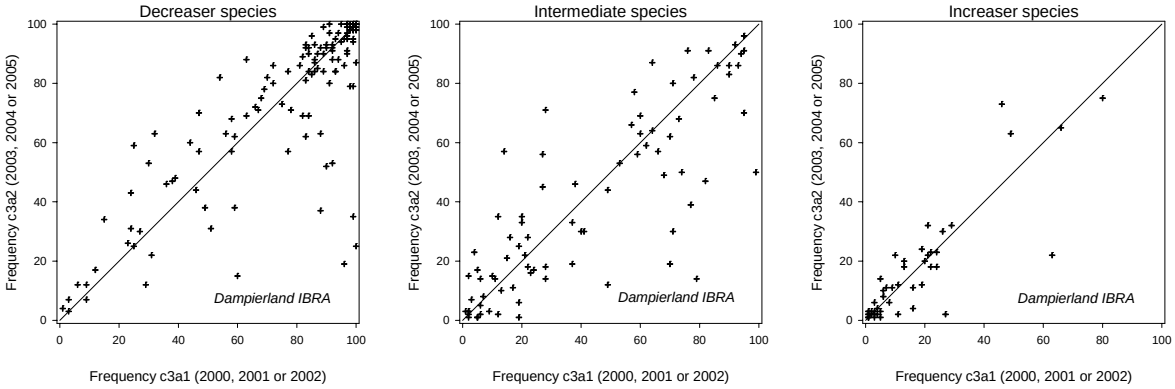


Table 1:44. Change in frequency of decreaser, intermediate and increaser perennial grass species – percentage of sites in each seasonal category - Dampierland IBRA, cycle 1

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency <1.10	Increase. frequency ≥1.10	Number of sites
All years	Decreaser	12%	54%	34%	155
	Intermediate	23%	12%	64%	98
	Increaser	34%	14%	52%	44
Above average	Decreaser	12%	54%	34%	155
	Intermediate	23%	12%	64%	98
	Increaser	34%	14%	52%	44
Average	Decreaser	n/a	n/a	n/a	0
	Intermediate	n/a	n/a	n/a	0
	Increaser	n/a	n/a	n/a	0
Below average	Decreaser	n/a	n/a	n/a	0
	Intermediate	n/a	n/a	n/a	0
	Increaser	n/a	n/a	n/a	0

Table 1:45. Change in frequency of decreaser, intermediate and increaser perennial grass species – percentage of sites in each seasonal category - Dampierland IBRA, cycle 2

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency <1.10	Increase. frequency ≥1.10	Number of sites
All years	Decreaser	13%	60%	26%	134
	Intermediate	32%	25%	43%	79
	Increaser	33%	13%	53%	45
Above average	Decreaser	16%	56%	28%	100
	Intermediate	34%	24%	41%	58
	Increaser	38%	13%	50%	32
Average	Decreaser	6%	74%	21%	34
	Intermediate	24%	29%	48%	21
	Increaser	23%	15%	62%	13
Below average	Decreaser	n/a	n/a	n/a	0
	Intermediate	n/a	n/a	n/a	0
	Increaser	n/a	n/a	n/a	0

Table 1:46. Change in frequency of decreaser, intermediate and increaser perennial grass species – percentage of sites in each seaconal category - Dampierland IBRA, cycle 3

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency <1.10	Increase. frequency ≥1.10	Number of sites
All years	Decreaser	17%	59%	24%	134
	Intermediate	42%	22%	36%	81
	Increaser	30%	28%	43%	42
Above average	Decreaser	15%	60%	26%	27
	Intermediate	64%	0%	45%	11
	Increaser	n/a	n/a	n/a	5
Average	Decreaser	13%	65%	22%	55
	Intermediate	50%	21%	29%	34
	Increaser	29%	38%	33%	24
Below average	Decreaser	23%	52%	25%	52
	Intermediate	33%	28%	39%	36
	Increaser	28%	17%	56%	18

Table 1:47. Weighted average across all three cycles - change in frequency of decreaser, intermediate and increaser perennial grass species – percentage of sites in each seasonal category - Dampierland IBRA.

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency <1.10	Increase. frequency ≥1.10	Number of sites	Cycles used
All years	Decreaser	14%	57%	28%	423	1,2,3
	Intermediate	23%	28%	49%	258	1,2,3
	Increaser	32%	18%	49%	131	1,2,3
Above average	Decreaser	14%	55%	31%	282	1,2,3
	Intermediate	26%	18%	55%	167	1,2,3
	Increaser	36%	14%	51%	76	1,2
Average	Decreaser	10%	68%	22%	89	2,3
	Intermediate	17%	46%	37%	55	2,3

	Increaser	27%	30%	43%	37	2,3
Below average	Decreaser	23%	52%	25%	52	3
	Intermediate	17%	46%	37%	36	3
	Increaser	28%	17%	56%	18	3

Change in vegetation richness and occurrence

Native perennial species richness

Table 1:48. Dampierland IBRA – summary of native perennial species richness, cycle 3

Number of sites assessed in cycle 3, assessment 1 and cycle3 assessment 2 (c3a1 & c3a2)	136
Average number of native perennial species per site at c3a1 – for sites assessed in both c3a1 and c3a2: +/- standard error of the mean	5.6 +/- 0.21
Average number of native perennial species per site in c3a2 – for sites assessed in both c3a1 and c3a2: +/- standard error of the mean	6.1 +/- 0.20
Average ratio of species richness: c3a2 to c3a1: +/- standard error of the mean	1.20 +/- 0.05
Species richness: ratio c3a2 to c3a1, percentage of sites at least 1.0	70%
Species richness: ratio c3a2 to c3a1, percentage of sites <0.90	27%
Species richness: ratio c3a2 to c3a1, percentage of sites <0.50	0%

Figure 1:16. Change in species richness on each site between each sampling cycle – Dampierland IBRA. Bubble size represents number of sites at each x,y point.

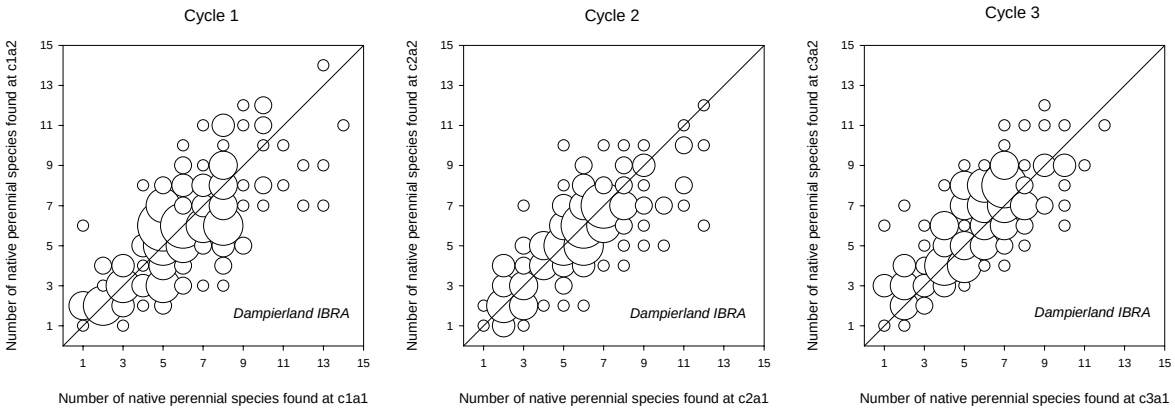


Table 1:49. Cycle 1 - native perennial species richness Dampierland IBRA- c1a2 divided by c1a1.

Seasonal Quality	Species group	Decline. Richness index <	No change. 0.80 ≤ Richness	Increase. Richness index	Number of sites

		0.80	index <1.20	≥1.20	
All years	All	28%	43%	30%	159
Above average	All	28%	43%	30%	159
Average	All	n/a	n/a	n/a	0
Below average	All	n/a	n/a	n/a	0

Table 1:50. Cycle 2 - native perennial species richness Dampierland IBRA- c2a2 divided by c2a1.

Seasonal Quality	Species group	Decline. Richness index < 0.80	No change. 0.80 ≤ Richness index <1.20	Increase. Richness index ≥1.20	Number of sites
All years	All	24%	53%	24%	136
Above average	All	26%	52%	22%	102
Average	All	15%	56%	29%	34
Below average	All	n/a	n/a	n/a	0

Table 1:51. Cycle 3 - native perennial species richness Dampierland IBRA- c3a2 divided by c3a1.

Seasonal Quality	Species group	Decline. Richness index < 0.80	No change. 0.80 ≤ Richness index <1.20	Increase. Richness index ≥1.20	Number of sites
All years	All	13%	51%	36%	136
Above average	All	7%	46%	46%	28
Average	All	13%	57%	30%	56
Below average	All	17%	46%	37%	52

Table 1:52. Weighted average across all three cycles - native perennial species richness Dampierland IBRA.

Seasonal Quality	Species group	Decline. Richness index < 0.80	No change. 0.80 ≤ Richness index <1.20	Increase. Richness index ≥1.20	Number of sites	Cycles used
All years	All	22%	49%	30%	431	1,2,3
Above average	All	25%	46%	29%	289	1,2,3
Average	All	14%	57%	30%	90	2,3
Below average	All	17%	46%	37%	52%	3

Frequency of occurrence – native species

Table 1:53. Dampierland IBRA – species found on at least five sites at either the first or second assessment of each cycle and on at least one site at the first assessment date of each cycle.

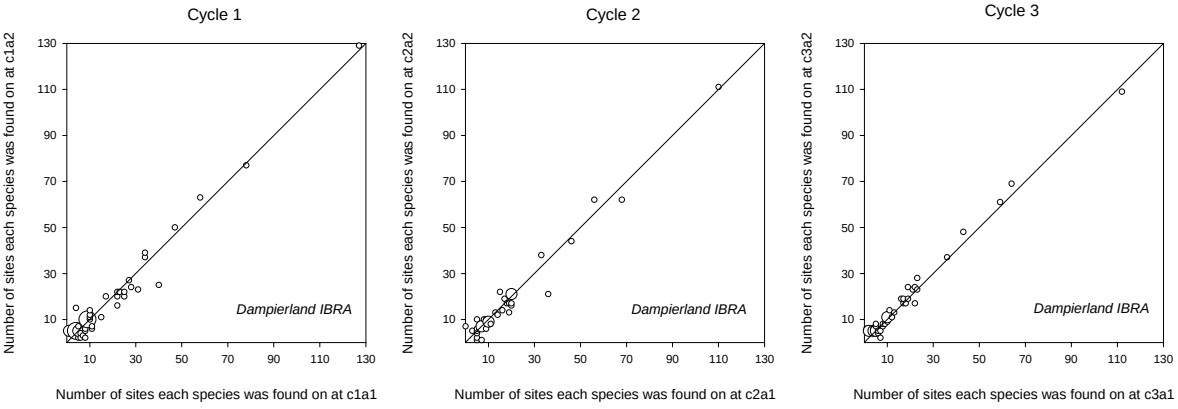
	c1a1 & c1a2	c2a1 & c2a2	c3a1 & c3a2
Number of species	46	36	41
Average number of sites each species was found on	18.8 +/- 3.34	19.4 +/- 3.56	17.0 +/- 3.24
Average number of sites each species was found on	18.2+/- 3.39	18.5 +/- 3.58	17.9 +/- 3.25
Occurrence ratio at least 1.0 – percentage of species	54%	50%	73%
Occurrence ratio >1.10 – percentage of species	33%	25%	39%
Occurrence ratio < 0.90 – percentage of species	39%	36%	17%
Occurrence ratio < 0.50 – percentage of species	9%	8%	2%
Average occurrence ratio +/- standard error of the mean	1.16 +/- 0.14	0.95 +/- 0.06	1.33 +/- 0.16

Table 1:54. Native species found on WARMS sites within the Dampierland IBRA. Data were filtered to include only those species found on at least five sites at any of the assessments, and on at least one site at the first assessment of each of the three sampling cycles. The table shows the number of sites each species was found on and the number of sites assessed at the first and second assessment of each cycle.

SPECIES_NAME	c1a1 & c1a2	c2a1 & c2a2	c3a1 & c3a2	ratio c1a2/ c1a1	ratio c2a2/ c2a1	ratio c3a1/ c3a2
Acacia farnesiana	8 then 9 of 158	9 then 10 of 135	10 then 11 of 136	1.13	1.11	1.10
Acacia holosericea	9 then 10 of 158	8 then 10 of 135	10 then 9 of 136	1.11	1.25	0.90
Acacia suberosa	10 then 12 of 158	10 then 9 of 135	9 then 11 of 136	1.20	0.90	1.22
Acacia tumida	10 then 10 of 158	6 then 6 of 135	6 then 4 of 136	1.00	1.00	0.67
Aristida inaequiglumis	25 then 20 of 158	18 then 17 of 135	18 then 17 of 136	0.80	0.94	0.94
Aristida latifolia	34 then 37 of 158	33 then 38 of 135	36 then 37 of 136	1.09	1.15	1.03
Astrebla elymoides	4 then 15 of 158	14 then 12 of 135	11 then 14 of 136	3.75	0.86	1.27
Astrebla pectinata	10 then 14 of 158	13 then 13 of 135	12 then 11 of 136	1.40	1.00	0.92
Astrebla squarrosa	9 then 10 of 158	9 then 6 of 135	5 then 8 of 136	1.11	0.67	1.60
Atalaya hemiglauca	31 then 23 of 158	20 then 16 of 135	16 then 19 of 136	0.74	0.80	1.19
Bauhinia cunninghamii	28 then 24 of 158	20 then 21 of 135	22 then 17 of 136	0.86	1.05	0.77
Bothriochloa ewartiana	4 then 5 of 158	5 then 5 of 135	5 then 5 of 136	1.25	1.00	1.00
Carissa lanceolata	22 then 16 of 158	15 then 22 of 135	23 then 28 of 136	0.73	1.47	1.22
Chrysopogon fallax	127 then 129 of 158	110 then 111 of 135	112 then 109 of 136	1.02	1.01	0.97
Corchorus sidoides	40 then 25 of 158	20 then 17 of 135	19 then 24 of 136	0.63	0.85	1.26
Corchorus walcottii	5 then 2 of 158	2 then 2 of 135	2 then 4 of 136	0.40	1.00	2.00
Corymbia dampieri	4 then 5 of 158	3 then 4 of 135	5 then 5 of 136	1.25	1.33	1.00
Dichanthium fecundum	58 then 63 of 158	56 then 62 of 135	59 then 61 of 136	1.09	1.11	1.03
Dolichandrone heterophylla	22 then 22 of 158	17 then 19 of 135	19 then 19 of 136	1.00	1.12	1.00
Distichostemon hispidulus	1 then 5 of 158	1 then 1 of 135	1 then 1 of 136	5.00	1.00	1.00
Eragrostis desertorum	11 then 6 of 158	5 then 1 of 135	1 then 3 of 136	0.55	0.20	3.00
Eragrostis setifolia	15 then 11 of 158	11 then 8 of 135	8 then 7 of 136	0.73	0.73	0.88
Eriachne obtusa	78 then 77 of 158	68 then 62 of 135	64 then 69 of 136	0.99	0.91	1.08
Eucalyptus microtheca	5 then 5 of 158	5 then 6 of 135	5 then 7 of 136	1.00	1.20	1.40

Eucalyptus tectifica	5 then 5 of 158	4 then 4 of 135	4 then 6 of 136	1.00	1.00	1.50
Eulalia aurea	4 then 5 of 158	5 then 4 of 135	4 then 5 of 136	1.25	0.80	1.25
Gossypium australe	8 then 6 of 158	5 then 10 of 135	10 then 11 of 136	0.75	2.00	1.10
Grevillea refracta	1 then 5 of 158	2 then 2 of 135	2 then 1 of 136	5.00	1.00	0.50
Grevillea striata	11 then 7 of 158	7 then 7 of 135	8 then 8 of 136	0.64	1.00	1.00
Hakea arborescens	2 then 4 of 158	3 then 5 of 135	6 then 5 of 136	2.00	1.67	0.83
Halosarcia indica	6 then 4 of 158	2 then 2 of 135	2 then 5 of 136	0.67	1.00	2.50
Neobassia astrocarpa	8 then 2 of 158	2 then 2 of 135	2 then 5 of 136	0.25	1.00	2.50
Neptunia dimorphantha	22 then 20 of 158	19 then 13 of 135	13 then 13 of 136	0.91	0.68	1.00
Neptunia monosperma	5 then 7 of 158	7 then 1 of 135	1 then 4 of 136	1.40	0.14	4.00
Panicum decompositum	47 then 50 of 158	46 then 44 of 135	43 then 48 of 136	1.06	0.96	1.12
Pennisetum basedowii			7 then 2 of 136			0.29
Rhynchosia minima	34 then 39 of 158	36 then 21 of 135	21 then 23 of 136	1.15	0.58	1.10
Sehima nervosum	25 then 22 of 158	20 then 21 of 135	22 then 24 of 136	0.88	1.05	1.09
Sida fibulifera	8 then 5 of 158	5 then 2 of 135	1 then 6 of 136	0.63	0.40	6.00
Senna notabilis	7 then 3 of 158	3 then 1 of 135	1 then 5 of 136	0.43	0.33	5.00
Sorghum plumosum	17 then 20 of 158	16 then 14 of 135	17 then 19 of 136	1.18	0.88	1.12
Sporobolus mitchellii	10 then 11 of 158	10 then 9 of 135	9 then 8 of 136	1.10	0.90	0.89
Sporobolus virginicus	9 then 10 of 158	7 then 7 of 135	7 then 5 of 136	1.11	1.00	0.71
Terminalia canescens	4 then 4 of 158	4 then 4 of 135	4 then 5 of 136	1.00	1.00	1.25
Triodia bitextura	27 then 27 of 158	20 then 20 of 135	23 then 23 of 136	1.00	1.00	1.00
Triodia pungens	23 then 22 of 158	19 then 17 of 135	17 then 17 of 136	0.96	0.89	1.00
Waltheria indica	9 then 8 of 158	4 then 0 of 135		0.89	0.00	
Whiteochloa airoides	6 then 2 of 158	2 then 2 of 135	2 then 2 of 136	0.33	1.00	1.00
Xerochloa barbata	5 then 4 of 158	2 then 2 of 135	2 then 2 of 136	0.80	1.00	1.00

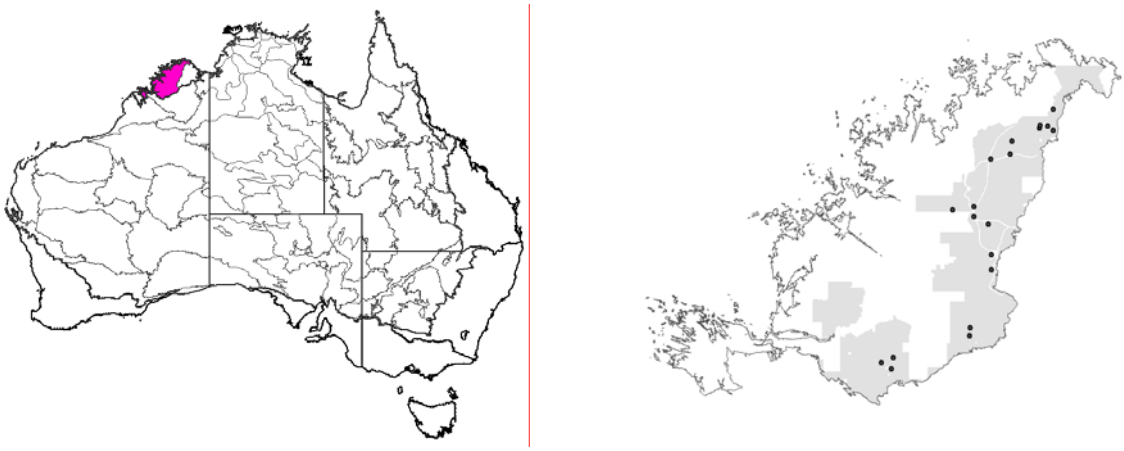
Figure 1:17. Frequency of occurrence for all native species found on at least five sites at either the first or second sampling, for each cycle – Dampierland IBRA. Bubble size represents number of sites at each x,y point. .



Northern Kimberley1 sub-IBRA

For grassland sites, only data from Northern Kimberley1 sub-IBRA is reported.

Figure 1:18. Location of Northern Kimberley sub-IBRA (left) and WARMS sites in the sub-IBRA (right). Greyed areas are pastoral tenure.



Site and seasonal summary

For grassland sites, only Northern Kimberley1 (Mitchell) is considered

Table 1:55. Northern Kimberley1 sub-IBRA – grassland sites – total number of sites and dates assessed.

Number of grassland sites assessed	20
Number of grassland sites assessed in NK1 (Mitchell)	**19**
Number of grassland sites assessed in NK2 (Berkeley)	1
First assessment (installation): NK1	23/04/94 to 26/08/94
Second assessment: NK1	09/06/97 to 27/07/97
Third assessment: NK1	26/07/00 to 13/09/00
Fourth assessment: NK1	30/07/03 to 28/06/03

Table 1:56. Northern Kimberley1 sub-IBRA – grassland sites – seasonal category and number of sites assessed in each cycle.

	Cycle1	Cycle 2	Cycle 3
Number of grassland sites assessed	17	6	5
Above average seasonal quality - – percentage of sites	100%	n/a	n/a
Average seasonal quality - – percentage of sites	0%	n/a	n/a
Below average seasonal quality – percentage of sites	0%	n/a	n/a

Change in landscape function

Perennial grass frequency

Table 1:57. Northern Kimberley1 sub-IBRA – summary of perennial grass frequency.

	Cycle 1	Cycle 2	Cycle 3
Average frequency: first assessment of cycle +/- standard error of the mean	93.4 +/- 1.96	n/a	n/a
Average frequency: second assessment of cycle +/- standard error of the mean	82.9 +/- 5.16	n/a	n/a
Average frequency ratio between the two assessments +/- standard error of the mean	0.89 +/- 0.05	n/a	n/a
Frequency ratio at least 1.0 – percentage of sites	78%	n/a	n/a
Frequency ratio <0.90 – percentage of sites	10%	n/a	n/a
Frequency ratio <0.50 – percentage of sites	0%	n/a	n/a

Figure 1:19. Change in perennial grass frequency between each sampling cycle (C) – Northern Kimberley1 sub-IBRA.

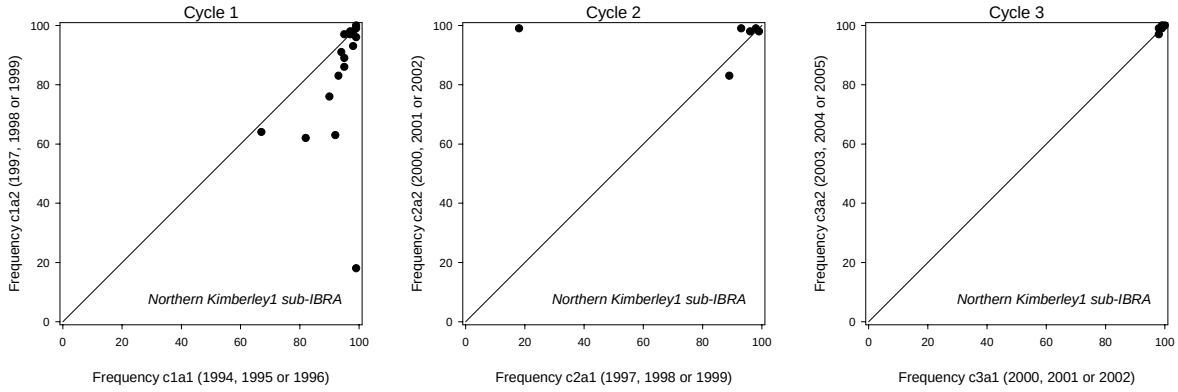


Table 1:58. Cycle 1 - percentage of sites in each seasonal category showing change in perennial grass frequency - Northern Kimberley sub-IBRA.

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency < 1.10	Increase. frequency ≥ 1.10	Number of sites
All years	All	29%	71%	0%	17
Above average	All	29%	71%	0%	17
Average	All	n/a	n/a	n/a	0

Below average	All	n/a	n/a	n/a	0

Table 1:59. Cycle 2 - percentage of sites in each seasonal category showing change in perennial grass frequency - Central Kimberley IBRA.

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency < 1.10	Increase. frequency ≥ 1.10	Number of sites
All years	All	n/a	n/a	n/a	6
Above average	All	n/a	n/a	n/a	6
Average	All	n/a	n/a	n/a	0
Below average	All	n/a	n/a	n/a	0

Table 1:60. Cycle 3 - percentage of sites in each seasonal category showing change in perennial grass frequency - Northern Kimberley1 sub-IBRA.

Seasonal Quality	Species group	Decline. frequency <0.90	No change. ≤0.90 frequency <1.10	Increase. frequency ≥1.10	Number of sites
All years	All	n/a	n/a	n/a	5
Above average	All	n/a	n/a	n/a	1
Average	All	n/a	n/a	n/a	3
Below average	All	n/a	n/a	n/a	1

Table 1:61. Weighted average across all three cycles - percentage of sites in each seasonal category showing change in perennial grass frequency. Only cycles containing at least 10 sites in each seasonal quality category were used. Northern Kimberley1 sub-IBRA.

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency < 1.10	Increase. frequency ≥ 1.10	Number of site by year combinations	Cycles used
All years	All	29%	71%	0%	17	1
Above average	All	29%	71%	0%	17	1
Average	All	n/a	n/a	n/a	n/a	n/a
Below average	All	n/a	n/a	n/a	n/a	n/a

Crown cover, woody species taller than 1m

Averages of frequency ratios can not be calculated because of the large number of crown cover estimates of zero (i.e. denominator = zero).

Table 1:62. Northern Kimberley1 sub-IBRA – summary of crown cover

Average crown cover cycle 3, assessment1 (c3a1)	n/a
Average crown cover cycle 3, assessment2 (c3a2)	n/a
* Crown cover: ratio c3a2 to c3a1, percentage of sites at least 1.0	n/a
* Crown cover: ratio c3a2 to c3a1, percentage of sites <0.90	n/a
* Crown cover: ratio c3a2 to c3a1, percentage of sites <0.50	n/a

* Sites with zero crown cover at both c3a1 and c3a2 have not been included

Figure 1:20. Change in crown cover between each sampling cycle (C) – Northern Kimberley1 sub-IBRA.

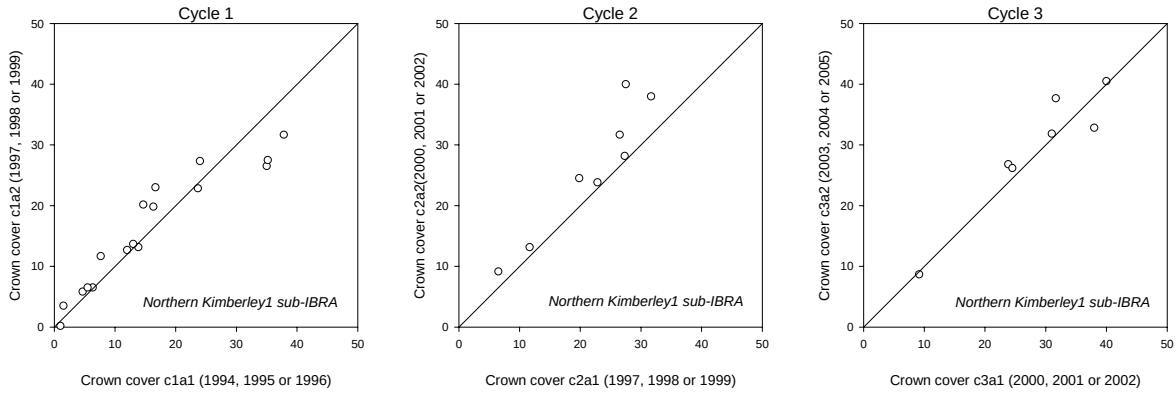


Table 1:63. Cycle 3 – percentage of sites in each seasonal quality category showing change in crown cover - Northern Kimberley1 sub-IBRA. Sites with zero crown cover have not been included.

Seasonal Quality	Species group	Crown cover <0.90	No change. ≤0.90 crown cover <1.10	Crown cover ≥1.10	Number of sites
All years	All	n/a	n/a	n/a	7
Above average	All	n/a	n/a	n/a	1
Average	All	n/a	n/a	n/a	4
Below average	All	n/a	n/a	n/a	2

Resource Capture Index

Table 1:64. Northern Kimberley1 sub-IBRA – summary of resource capture index.

Number of sites assessed in cycle 3, assessment 1 (c3a1) and cycle 3, assessment 2 (c3a2)	6

Average Resource Capture Index - c3a1	n/a
Average Resource Capture Index – c3a2	n/a
Average ratio of Resource Capture Index – c3a2 to c3a1 +/- standard error of the mean	n/a
Resource Capture Index: ratio c3a2 to c3a1, percentage of sites at least 1.0	n/a
Resource Capture Index: ratio c3a2 to c3a1, percentage of sites <0.90	n/a
Resource Capture Index: ratio c3a2 to c3a1, percentage of sites <0.50	n/a
Average Resource Capture Index: ratio c3a2 to c3a1 for above average seasonal quality	n/a
Average Resource Capture Index: ratio c3a2 to c3a1 for average seasonal quality	n/a
Average Resource Capture Index: ratio c3a2 to c3a1 for below average seasonal quality	n/a

Figure 1:21. Change in Resource Capture Index, cycle 3 – Northern Kimberley1 sub- IBRA.

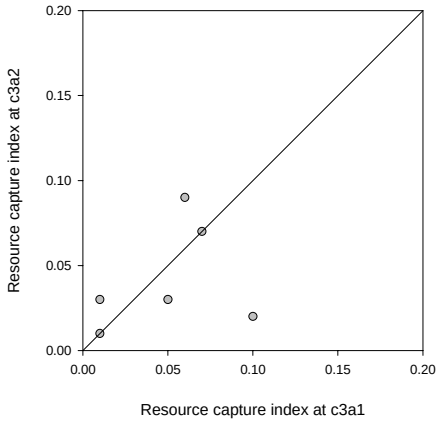


Table 1:65. Resource capture index – percentage of sites in each seasonal category showing change in the index - Northern Kimberley1 sub-IBRA, cycle 3.

Seasonal Quality	Species group	Decline. RCI < 0.90	No change. 0.90 ≤ RCI <1.10	Increase. RCI >=1.10	Number of sites
All years	All	n/a	n/a	n/a	6
Above average	All	n/a	n/a	n/a	1
Average	All	n/a	n/a	n/a	4
Below average	All	n/a	n/a	n/a	1

Proportional landscape function - stability, infiltration and nutrient cycling indices

Table 1:66. Proportional landscape function indices – Northern Kimberley1 sub-IBRA, cycle 3.

	Stability index	Infiltration index	Nutrient cycling index
Number of sites assessed in c3a1 and c3a2	6	6	6
c3a1 average +/- standard error of the mean	n/a	n/a	n/a
c3a2 average +/- standard error of the mean	n/a	n/a	n/a
Ratio of index: average +/- standard error of the mean	n/a	n/a	n/a
Ratio of index: c3a2 to c3a1 percentage of sites at least 1.0	n/a	n/a	n/a
Ratio of index: c3a2 to c3a1 percentage of sites <0.90	n/a	n/a	n/a
Ratio of index: c3a2 to c3a1 percentage of sites <0.50	n/a	n/a	n/a
Average of index ratio: c3a2 to c3a1 for above average seasonal quality	n/a	n/a	n/a
Average of index ratio: c3a2 to c3a1 for average seasonal quality	n/a	n/a	n/a
Average of index ratio: c3a2 to c3a1 for below average seasonal quality	n/a	n/a	n/a

Figure 1:22. Proportional landscape function - stability, infiltration and nutrient cycling indices, cycle3 – Northern Kimberley1 sub-IBRA. The top panes show all data, the lower panes show expanded views over limited ranges.

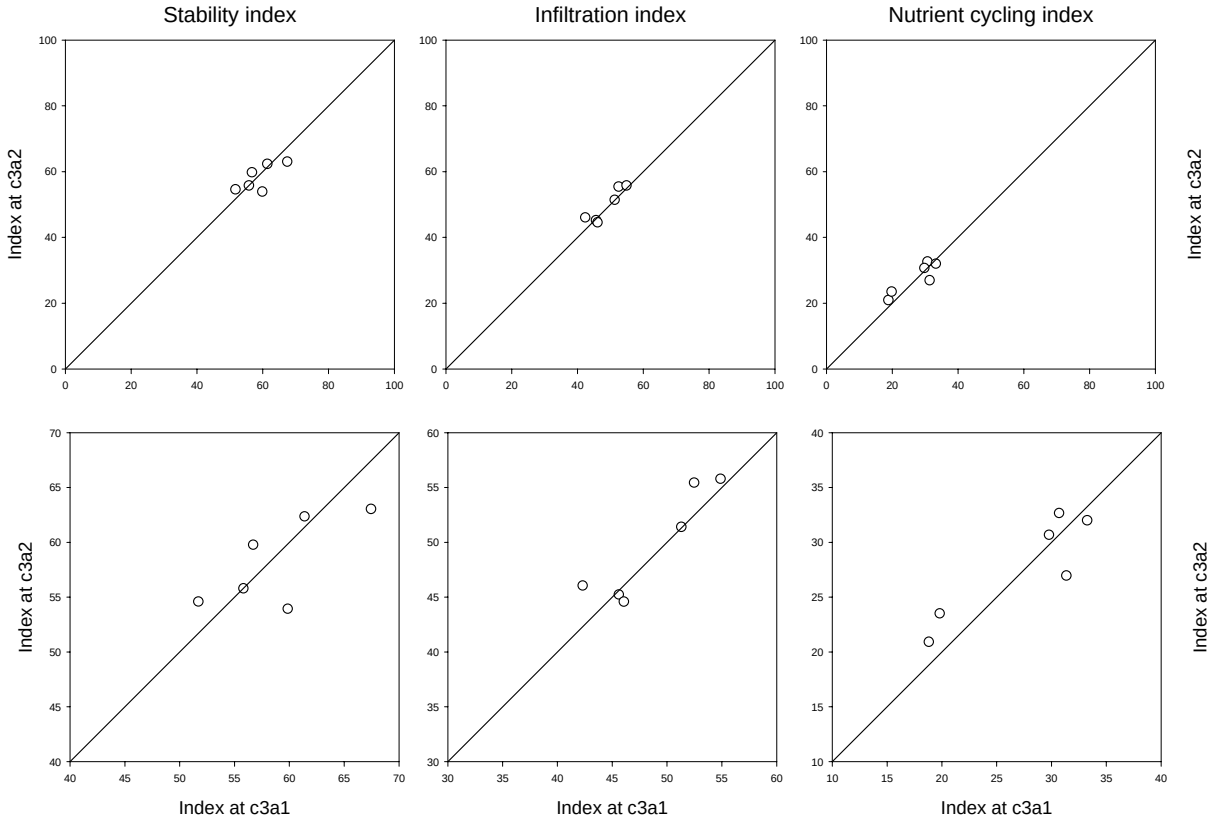


Table 1:67. Proportional landscape function - stability index – Northern Kimberley1 sub-IBRA. Ratio of stability index (RSI) at cycle 3, assessment 2 (c3a2) to index at cycle 3, assessment 1 (c3a1).

Seasonal Quality	Species group	Decline. RSI < 0.90	No change. 0.90>= RSI <1.10	Increase. RSI >=1.10	Number of sites
All years	All	n/a	n/a	n/a	6
Above average	All	n/a	n/a	n/a	1
Average	All	n/a	n/a	n/a	4
Below average	All	n/a	n/a	n/a	1

Table 1:68. Proportional landscape function - infiltration index – Northern Kimberley1 sub-IBRA. Ratio of infiltration index (RII) at cycle 3, assessment 2 (c3a2) to index at cycle 3, assessment 1 (c3a1).

Seasonal Quality	Species group	Decline. RII < 0.90	No change. 0.90>= RII <1.10	Increase. RII >=1.10	Number of sites
All years	All	n/a	n/a	n/a	6
Above average	All	n/a	n/a	n/a	1
Average	All	n/a	n/a	n/a	4
Below average	All	n/a	n/a	n/a	1

Table 1:69. Proportional landscape function – nutrient cycling index – Northern Kimberley1 sub-IBRA. Ratio of nutrient cycling index (RNCI) at cycle 3, assessment 2 (c3a2) to index at cycle 3, assessment 1 (c3a1).

Seasonal Quality	Species group	Decline. RNCI < 0.90	No change. 0.90>= RNCI <1.10	Increase. RNCI >=1.10	Number of sites
All years	All	n/a	n/a	n/a	6
Above average	All	n/a	n/a	n/a	1
Average	All	n/a	n/a	n/a	4
Below average	All	n/a	n/a	n/a	1

Change in sustainable management of the pastoral estate – grassland sites

Frequency of Decreaser, Intermediate and Increaser perennial grass species

Table 1:70. Summary of frequency of decreaser, intermediate and increaser perennial grass species, Northern Kimberley1 sub-IBRA, cycle 3.

Average change in frequency +/- standard error of the mean	n/a		
Frequency: ratio c3a2 to c3a1, percentage of sites ≥ 1.0	n/a	n/a	n/a
Frequency: ratio c3a2 to c3a1, percentage of sites <0.90	n/a	n/a	n/a
Frequency: ratio c3a2 to c3a1, percentage of sites <0.50	n/a	n/a	n/a
Average change in frequency: c3a2 to c3a1, above average seasonal quality	n/a	n/a	n/a
Average change in frequency: c3a2 to c3a1, average seasonal quality	n/a	n/a	n/a
Average change in frequency: c3a2 to c3a1, below average seasonal quality	n/a	n/a	n/a

Figure 1:23. Change in perennial grass frequency, cycle 3 – decreaser, intermediate and increaser species

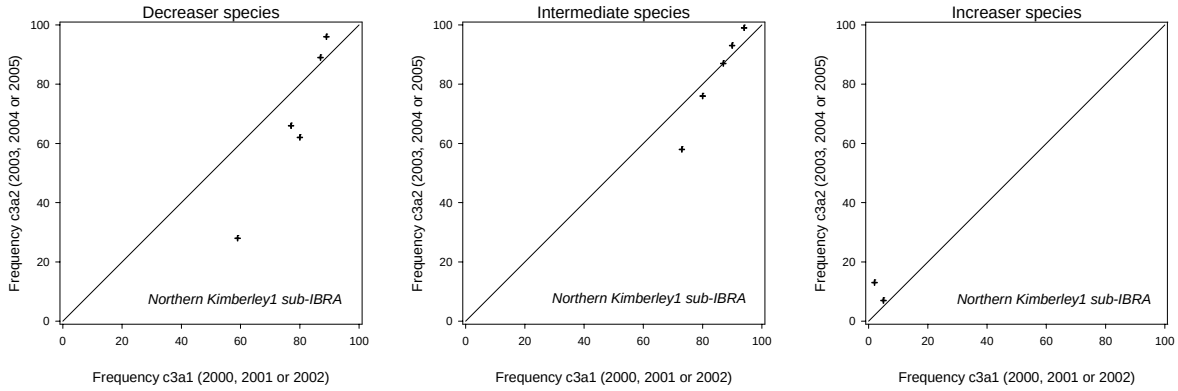


Table 1:71. Change in frequency of decreaser, intermediate and increaser perennial grass species – percentage of sites in each seasonal category – Northern Kimberley1 sub-IBRA, cycle 1

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency <1.10	Increase. frequency ≥1.10	Number of sites
All years	Decreaser	47%	41%	12%	17
	Intermediate	42%	25%	33%	12
	Increaser	n/a	n/a	n/a	2
Above average	Decreaser	47%	41%	12%	17
	Intermediate	42%	25%	33%	12
	Increaser	n/a	n/a	n/a	2
Average	Decreaser	n/a	n/a	n/a	0
	Intermediate	n/a	n/a	n/a	0
	Increaser	n/a	n/a	n/a	0
Below average	Decreaser	n/a	n/a	n/a	0
	Intermediate	n/a	n/a	n/a	0
	Increaser	n/a	n/a	n/a	0

Table 1:72. Change in frequency of decreaser, intermediate and increaser perennial grass species – percentage of sites in each seasonal category - Northern Kimberley1 sub-IBRA, cycle 2

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency <1.10	Increase. frequency ≥1.10	Number of sites
All years	Decreaser	n/a	n/a	n/a	6
	Intermediate	n/a	n/a	n/a	5
	Increaser	n/a	n/a	n/a	2
Above average	Decreaser	n/a	n/a	n/a	6
	Intermediate	n/a	n/a	n/a	5
	Increaser	n/a	n/a	n/a	2
Average	Decreaser	n/a	n/a	n/a	0
	Intermediate	n/a	n/a	n/a	0
	Increaser	n/a	n/a	n/a	0
Below average	Decreaser	n/a	n/a	n/a	0
	Intermediate	n/a	n/a	n/a	0
	Increaser	n/a	n/a	n/a	0

Table 1:73. Change in frequency of decreaser, intermediate and increaser perennial grass species – percentage of sites in each seaconal category - Northern Kimberley1 sub-IBRA, cycle 3

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency <1.10	Increase. frequency ≥1.10	Number of sites
All years	Decreaser	n/a	n/a	n/a	5
	Intermediate	n/a	n/a	n/a	5
	Increaser	n/a	n/a	n/a	2
Above average	Decreaser	n/a	n/a	n/a	1
	Intermediate	n/a	n/a	n/a	1
	Increaser	n/a	n/a	n/a	0
Average	Decreaser	n/a	n/a	n/a	3
	Intermediate	n/a	n/a	n/a	3
	Increaser	n/a	n/a	n/a	2
Below average	Decreaser	n/a	n/a	n/a	1
	Intermediate	n/a	n/a	n/a	1
	Increaser	n/a	n/a	n/a	0

Table 1:74. Weighted average across all three cycles - change in frequency of decreaser, intermediate and increaser perennial grass species – percentage of sites in each seasonal category - Northern Kimberley1 sub-IBRA.

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency <1.10	Increase. frequency ≥1.10	Number of sites	Cycles used
All years	Decreaser	47%	41%	12%	17	1
	Intermediate	42%	25%	33%	12	1
	Increaser	n/a	n/a	n/a	n/a	n/a
Above average	Decreaser	47%	41%	12%	17	1
	Intermediate	42%	25%	33%	12	1
	Increaser	n/a	n/a	n/a	n/a	n/a
Average	Decreaser	n/a	n/a	n/a	n/a	n/a

	Intermediate	n/a	n/a	n/a	n/a	n/a
	Increaser	n/a	n/a	n/a	n/a	n/a
Below average	Decreaser	n/a	n/a	n/a	n/a	n/a
	Intermediate	n/a	n/a	n/a	n/a	n/a
	Increaser	n/a	n/a	n/a	n/a	n/a

Change in vegetation richness and occurrence

Native perennial species richness

Table 1:75. Northern Kimberley1 sub-IBRA – summary of native perennial species richness, cycle 3

Number of sites assessed in cycle 3, assessment 1 and cycle3 assessment 2 (c3a1 & c3a2)	5
Average number of native perennial species per site at c3a1 – for sites assessed in both c3a1 and c3a2: +/- standard error of the mean	n/a
Average number of native perennial species per site in c3a2 – for sites assessed in both c3a1 and c3a2: +/- standard error of the mean	n/a
Average ratio of species richness: c3a2 to c3a1: +/- standard error of the mean	n/a
Species richness: ratio c3a2 to c3a1, percentage of sites at least 1.0	n/a
Species richness: ratio c3a2 to c3a1, percentage of sites <0.90	n/a
Species richness: ratio c3a2 to c3a1, percentage of sites <0.50	n/a

Figure 1:24. Change in species richness on each site between each sampling cycle – Northern Kimberley1 sub-IBRA. Bubble size represents number of sites at each x,y point.

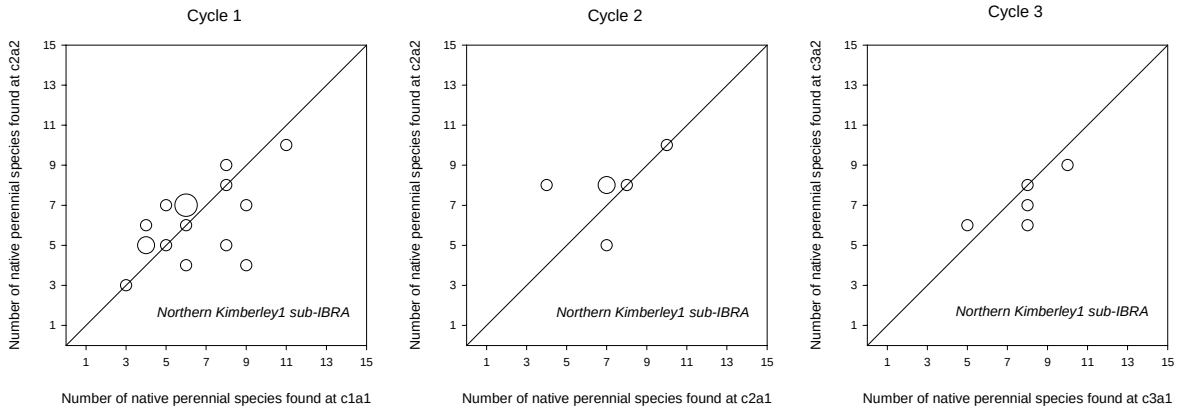


Table 1:76. Cycle 1 - native perennial species richness Northern Kimberley1 sub-IBRA- c1a2 divided by c1a1.

Seasonal	Species group	Decline.	No change.	Increase.	Number of sites

Quality		Richness index < 0.80	0.80 ≤ Richness index <1.20	Richness index ≥1.20	
All years	All	24%	53%	24%	17
Above average	All	24%	53%	24%	17
Average	All	n/a	n/a	n/a	0
Below average	All	n/a	n/a	n/a	0

Table 1:77. Cycle 2 - native perennial species richness Northern Kimberley1 sub-IBRA- c2a2 divided by c2a1.

Seasonal Quality	Species group	Decline. Richness index < 0.80	No change. 0.80 ≤ Richness index <1.20	Increase. Richness index ≥1.20	Number of sites
All years	All	n/a	n/a	n/a	6
Above average	All	n/a	n/a	n/a	6
Average	All	n/a	n/a	n/a	0
Below average	All	n/a	n/a	n/a	0

Table 1:78. Cycle 3 - native perennial species richness Northern Kimberley1 sub-IBRA- c3a2 divided by c3a1.

Seasonal Quality	Species group	Decline. Richness index < 0.80	No change. 0.80 ≤ Richness index <1.20	Increase. Richness index ≥1.20	Number of sites
All years	All	n/a	n/a	n/a	5
Above average	All	n/a	n/a	n/a	1
Average	All	n/a	n/a	n/a	3
Below average	All	n/a	n/a	n/a	1

Table 1:79. Weighted average across all three cycles - native perennial species richness Northern Kimberley1 sub-IBRA.

Seasonal Quality	Species group	Decline. Richness index < 0.80	No change. 0.80 ≤ Richness index <1.20	Increase. Richness index ≥1.20	Number of sites	Cycles used
All years	All	24%	53%	24%	17	1
Above average	All	24%	53%	24%	17	1
Average	All	n/a	n/a	n/a	n/a	n/a
Below average	All	n/a	n/a	n/a	n/a	n/a

Frequency of occurrence – native species

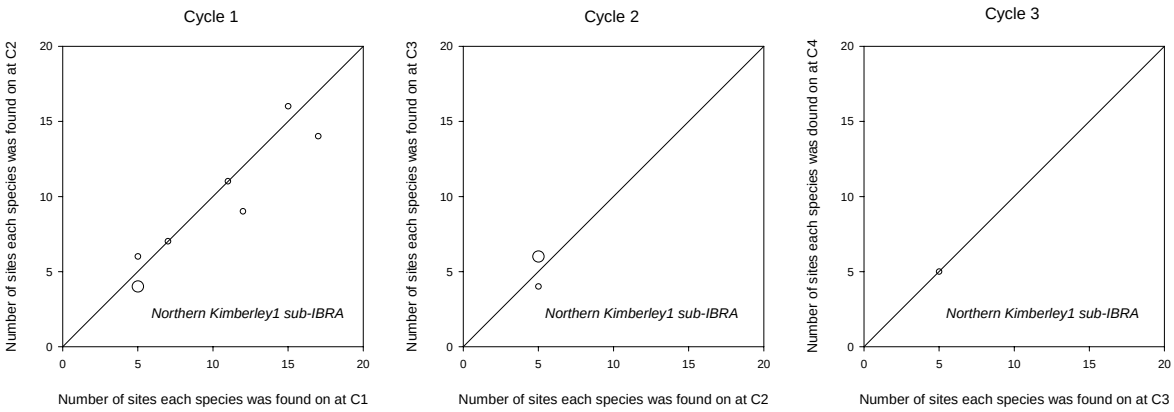
Table 1:80. Northern Kimberley1 sub-IBRA – species found on at least five sites at either the first or second assessment of each cycle and on at least one site at the first assessment date of each cycle.

	c1a1 & c1a2	c2a1 & c2a2	c3a1 & c3a2
Number of species	8	3	1
Average number of sites each species was found on	n/a	n/a	n/a
Average number of sites each species was found on	n/a	n/a	n/a
Occurrence ratio at least 1.0 – percentage of species	n/a	n/a	n/a
Occurrence ratio >1.10 – percentage of species	n/a	n/a	n/a
Occurrence ratio < 0.90 – percentage of species	n/a	n/a	n/a
Occurrence ratio < 0.50 – percentage of species	n/a	n/a	n/a
Average occurrence ratio +/- standard error of the mean	n/a	n/a	n/a

Table 1:81. Native species found on WARMS sites within the Northern Kimberley1 sub-IBRA. Data were filtered to include only those species found on at least five sites at any of the assessments, and on at least one site at the first assessment of each of the three sampling cycles. The table shows the number of sites each species was found on and the number of sites assessed at the first and second assessment of each cycle.

SPECIES_NAME	c1a1 & c1a2	c2a1 & c2a2	c3a1 & c3a2	ratio c1a2/ c1a1	ratio c2a2/ c2a1	ratio c3a1/ c3a2
Chrysopogon fallax	15 then 16 of 17	5 then 6 of 6	4 then 4 of 5	1.07	1.20	1.00
Dichanthium fecundum	5 then 6 of 17	1 then 2 of 6	1 then 0 of 5	1.20	2.00	0.00
Eucalyptus tectifica	5 then 4 of 17	3 then 3 of 6	3 then 3 of 5	0.80	1.00	1.00
Heteropogon contortus	12 then 9 of 17	3 then 4 of 6	4 then 4 of 5	0.75	1.33	1.00
Panicum decompositum	5 then 4 of 17			0.80		
Sehima nervosum	11 then 11 of 17	5 then 4 of 6	4 then 4 of 5	1.00	0.80	1.00
Sorghum plumosum	17 then 14 of 17	5 then 6 of 6	5 then 5 of 5	0.82	1.20	1.00
Themeda triandra	7 then 7 of 17	3 then 3 of 6	2 then 3 of 5	1.00	1.00	1.50

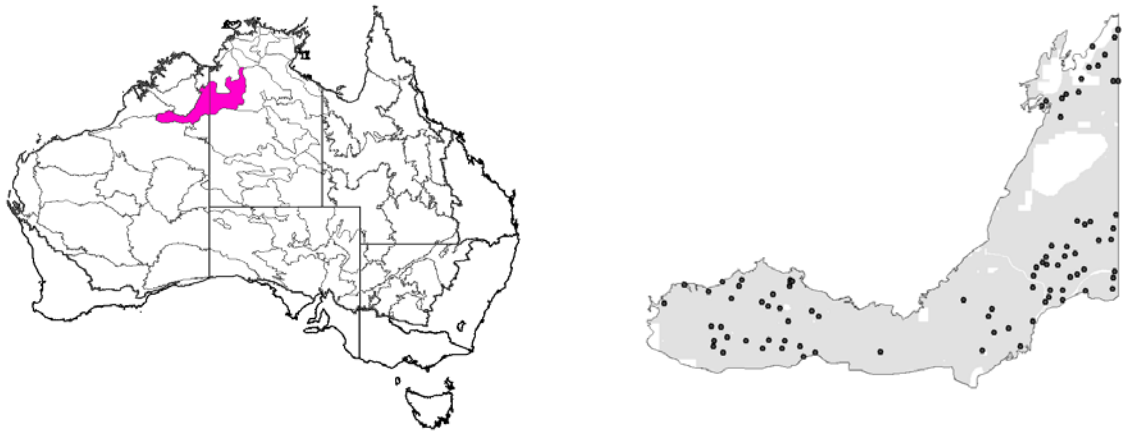
Figure 1:25. Frequency of occurrence for all native species found on at least five sites at either the first or second sampling, for each cycle – Northern Kimberley1 sub-IBRA. Bubble size represents number of sites at each x,y point.



Ord Victoria Plain IBRA

For grassland sites, data from both Ord Victoria Plain sub-IBRAs were pooled and the complete Ord Victoria Plain IBRA is reported.

Figure 1:26. Location of Ord Victoria Plain IBRA (left) and WARMS sites in the IBRA (right). Greyed areas are pastoral tenure.



Site and seasonal summary

Table 1:82. Ord Victoria Plain IBRA – grassland sites – total number of sites and dates assessed.

Number of grassland sites assessed	86
Number of grassland sites assessed in OVP1 (Ord Victoria Plain P1)	16
Number of grassland sites assessed in OVP2 (South Kimberley Interzone)	70
First assessment (installation)	11/07/94 to 23/09/96
Second assessment	11/07/97 to 15/06/99
Third assessment	20/06/00 to 22/08/02
Fourth assessment	26/05/03 to 23/08/05

Table 1:83. Ord Victoria Plain IBRA – grassland sites – seasonal category and number of sites assessed in each cycle.

	Cycle1	Cycle 2	Cycle 3
Number of grassland sites assessed	77	78	76
Above average seasonal quality - – percentage of sites	100%	86%	55%
Average seasonal quality - – percentage of sites	0%	14%	24%
Below average seasonal quality – percentage of sites	0%	0%	21%

Change in landscape function

Perennial grass frequency

Table 1:84. Ord Victoria Plain IBRA – summary of perennial grass frequency.

	Cycle 1	Cycle 2	Cycle 3
Average frequency: first assessment of cycle +/- standard error of the mean	72.9 +/- 2.87	78.1 +/- 2.71	86.2 +/- 2.34
Average frequency: second assessment of cycle +/- standard error of the mean	78.9 +/- 2.54	86.0 +/- 2.29	86.5 +/- 2.29
Average frequency ratio between the two assessments +/- standard error of the mean	1.17 +/- 0.05	1.16 +/- 0.04	1.02 +/- 0.02
Frequency ratio at least 1.0 – percentage of sites	70%	83%	66%
Frequency ratio <0.90 – percentage of sites	10%	4%	13%
Frequency ratio <0.50 – percentage of sites	1%	1%	1%

Figure 1:27. Change in perennial grass frequency between each sampling cycle (C) – Ord Victoria Plain IBRA.

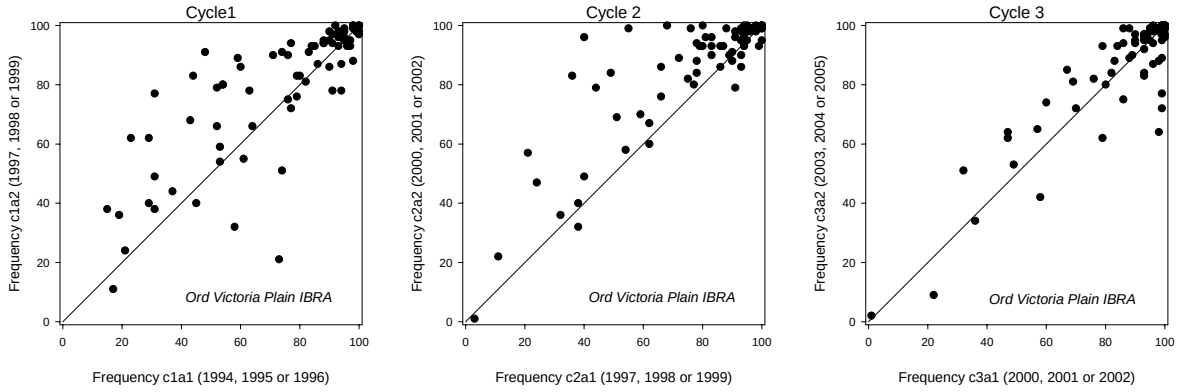


Table 1:85. Cycle 1 - percentage of sites in each seasonal category showing change in perennial grass frequency – Ord Victoria Plain IBRA.

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency < 1.10	Increase. frequency ≥ 1.10	Number of sites
All years	All	10%	56%	34%	77
Above average	All	10%	56%	34%	77
Average	All	n/a	n/a	n/a	0

Below average	All	n/a	n/a	n/a	0

Table 1:86. Cycle 2 - percentage of sites in each seasonal category showing change in perennial grass frequency – Ord Victoria Plain IBRA.

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency < 1.10	Increase. frequency ≥ 1.10	Number of sites
All years	All	4%	63%	33%	78
Above average	All	3%	69%	28%	67
Average	All	10%	27%	64%	11
Below average	All	n/a	n/a	n/a	0

Table 1:87. Cycle 3 - percentage of sites in each seasonal category showing change in perennial grass frequency – Ord Victoria Plain IBRA.

Seasonal Quality	Species group	Decline. frequency <0.90	No change. ≤0.90 frequency <1.10	Increase. frequency ≥1.10	Number of sites
All years	All	13%	71%	16%	76
Above average	All	7%	79%	14%	42
Average	All	22%	67%	11%	18
Below average	All	19%	56%	25%	16

Table 1:88. Weighted average across all three cycles - percentage of sites in each seasonal category showing change in perennial grass frequency. Only cycles containing at least 10 sites in each seasonal quality category were used. Ord Victoria Plain IBRA.

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency < 1.10	Increase. frequency ≥ 1.10	Number of site by year combinations	Cycles used
All years	All	9%	63%	28%	231	1,2,3
Above average	All	7%	66%	27%	186	1,2,3
Average	All	17%	52%	31%	29	2,3
Below average	All	19%	56%	25%	16	3

Crown cover, woody species taller than 1m

Averages of frequency ratios can not be calculated because of the large number of crown cover estimates of zero (i.e. denominator = zero).

Table 1:89. Ord Victoria Plain IBRA – summary of crown cover

Average crown cover cycle 3, assessment1 (c3a1)	1.90
Average crown cover cycle 3, assessment2 (c3a2)	2.25
* Crown cover: ratio c3a2 to c3a1, percentage of sites at least 1.0	62%
* Crown cover: ratio c3a2 to c3a1, percentage of sites <0.90	28%
* Crown cover: ratio c3a2 to c3a1, percentage of sites <0.50	10%

* Sites with zero crown cover at both c3a1 and c3a2 have not been included

Figure 1:28. Change in crown cover between each sampling cycle (C) – Ord Victoria Plain IBRA.

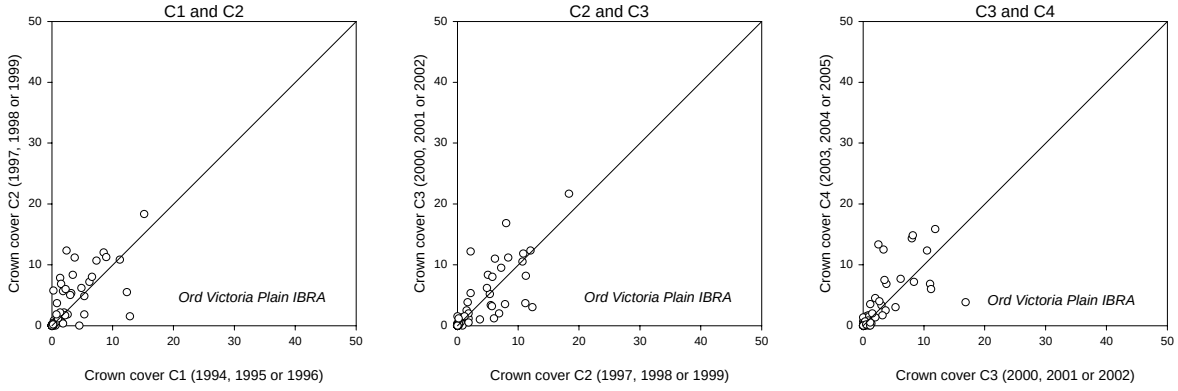


Table 1:90. Cycle 3 – percentage of sites in each seasonal quality category showing change in crown cover – Ord Victoria Plain IBRA. Sites with zero crown cover have not been included.

Seasonal Quality	Species group	Crown cover <0.90	No change. ≤0.90 crown cover <1.10	Crown cover ≥1.10	Number of sites
All years	All	28%	10%	62%	39
Above average	All	50%	0%	50%	12
Average	All	29%	14%	57%	14
Below average	All	8%	15%	77%	13

Resource Capture Index

Table 1:91. Ord Victoria Plain IBRA – summary of resource capture index.

Number of sites assessed in cycle 3, assessment 1 (c3a1) and cycle 3, assessment 2 (c3a2)	68
Average Resource Capture Index - c3a1	0.08
Average Resource Capture Index – c3a2	0.07
Average ratio of Resource Capture Index – c3a2 to c3a1 +/- standard error of the mean	1.25 +/- 0.11
Resource Capture Index: ratio c3a2 to c3a1, percentage of sites at least 1.0	57%
Resource Capture Index: ratio c3a2 to c3a1, percentage of sites <0.90	43%
Resource Capture Index: ratio c3a2 to c3a1, percentage of sites <0.50	18%
Average Resource Capture Index: ratio c3a2 to c3a1 for above average seasonal quality	1.12
Average Resource Capture Index: ratio c3a2 to c3a1 for average seasonal quality	1.36
Average Resource Capture Index: ratio c3a2 to c3a1 for below average seasonal quality	1.49

Figure 1:29. Change in Resource Capture Index, cycle 3 – Ord Victoria Plain IBRA.

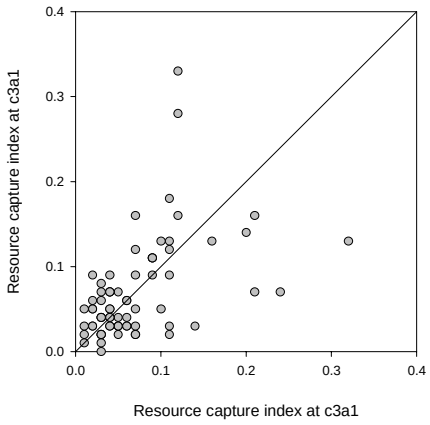


Table 1:92. Resource capture index – percentage of sites in each seasonal category showing change in the index – Ord Victoria Plain IBRA, cycle 3.

Seasonal Quality	Species group	Decline. RCI < 0.90	No change. 0.90 ≤ RCI <1.10	Increase. RCI >=1.10	Number of sites
All years	All	43%	10%	47%	72
Above average	All	51%	10%	39%	41
Average	All	35%	6%	59%	17
Below average	All	29%	14%	57%	14

Proportional landscape function - stability, infiltration and nutrient cycling indices

Table 1:93. Proportional landscape function indices – Ord Victoria Plain IBRA, cycle 3.

	Stability index	Infiltration index	Nutrient cycling index
Number of sites assessed in c3a1 and c3a2	71	71	71
c3a1 average +/- standard error of the mean	54.9 +/- 1.01	46.3 +/- 0.65	26.6 +/- 0.90
c3a2 average +/- standard error of the mean	51.1 +/- 0.91	40.0 +/- 0.64	20.5 +/- 0.66
Ratio of index: average +/- standard error of the mean	0.95 +/- 0.02	0.88 +/- 0.02	0.80 +/- 0.03
Ratio of index: c3a2 to c3a1 percentage of sites at least 1.0	34%	18%	21%
Ratio of index: c3a2 to c3a1 percentage of sites <0.90	41%	52%	67%
Ratio of index: c3a2 to c3a1 percentage of sites <0.50	1%	3%	6%
Average of index ratio: c3a2 to c3a1 for above average seasonal quality	0.94 +/- 0.03	0.86 +/- 0.03	0.77 +/- 0.03
Average of index ratio: c3a2 to c3a1 for average seasonal quality	0.98 +/- 0.04	0.93 +/- 0.03	0.91 +/- 0.05
Average of index ratio: c3a2 to c3a1 for below average seasonal quality	0.92 +/- 0.05	0.86 +/- 0.05	0.77 +/- 0.07

Figure 1:30. Proportional landscape function - stability, infiltration and nutrient cycling indices, cycle3 – Ord Victoria Plain IBRA. The top panes show all data, the lower panes show expanded views over limited ranges.

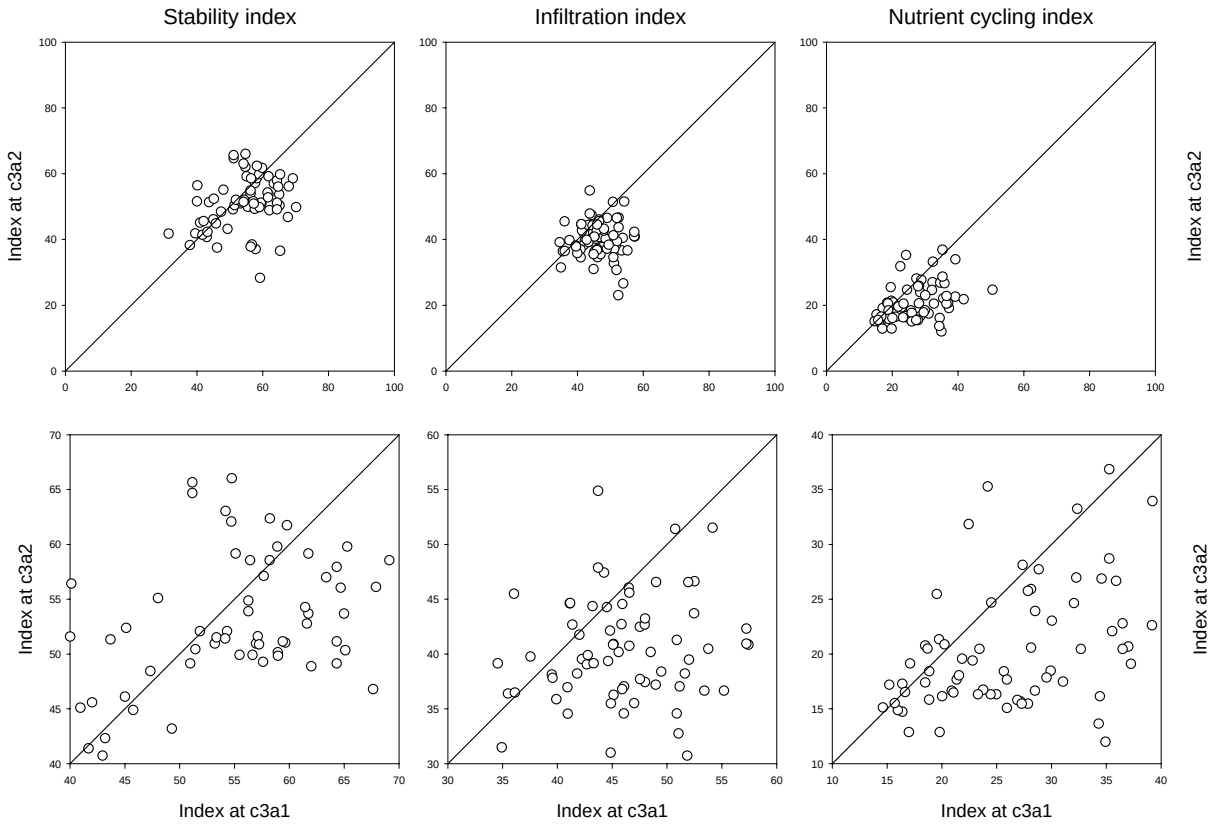


Table 1:94. Proportional landscape function - stability index – Ord Victoria Plain IBRA. Ratio of stability index (RSI) at cycle 3, assessment 2 (c3a2) to index at cycle 3, assessment 1 (c3a1).

Seasonal Quality	Species group	Decline. RSI < 0.90	No change. 0.90>= RSI <1.10	Increase. RSI >=1.10	Number of sites
All years	All	41%	42%	17%	71
Above average	All	41%	44%	15%	41
Average	All	31%	44%	25%	16
Below average	All	50%	36%	14%	14

Table 1:95. Proportional landscape function - infiltration index – Ord Victoria Plain IBRA. Ratio of infiltration index (RII) at cycle 3, assessment 2 (c3a2) to index at cycle 3, assessment 1 (c3a1).

Seasonal Quality	Species group	Decline. RII < 0.90	No change. 0.90>= RII <1.10	Increase. RII >=1.10	Number of sites
All years	All	52%	44%	4%	71
Above average	All	54%	41%	5%	41
Average	All	38%	63%	0%	16
Below average	All	64%	29%	7%	14

Table 1:96. Proportional landscape function – nutrient cycling index – Ord Victoria Plain IBRA. Ratio of nutrient cycling index (RNCI) at cycle 3, assessment 2 (c3a2) to index at cycle 3, assessment 1 (c3a1).

Seasonal Quality	Species group	Decline. RNCI < 0.90	No change. 0.90>= RNCI <1.10	Increase. RNCI >=1.10	Number of sites
All years	All	68%	24%	8%	71
Above average	All	76%	20%	5%	41
Average	All	38%	44%	19%	16
Below average	All	79%	14%	7%	14

Change in sustainable management of the pastoral estate – grassland sites

Frequency of Decreaser, Intermediate and Increaser perennial grass species

Table 1:97. Summary of frequency of decreaser, intermediate and increaser perennial grass species, Ord Victoria Plain IBRA, cycle 3.

Average change in frequency +/- standard error of the mean	2.33 +/- 1.26	0.99 +/- 0.08	0.95 +/- 0.07
Frequency: ratio c3a2 to c3a1, percentage of sites ≥ 1.0	68%	60%	46%
Frequency: ratio c3a2 to c3a1, percentage of sites <0.90	18%	37%	48%
Frequency: ratio c3a2 to c3a1, percentage of sites <0.50	3%	14%	20%
Average change in frequency: c3a2 to c3a1, above average seasonal quality	3.32	1.07	1.02
Average change in frequency: c3a2 to c3a1, average seasonal quality	1.08	0.74	n/a
Average change in frequency: c3a2 to c3a1, below average seasonal quality	1.19	n/a	0.97

Figure 1:31. Change in perennial grass frequency between, cycle 3 – decreaser, intermediate and increaser species

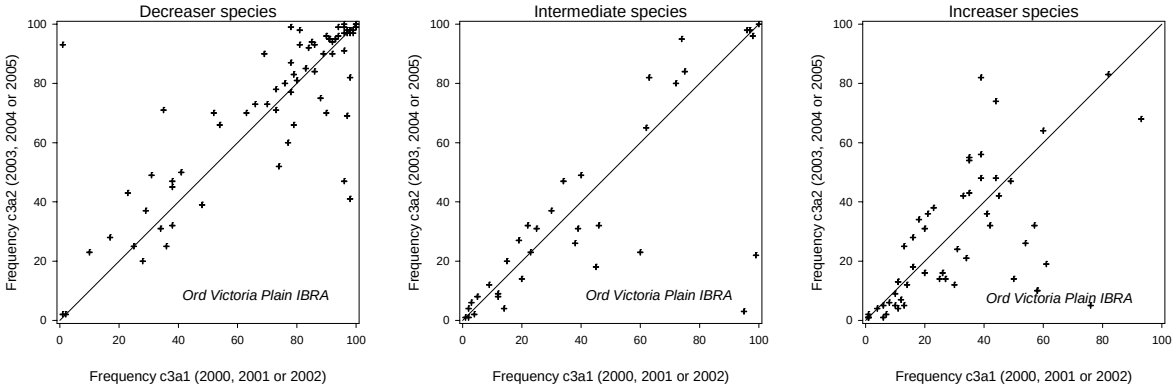


Table 1:98. Change in frequency of decreaser, intermediate and increaser perennial grass species – percentage of sites in each seasonal category - Ord Victoria Plain IBRA, cycle 1

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency <1.10	Increase. frequency ≥1.10	Number of sites
All years	Decreaser	46%	30%	24%	74
	Intermediate	32%	17%	51%	41
	Increaser	64%	7%	29%	45
Above average	Decreaser	46%	30%	24%	74
	Intermediate	32%	17%	51%	41
	Increaser	64%	7%	29%	45
Average	Decreaser	n/a	n/a	n/a	0
	Intermediate	n/a	n/a	n/a	0
	Increaser	n/a	n/a	n/a	0
Below average	Decreaser	n/a	n/a	n/a	0
	Intermediate	n/a	n/a	n/a	0
	Increaser	n/a	n/a	n/a	0

Table 1:99. Change in frequency of decreaser, intermediate and increaser perennial grass species – percentage of sites in each seasonal category - Ord Victoria Plain IBRA, cycle 2

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency <1.10	Increase. frequency ≥1.10	Number of sites
All years	Decreaser	11%	45%	44%	75
	Intermediate	26%	10%	64%	42
	Increaser	30%	21%	49%	47
Above average	Decreaser	9%	48%	42%	64
	Intermediate	26%	10%	64%	39
	Increaser	33%	25%	43%	40
Average	Decreaser	18%	36%	45%	11
	Intermediate	n/a	n/a	n/a	3
	Increaser	n/a	n/a	n/a	7
Below average	Decreaser	n/a	n/a	n/a	0
	Intermediate	n/a	n/a	n/a	0

	Increaser	n/a	n/a	n/a	0

Table 1:100. Change in frequency of decreaser, intermediate and increaser perennial grass species – percentage of sites in each seaconal category – Ord Victoria Plain IBRA, cycle 3

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency <1.10	Increase. frequency ≥1.10	Number of sites
All years	Decreaser	18%	53%	29%	73
	Intermediate	37%	20%	43%	35
	Increaser	48%	19%	33%	54
Above average	Decreaser	15%	63%	23%	40
	Intermediate	19%	25%	56%	16
	Increaser	45%	13%	42%	31
Average	Decreaser	18%	47%	35%	17
	Intermediate	75%	8%	17%	12
	Increaser	n/a	n/a	n/a	9
Below average	Decreaser	25%	38%	38%	16
	Intermediate	n/a	n/a	n/a	7
	Increaser	36%	36%	29%	14

Table 1:101. Weighted average across all three cycles - change in frequency of decreaser, intermediate and increaser perennial grass species – percentage of sites in each seasonal category - Ord Victoria Plain IBRA.

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency <1.10	Increase. frequency ≥1.10	Number of sites	Cycles used
All years	Decreaser	25%	43%	33%	225	1,2,3
	Intermediate	31%	15%	53%	118	1,2,3
	Increaser	44%	17%	39%	174	1,2,3
Above average	Decreaser	26%	44%	30%	178	1,2,3
	Intermediate	27%	15%	57%	96	1,2,3
	Increaser	48%	15%	37%	116	1,2,3
Average	Decreaser	18%	43%	39%	28	2,3
	Intermediate	75%	8%	17%	12	3
	Increaser	n/a	n/a	n/a	n/a	n/a
Below average	Decreaser	25%	38%	38%	16	3
	Intermediate	n/a	n/a	n/a	n/a	n/a
	Increaser	36%	36%	29%	14	3

Change in vegetation richness and occurrence

Native perennial species richness

Table 1:102. Ord Victoria Plain IBRA – summary of native perennial species richness, cycle 3

Number of sites assessed in cycle 3, assessment 1 and cycle3 assessment 2 (c3a1 & c3a2)	76
Average number of native perennial species per site at c3a1 – for sites assessed in both c3a1 and c3a2: +/- standard error of the mean	7.2 +/- 0.28
Average number of native perennial species per site in c3a2 – for sites assessed in both c3a1 and c3a2: +/- standard error of the mean	7.0 +/- 0.24
Average ratio of species richness: c3a2 to c3a1: +/- standard error of the mean	1.03 +/- 0.03
Species richness: ratio c3a2 to c3a1, percentage of sites at least 1.0	58%
Species richness: ratio c3a2 to c3a1, percentage of sites <0.90	37%
Species richness: ratio c3a2 to c3a1, percentage of sites <0.50	0%

Figure 1:32. Change in species richness on each site between each sampling cycle – Ord Victoria Plain IBRA. Bubble size represents number of sites at each x,y point.

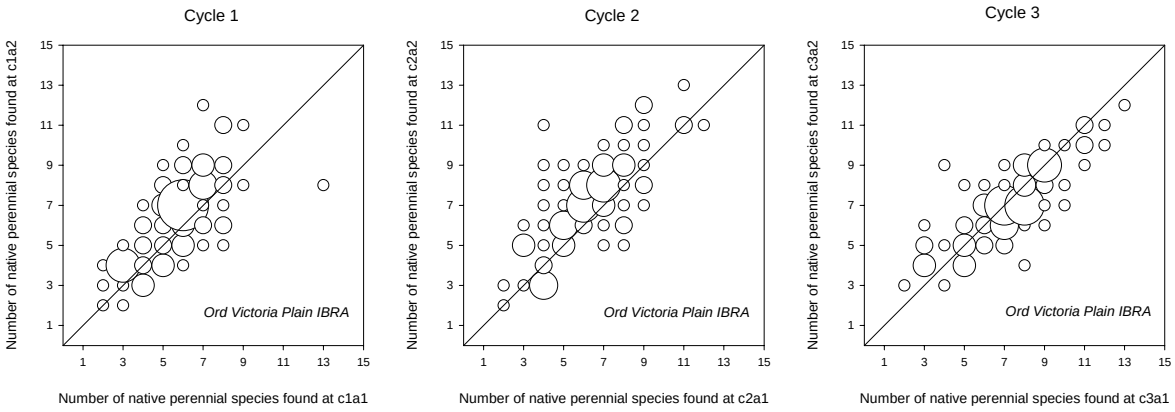


Table 1:103. Cycle 1 - native perennial species richness Ord Victoria Plain IBRA - c1a2 divided by c1a1.

Seasonal Quality	Species group	Decline. Richness index < 0.80	No change. 0.80 ≤ Richness index <1.20	Increase. Richness index ≥1.20	Number of sites
All years	All	13%	46%	41%	78
Above average	All	13%	46%	41%	78
Average	All	n/a	n/a	n/a	0
Below average	All	n/a	n/a	n/a	0

Table 1:104. Cycle 2 - native perennial species richness Ord Victoria Plain IBRA - c2a2 divided by c2a1.

Seasonal Quality	Species group	Decline. Richness index <	No change. 0.80 ≤ Richness	Increase. Richness index	Number of sites

		0.80	index <1.20	≥1.20	
All years	All	12%	46%	42%	78
Above average	All	12%	51%	37%	67
Average	All	9%	18%	73%	11
Below average	All	n/a	n/a	n/a	0

Table 1:105. Cycle 3 - native perennial species richness Ord Victoria Plain IBRA - c3a2 divided by c3a1.

Seasonal Quality	Species group	Decline. Richness index < 0.80	No change. 0.80 ≤ Richness index <1.20	Increase. Richness index ≥1.20	Number of sites
All years	All	16%	66%	18%	76
Above average	All	10%	79%	12%	42
Average	All	17%	67%	17%	18
Below average	All	13%	50%	38%	16

Table 1:106. Weighted average across all three cycles - native perennial species richness Ord Victoria Plain IBRA.

Seasonal Quality	Species group	Decline. Richness index < 0.80	No change. 0.80 ≤ Richness index <1.20	Increase. Richness index ≥1.20	Number of sites	Cycles used
All years	All	14%	53%	34%	232	1,2,3
Above average	All	12%	55%	33%	187	1,2,3
Average	All	14%	48%	38%	29	2,3
Below average	All	13%	50%	38%	16	3

Frequency of occurrence – native species

Table 1:107. Ord Victoria Plain IBRA – species found on at least five sites at either the first or second assessment of each cycle and on at least one site at the first assessment date of each cycle.

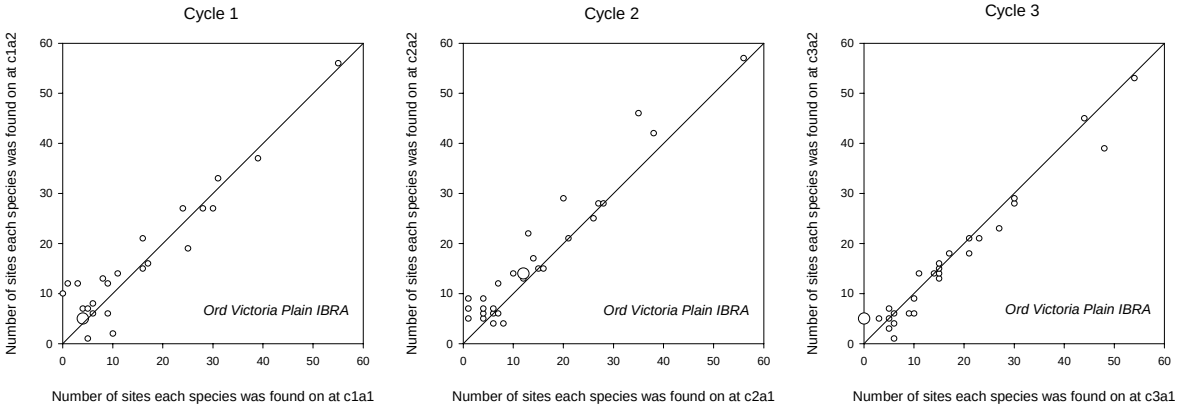
	c1a1 & c1a2	c2a1 & c2a2	c3a1 & c3a2
Number of species	24	29	26
Average number of sites each species was found on	15.3 +/- 2.77	14.3 +/- 2.39	17.9 +/- 2.71
Average number of sites each species was found on	16.2 +/- 2.65	16.8 +/- 2.49	16.7 +/- 2.59
Occurrence ratio at least 1.0 – percentage of species	63%	83%	42%
Occurrence ratio > 1.10 – percentage of species	50%	55%	12%
Occurrence ratio < 0.90 – percentage of species	17%	10%	35%

Occurrence ratio < 0.50 – percentage of species	8%	0%	4%
Average occurrence ratio +/- standard error of the mean	1.64 +/- 0.47	1.80 +/- 0.35	0.93 +/- 0.05

Table 1:108. Native species found on WARMS sites within the Ord Victoria Plain IBRA. Data were filtered to include only those species found on at least five sites at any of the assessments, and on at least one site at the first assessment of each of the three sampling cycles. The table shows the number of sites each species was found on and the number of sites assessed at the first and second assessment of each cycle.

SPECIES_NAME	c1a1 & c1a2	c2a1 & c2a2	c3a1 & c3a2	ratio c1a2/ c1a1	ratio c2a2/ c2a1	ratio c3a1/ c3a2
Acacia farnesiana	4 then 7 of 77	7 then 12 of 78	10 then 6 of 76	1.75	1.71	0.60
Acacia victoriae	6 then 8 of 77	8 then 4 of 78	3 then 4 of 76	1.33	0.50	1.33
Aristida inaequiglumis	8 then 13 of 77	12 then 13 of 78	11 then 14 of 76	1.63	1.08	1.27
Aristida latifolia	39 then 37 of 77	38 then 42 of 78	44 then 45 of 76	0.95	1.11	1.02
Astrebla elymoides	28 then 27 of 77	27 then 28 of 78	30 then 28 of 76	0.96	1.04	0.93
Astrebla pectinata	30 then 27 of 77	28 then 28 of 78	30 then 29 of 76	0.90	1.00	0.97
Astrebla squarrosa	16 then 15 of 77	15 then 15 of 78	17 then 18 of 76	0.94	1.00	1.06
Atalaya hemiglauca	9 then 6 of 77	6 then 6 of 78	4 then 3 of 76	0.67	1.00	0.75
Carissa lanceolata	3 then 4 of 77	4 then 5 of 78	4 then 4 of 76	1.33	1.25	1.00
Chrysopogon fallax	55 then 56 of 77	56 then 57 of 78	54 then 53 of 76	1.02	1.02	0.98
Corchorus sidoides	5 then 7 of 77	7 then 6 of 78	6 then 6 of 76	1.40	0.86	1.00
Crotalaria dissitiflora		10 then 14 of 78	15 then 13 of 76		1.40	0.87
Dichanthium fecundum	25 then 19 of 77	20 then 29 of 78	27 then 23 of 76	0.76	1.45	0.85
Dolichandrone heterophylla	2 then 4 of 77	4 then 7 of 78	6 then 4 of 76	2.00	1.75	0.67
Eragrostis setifolia	3 then 4 of 77	4 then 6 of 78	5 then 3 of 76	1.33	1.50	0.60
Eriachne obtusa	24 then 27 of 77	26 then 25 of 78	21 then 18 of 76	1.13	0.96	0.86
Eulalia aurea	11 then 14 of 77	14 then 17 of 78	15 then 14 of 76	1.27	1.21	0.93
Flemingia pauciflora	1 then 1 of 77	1 then 9 of 78	10 then 9 of 76	1.00	9.00	0.90
Gossypium australe	3 then 12 of 77	12 then 14 of 78	14 then 14 of 76	4.00	1.17	1.00
Neptunia dimorphantha	4 then 5 of 77	6 then 4 of 78	3 then 4 of 76	1.25	0.67	1.33
Neptunia monosperma	16 then 21 of 77	21 then 21 of 78	21 then 21 of 76	1.31	1.00	1.00
Panicum decompositum	31 then 33 of 77	35 then 46 of 78	48 then 39 of 76	1.06	1.31	0.81
Pluchea tetranthera	4 then 5 of 77	4 then 3 of 78	3 then 5 of 76	1.25	0.75	1.67
Rhynchosia minima	9 then 12 of 77	13 then 22 of 78	23 then 21 of 76	1.33	1.69	0.91
Sehima nervosum	2 then 4 of 77	4 then 9 of 78	9 then 6 of 76	2.00	2.25	0.67
Sida fibulifera	1 then 12 of 77	12 then 14 of 78	15 then 15 of 76	12.00	1.17	1.00
Senna notabilis		1 then 7 of 78	6 then 1 of 76		7.00	0.17
Tephrosia rosea		1 then 5 of 78	5 then 5 of 76		5.00	1.00
Triodia intermedia	6 then 6 of 77	6 then 7 of 78	5 then 7 of 76	1.00	1.17	1.40
Triodia pungens	17 then 16 of 77	16 then 15 of 78	15 then 16 of 76	0.94	0.94	1.07
Whiteochloa airoides	10 then 2 of 77	2 then 3 of 78	3 then 1 of 76	0.20	1.50	0.33
Xerochloa laniflora	5 then 1 of 77	1 then 2 of 78	2 then 4 of 76	0.20	2.00	2.00

Figure 1:33. Frequency of occurrence for all native species found on at least five sites at either the first or second sampling, for each cycle – Ord Victoria Plain IBRA. Bubble size represents number of sites at each x,y point.

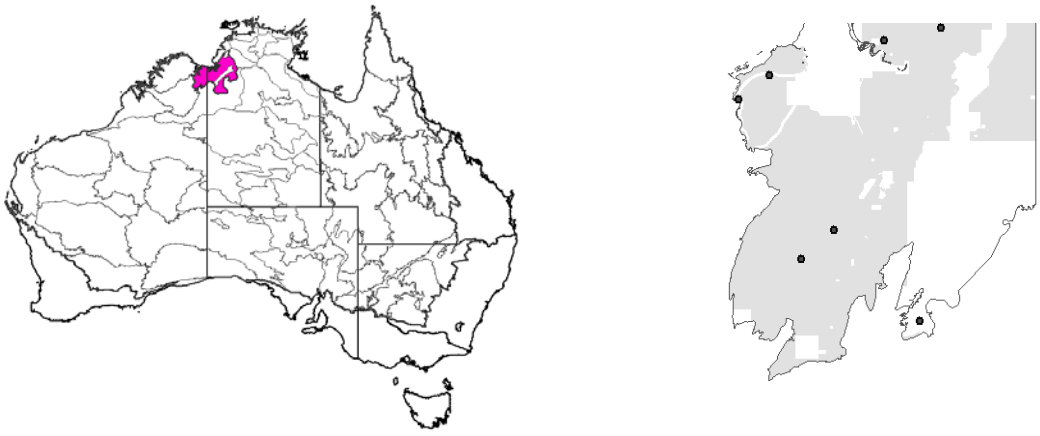


Number of sites each species was found on at c1a1

Victoria Bonaparte1 sub-IBRA

For grassland sites, only data from Victoria Bonaparte1 sub-IBRA is reported. Victoria Bonaparte2 and Victoria Bonaparte3 sub-IBRAs are found in the Northern Territory.

Figure 1:34. Location of Victoria Bonaparte1 sub-IBRA (left) and WARMS sites in the sub-IBRA (right). Greyed areas are pastoral tenure.



Site and seasonal summary

For grassland sites, only Victoria Bonaparte1 (Victoria Bonaparte1) sub-IBRA is considered.

Table 1:109. Victoria Bonaparte1 sub-IBRA – grassland sites – total number of sites and dates assessed.

Number of grassland sites assessed	15
Number of grassland sites assessed in VB1 (Victoria Bonaparte)	15
First assessment (installation)	06/06/96 to 10/09/96
Second assessment	13/05/99 to 27/07/99
Third assessment	22/05/02 to 06/09/02
Fourth assessment	09/05/05 to 30/06/05

Table 1:110. Victoria Bonaparte1 sub-IBRA – grassland sites – seasonal category and number of sites assessed in each cycle.

	Cycle1	Cycle 2	Cycle 3
Number of grassland sites assessed	12	10	12
Above average seasonal quality - – percentage of sites	100%	0%	0%
Average seasonal quality - – percentage of sites	0%	100%	25%
Below average seasonal quality – percentage of sites	0%	0%	75%

Change in landscape function

Perennial grass frequency

Table 1:111. Victoria Bonaparte1 sub-IBRA IBRA – summary of perennial grass frequency.

Average frequency Cycle 3 – for sites assessed in both cycle 3 and cycle 4	79.1
Average frequency Cycle 4 – for sites assessed in both cycle 3 and cycle 4	76.2
Average frequency ratio Cycle 4 to Cycle 3: +/- standard error of the mean	
Frequency: ratio Cycle 4 to Cycle 3 at least 1.0 – percentage of sites	33%
Frequency: ratio Cycle 4 to Cycle 3 <0.90 – percentage of sites	25%
Frequency: ratio Cycle 4 to Cycle 3 <0.50 – percentage of sites	0%

Figure 1:35. Change in perennial grass frequency between each sampling cycle (C) – Victoria Bonaparte1 sub-IBRA.

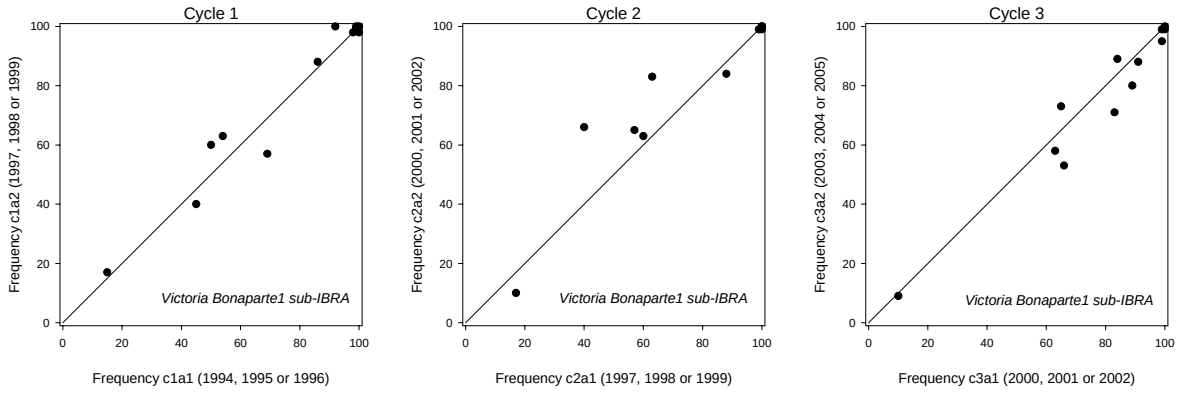


Table 1:112. Victoria Bonaparte1 sub-IBRA – summary of perennial grass frequency.

	Cycle 1	Cycle 2	Cycle 3
Average frequency: first assessment of cycle +/- standard error of the mean	75.6 +/- 8.23	72.4 +/- 9.32	79.1 +/- 7.46
Average frequency: second assessment of cycle +/- standard error of the mean	76.7 +/- 8.22	76.9 +/- 8.85	76.2 +/- 7.64
Average frequency ratio between the two assessments +/- standard error of the mean	1.03 +/- 0.03	1.07 +/- 0.09	0.96 +/- 0.03
Frequency ratio at least 1.0 – percentage of sites	75%	70%	75%
Frequency ratio <0.90 – percentage of sites	17%	10%	25%
Frequency ratio <0.50 – percentage of sites	0%	0%	0%

Table 1:113. Cycle 1 - percentage of sites in each seasonal category showing change in perennial grass frequency – Victoria Bonaparte1 sub-IBRA.

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency < 1.10	Increase. frequency ≥ 1.10	Number of sites
All years	All	17%	58%	25%	12
Above average	All	17%	58%	25%	12
Average	All	n/a	n/a	n/a	0
Below average	All	n/a	n/a	n/a	0

Table 1:114. Cycle 2 - percentage of sites in each seasonal category showing change in perennial grass frequency – Victoria Bonaparte1 sub-IBRA.

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency < 1.10	Increase. frequency ≥ 1.10	Number of sites
All years	All	10%	60%	30%	10
Above average	All	n/a	n/a	n/a	0
Average	All	10%	60%	30%	10
Below average	All	n/a	n/a	n/a	0

Table 1:115. Cycle 3 - percentage of sites in each seasonal category showing change in perennial grass frequency – Victoria Bonaparte1 sub-Kimberley IBRA.

Seasonal Quality	Species group	Decline. frequency <0.90	No change. ≤0.90 frequency <1.10	Increase. frequency ≥1.10	Number of sites
All years	All	25%	67%	8%	12
Above average	All	n/a	n/a	n/a	0
Average	All	n/a	n/a	n/a	3
Below average	All	n/a	n/a	n/a	9

Table 1:116. Weighted average across all three cycles - percentage of sites in each seasonal category showing change in perennial grass frequency. Only cycles containing at least 10 sites in each seasonal quality category were used. Victoria Bonaparte1 sub-IBRA.

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency < 1.10	Increase. frequency ≥ 1.10	Number of site by year combinations	Cycles used
All years	All	18%	62%	20%	34	1,2,3

Above average	All	17%	58%	25%	12	1
Average	All	10%	60%	30%	10	2
Below average	All	n/a	n/a	n/a	n/a	n/a

Crown cover, woody species taller than 1m

Averages of frequency ratios can not be calculated because of the large number of crown cover estimates of zero (i.e. denominator = zero).

Table 1:117. Victoria Bonaparte1 sub-IBRA – summary of crown cover

Average crown cover cycle 3, assessment1 (c3a1)	13.88
Average crown cover cycle 3, assessment2 (c3a2)	15.74
* Crown cover: ratio c3a2 to c3a1, percentage of sites at least 1.0	82%
* Crown cover: ratio c3a2 to c3a1, percentage of sites <0.90	10%
* Crown cover: ratio c3a2 to c3a1, percentage of sites <0.50	0%

* Sites with zero crown cover at both c3a1 and c3a2 have not been included

Figure 1:36. Change in crown cover between each sampling cycle (C) – Victoria Bonaparte1 sub-IBRA.

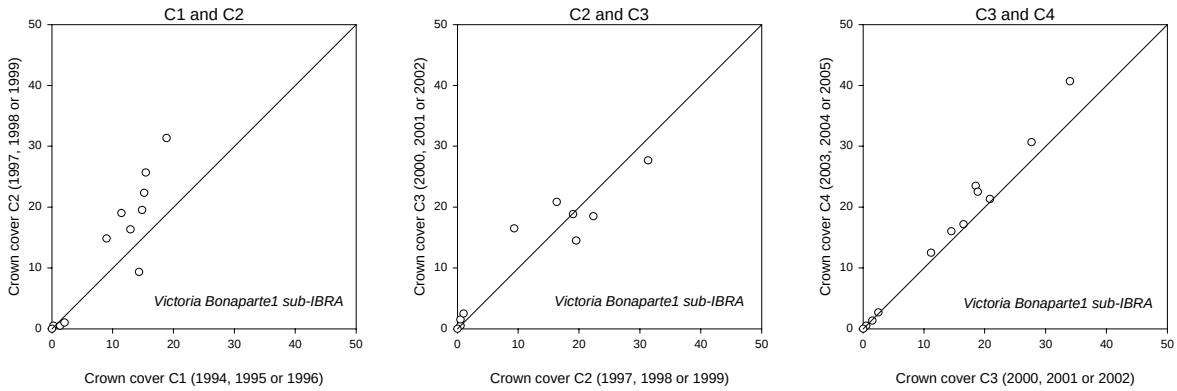


Table 1:118. Cycle 3 – percentage of sites in each seasonal quality category showing change in crown cover – Victoria Bonaparte1 sub-IBRA. Sites with zero crown cover have not been included.

Seasonal Quality	Species group	Crown cover <0.90	No change. ≤0.90 crown cover <1.10	Crown cover ≥1.10	Number of sites
All years	All	9%	36%	55%	11
Above average	All	n/a	n/a	n/a	0
Average	All	n/a	n/a	n/a	3

Below average	All	n/a	n/a	n/a	8

Resource Capture Index

Table 1:119. Victoria Bonaparte1 sub-IBRA – summary of resource capture index.

Number of sites assessed in cycle 3, assessment 1 (c3a1) and cycle 3, assessment 2 (c3a2)	12
Average Resource Capture Index - c3a1	0.05
Average Resource Capture Index – c3a2	0.03
Average ratio of Resource Capture Index – c3a2 to c3a1 +/- standard error of the mean	0.87 +/- 0.20
Resource Capture Index: ratio c3a2 to c3a1, percentage of sites at least 1.0	42%
Resource Capture Index: ratio c3a2 to c3a1, percentage of sites <0.90	50%
Resource Capture Index: ratio c3a2 to c3a1, percentage of sites <0.50	42%
Average Resource Capture Index: ratio c3a2 to c3a1 for above average seasonal quality	n/a
Average Resource Capture Index: ratio c3a2 to c3a1 for average seasonal quality	n/a
Average Resource Capture Index: ratio c3a2 to c3a1 for below average seasonal quality	n/a

Figure 1:37. Change in Resource Capture Index, cycle 3 – Victoria Bonaparte1 sub-IBRA.

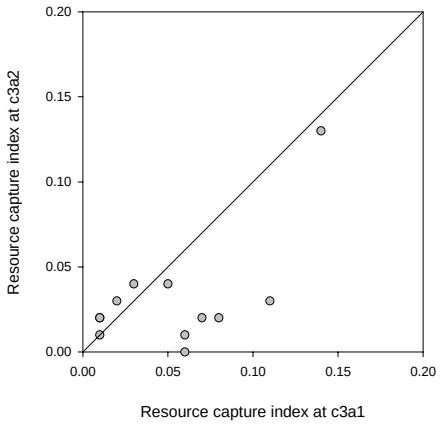


Table 1:120. Resource capture index – percentage of sites in each seasonal category showing change in the index – Victoria Bonaparte1 sub-IBRA, cycle 3.

Seasonal Quality	Species group	Decline. RCI < 0.90	No change. 0.90 ≤ RCI <1.10	Increase. RCI >=1.10	Number of sites
All years	All	n/a	n/a	n/a	12
Above average	All	n/a	n/a	n/a	0

Average	All	n/a	n/a	n/a	3
Below average	All	n/a	n/a	n/a	9

Proportional landscape function - stability, infiltration and nutrient cycling indices

Table 1:121. Proportional landscape function indices – Victoria Bonaparte1 sub-IBRA, cycle 3.

	Stability index	Infiltration index	Nutrient cycling index
Number of sites assessed in c3a1 and c3a2	11	11	11
c3a1 average +/- standard error of the mean	57.0 +/- 2.64	47.7 +/- 1.94	25.6 +/- 2.3
c3a2 average +/- standard error of the mean	54.8 +/- 1.61	42.8 +/- 1.84	23.4 +/- 2.1
Ratio of index: average +/- standard error of the mean	0.98 +/- 0.04	0.90 +/- 0.04	0.94 +/- 0.07
Ratio of index: c3a2 to c3a1 percentage of sites at least 1.0	34%	18%	27%
Ratio of index: c3a2 to c3a1 percentage of sites <0.90	41%	36%	45%
Ratio of index: c3a2 to c3a1 percentage of sites <0.50	1%	0%	0%
Average of index ratio: c3a2 to c3a1 for above average seasonal quality	n/a	n/a	n/a
Average of index ratio: c3a2 to c3a1 for average seasonal quality	n/a	n/a	n/a
Average of index ratio: c3a2 to c3a1 for below average seasonal quality	n/a	n/a	n/a

Figure 1:38. Proportional landscape function - stability, infiltration and nutrient cycling indices, cycle3 – Victoria Bonaparte1 sub-IBRA. The top panes show all data, the lower panes show expanded views over limited ranges.

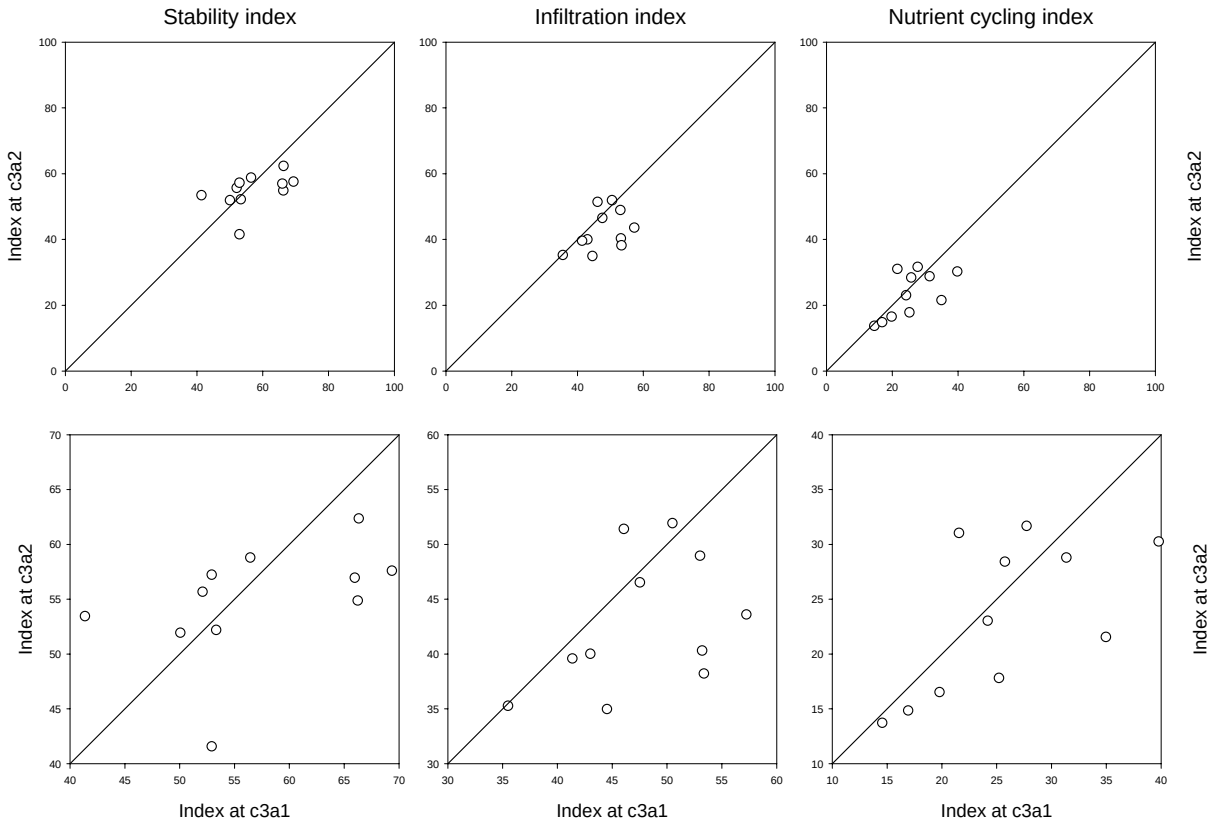


Table 1:122. Proportional landscape function - stability index –Victoria Bonaparte1 sub-IBRA. Ratio of stability index (RSI) at cycle 3, assessment 2 (c3a2) to index at cycle 3, assessment 1 (c3a1).

Seasonal Quality	Species group	Decline. RSI < 0.90	No change. 0.90>= RSI <1.10	Increase. RSI >=1.10	Number of sites
All years	All	36%	55%	9%	11
Above average	All	n/a	n/a	n/a	0
Average	All	n/a	n/a	n/a	2
Below average	All	n/a	n/a	n/a	9

Table 1:123. Proportional landscape function - infiltration index –Victoria Bonaparte1 sub-IBRA. Ratio of infiltration index (RII) at cycle 3, assessment 2 (c3a2) to index at cycle 3, assessment 1 (c3a1).

Seasonal Quality	Species group	Decline. RII < 0.90	No change. 0.90>= RII <1.10	Increase. RII >=1.10	Number of sites
All years	All	36%	55%	9%	11
Above average	All	n/a	n/a	n/a	0
Average	All	n/a	n/a	n/a	2
Below average	All	n/a	n/a	n/a	9

Table 1:124. Proportional landscape function – nutrient cycling index –Victoria Bonaprte1 sub-IBRA. Ratio of nutrient cycling index (RNCI) at cycle 3, assessment 2 (c3a2) to index at cycle 3, assessment 1 (c3a1).

Seasonal Quality	Species group	Decline. RNCI < 0.90	No change. 0.90>= RNCI <1.10	Increase. RNCI >=1.10	Number of sites
All years	All	45%	27%	27%	11
Above average	All	n/a	n/a	n/a	0
Average	All	n/a	n/a	n/a	2
Below average	All	n/a	n/a	n/a	9

Change in sustainable management of the pastoral estate – grassland sites

Frequency of Decreaser, Intermediate and Increaser perennial grass species

Table 1:125. Summary of frequency of decreaser, intermediate and increaser perennial grass species, Victoria Bonaparte1 sub-IBRA, cycle 3.

Average change in frequency +/- standard error of the mean	0.88 +/- 0.05	n/a	n/a
Frequency: ratio c3a2 to c3a1, percentage of sites ≥ 1.0	25%	n/a	n/a
Frequency: ratio c3a2 to c3a1, percentage of sites <0.90	42%	n/a	n/a
Frequency: ratio c3a2 to c3a1, percentage of sites <0.50	0%	n/a	n/a
Average change in frequency: c3a2 to c3a1, above average seasonal quality	n/a	n/a	n/a
Average change in frequency: c3a2 to c3a1, average seasonal quality	n/a	n/a	n/a
Average change in frequency: c3a2 to c3a1, below average seasonal quality	n/a	n/a	n/a

Figure 1:39. Change in perennial grass frequency between, cycle 3 – decreaser, intermediate and increaser species

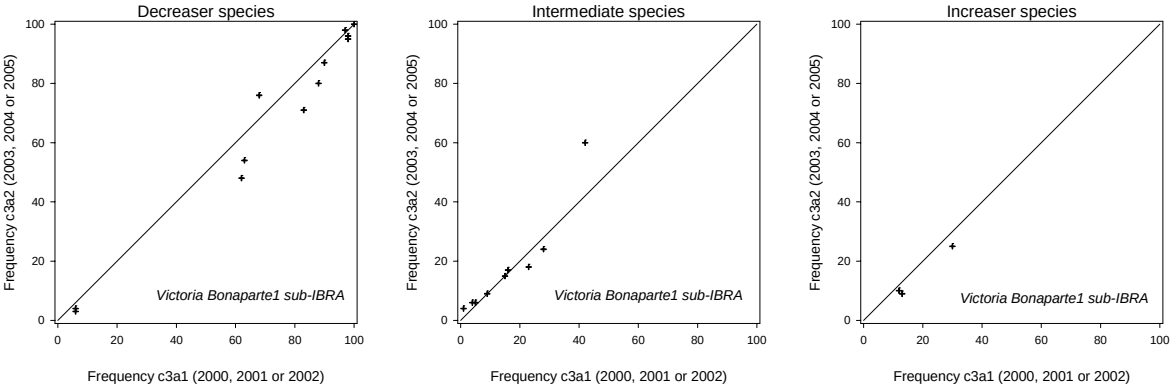


Table 1:126. Change in frequency of decreaser, intermediate and increaser perennial grass species – percentage of sites in each seasonal category – Victoria Bonaparte1 sub-IBRA, cycle 1

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency <1.10	Increase. frequency ≥1.10	Number of sites
All years	Decreaser	8%	50%	42%	12
	Intermediate	n/a	n/a	n/a	7
	Increaser	n/a	n/a	n/a	3
Above average	Decreaser	8%	50%	42%	12
	Intermediate	n/a	n/a	n/a	7
	Increaser	n/a	n/a	n/a	3
Average	Decreaser	n/a	n/a	n/a	0
	Intermediate	n/a	n/a	n/a	0
	Increaser	n/a	n/a	n/a	0
Below average	Decreaser	n/a	n/a	n/a	0
	Intermediate	n/a	n/a	n/a	0
	Increaser	n/a	n/a	n/a	0

Table 1:127. Change in frequency of decreaser, intermediate and increaser perennial grass species – percentage of sites in each seasonal category - Victoria Bonaparte1 sub-IBRA, cycle 2

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency <1.10	Increase. frequency ≥1.10	Number of sites
All years	Decreaser	10%	60%	30%	10
	Intermediate	n/a	n/a	n/a	5
	Increaser	n/a	n/a	n/a	3
Above average	Decreaser	n/a	n/a	n/a	0
	Intermediate	n/a	n/a	n/a	0
	Increaser	n/a	n/a	n/a	0
Average	Decreaser	10%	60%	30%	10
	Intermediate	n/a	n/a	n/a	5
	Increaser	n/a	n/a	n/a	3
Below average	Decreaser	n/a	n/a	n/a	0
	Intermediate	n/a	n/a	n/a	0

	Increaser	n/a	n/a	n/a	0

Table 1:128. Change in frequency of decreaser, intermediate and increaser perennial grass species – percentage of sites in each seasonal category – Victoria Bonaparte1 sub-IBRA, cycle 3

Seasonal Quality	Species group	Decline. frequency < 0.9	No change. 0.90 ≤ frequency <1.10	Increase. frequency ≥1.10	Number of sites
All years	Decreaser	42%	50%	8%	12
	Intermediate	n/a	n/a	n/a	9
	Increaser	n/a	n/a	n/a	3
Above average	Decreaser	n/a	n/a	n/a	0
	Intermediate	n/a	n/a	n/a	0
	Increaser	n/a	n/a	n/a	0
Average	Decreaser	n/a	n/a	n/a	3
	Intermediate	n/a	n/a	n/a	2
	Increaser	n/a	n/a	n/a	0
Below average	Decreaser	n/a	n/a	n/a	9
	Intermediate	n/a	n/a	n/a	7
	Increaser	n/a	n/a	n/a	3

Table 1:129. Weighted average across all three cycles - change in frequency of decreaser, intermediate and increaser perennial grass species – percentage of sites in each seasonal category - Victoria Bonaparte1 sub-IBRA.

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency <1.10	Increase. frequency ≥1.10	Number of sites	Cycles used
All years	Decreaser	21%	53%	26%	34	1,2,3
	Intermediate	n/a	n/a	n/a	n/a	n/a
	Increaser	n/a	n/a	n/a	n/a	n/a
Above average	Decreaser	8%	50%	42%	12	1
	Intermediate	n/a	n/a	n/a	n/a	n/a
	Increaser	n/a	n/a	n/a	n/a	n/a
Average	Decreaser	10%	60%	30%	10	2
	Intermediate	n/a	n/a	n/a	n/a	n/a
	Increaser	n/a	n/a	n/a	n/a	n/a
Below average	Decreaser	n/a	n/a	n/a	n/a	n/a
	Intermediate	n/a	n/a	n/a	n/a	n/a
	Increaser	n/a	n/a	n/a	n/a	n/a

Change in vegetation richness and occurrence

Native perennial species richness

Table 1:130. Victoria Bonaparte1 sub-IBRA – summary of native perennial species richness, cycle 3

Number of sites assessed in cycle 3, assessment 1 and cycle3 assessment 2 (c3a1 & c3a2)	12
Average number of native perennial species per site at c3a1 – for sites assessed in both c3a1 and c3a2: +/- standard error of the mean	6.5 +/- 0.45
Average number of native perennial species per site in c3a2 – for sites assessed in both c3a1 and c3a2: +/- standard error of the mean	6.3 +/- 0.27
Average ratio of species richness: c3a2 to c3a1: +/- standard error of the mean	0.94 +/- 0.05
Species richness: ratio c3a2 to c3a1, percentage of sites at least 1.0	50%
Species richness: ratio c3a2 to c3a1, percentage of sites <0.90	50%
Species richness: ratio c3a2 to c3a1, percentage of sites <0.50	0%

Figure 1:40. Change in species richness on each site between each sampling cycle – Victoria Bonaparte1 sub-IBRA. Bubble size represents number of sites at each x,y point.

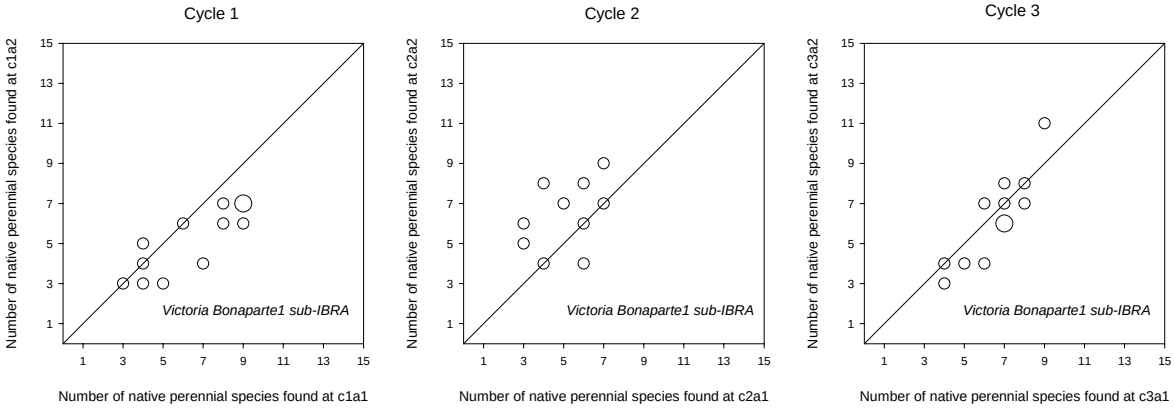


Table 1:131. Cycle 1 - native perennial species richness Victoria Bonaparte1 sub-IBRA - c1a2 divided by c1a1.

Seasonal Quality	Species group	Decline. Richness index < 0.80	No change. 0.80 ≤ Richness index <1.20	Increase. Richness index ≥1.20	Number of sites
All years	All	58%	33%	8%	12
Above average	All	58%	33%	8%	12
Average	All	n/a	n/a	n/a	0
Below average	All	n/a	n/a	n/a	0

Table 1:132. Cycle 2 - native perennial species richness Victoria Bonaparte1 sub-IBRA - c2a2 divided by c2a1.

Seasonal Quality	Species group	Decline. Richness index <	No change. 0.80 ≤ Richness	Increase. Richness index	Number of sites

		0.80	index <1.20	≥1.20	
All years	All	10%	30%	60%	10
Above average	All	n/a	n/a	n/a	0
Average	All	10%	30%	60%	10
Below average	All	n/a	n/a	n/a	0

Table 1:133. Cycle 3 - native perennial species richness Victoria Bonaparte1 sub-IBRA - c3a2 divided by c3a1.

Seasonal Quality	Species group	Decline. Richness index < 0.80	No change. 0.80 ≤ Richness index <1.20	Increase. Richness index ≥1.20	Number of sites
All years	All	17%	75%	8%	12
Above average	All	n/a	n/a	n/a	0
Average	All	n/a	n/a	n/a	3
Below average	All	n/a	n/a	n/a	9

Table 1:134. Weighted average across all three cycles - native perennial species richness Victoria Bonaparte1 sub-IBRA.

Seasonal Quality	Species group	Decline. Richness index < 0.80	No change. 0.80 ≤ Richness index <1.20	Increase. Richness index ≥1.20	Number of sites	Cycles used
All years	All	29%	47%	23%	34	1,2,3
Above average	All	58%	33%	8%	12%	1
Average	All	10%	30%	60%	10	2
Below average	All	n/a	n/a	n/a	0	n/a

Frequency of occurrence – native species

Table 1:135. Victoria Bonaparte1 sub-IBRA – species found on at least five sites at either the first or second assessment of each cycle and on at least one site at the first assessment date of each cycle.

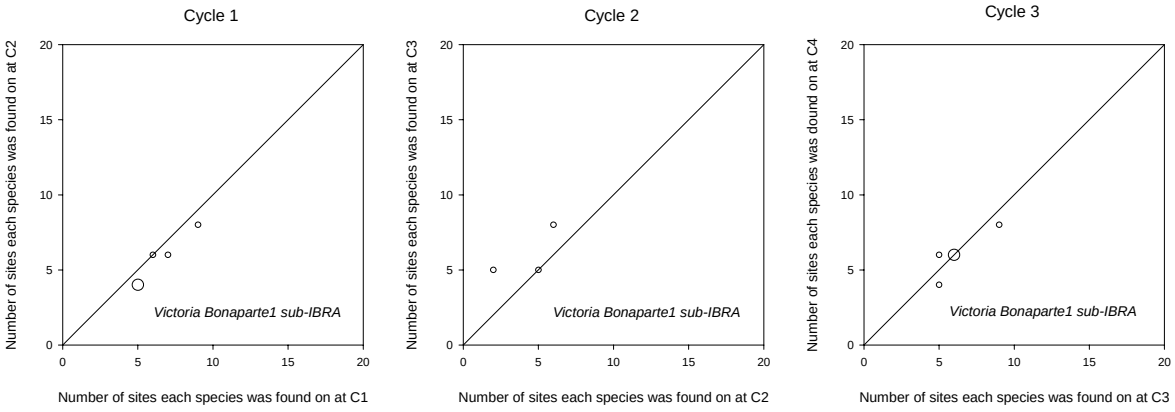
	c1a1 & c1a2	c2a1 & c2a2	c3a1 & c3a2
Number of species	5	3	5
Average number of sites each species was found on	n/a	n/a	n/a
Average number of sites each species was found on	n/a	n/a	n/a
Occurrence ratio at least 1.0 – percentage of species	n/a	n/a	n/a
Occurrence ratio >1.10 – percentage of species	n/a	n/a	n/a

Occurrence ratio < 0.90 – percentage of species	n/a	n/a	n/a
Occurrence ratio < 0.50 – percentage of species	n/a	n/a	n/a
Average occurrence ratio +/- standard error of the mean	n/a	n/a	n/a

Table 1:136. Native species found on WARMS sites within the Victoria Bonaparte1 sub-IBRA. Data were filtered to include only those species found on at least five sites at any of the assessments, and on at least one site at the first assessment of each of the three sampling cycles. The table shows the number of sites each species was found on and the number of sites assessed at the first and second assessment of each cycle.

SPECIES_NAME	c1a1 & c1a2	c2a1 & c2a2	c3a1 & c3a2	ratio c1a2/ c1a1	ratio c2a2/ c2a1	ratio c3a1/ c3a2
Chrysopogon fallax	9 then 8 of 12	6 then 8 of 10	9 then 8 of 12	0.89	1.33	0.89
Dichanthium fecundum	6 then 6 of 12	5 then 5 of 10	5 then 6 of 12	1.00	1.00	1.20
Eriachne obtusa	3 then 2 of 12	2 then 5 of 10	6 then 6 of 12	0.67	2.50	1.00
Sehima nervosum	5 then 4 of 12	3 then 2 of 10	3 then 3 of 12	0.80	0.67	1.00
Sorghum plumosum	7 then 6 of 12	4 then 4 of 10	6 then 6 of 12	0.86	1.00	1.00
Triodia bitextura	5 then 4 of 12	4 then 4 of 10	5 then 4 of 12	0.80	1.00	0.80

Figure 1:41. Frequency of occurrence for all native species found on at least five sites at either the first or second sampling, for each cycle – Victoria Bonaparte1 sub-IBRA. Bubble size represents number of sites at each x,y point.



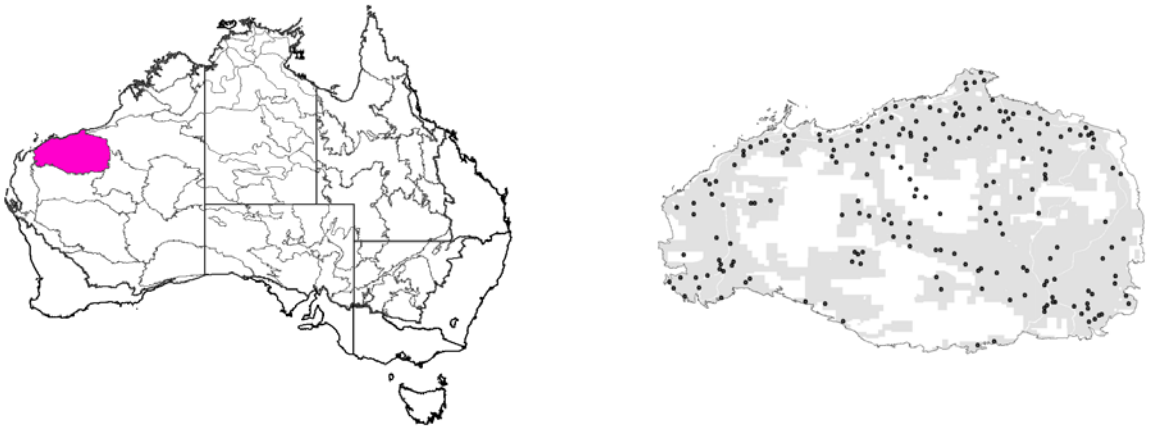
Pilbara region

The Pilbara region is a general term for the Pilbara IBRA.

Pilbara IBRA

For shrubland sites, only Pilbara3 sub-IBRA (Hamersley) is considered. For grassland sites, all four Pilbara sub-IBRAs are considered together.

Figure 1:42. Location of Pilbara IBRA (left) and WARMS sites in the sub-IBRA (right). Greyed areas are pastoral tenure.



Site and seasonal summary

Table 1:137. Pilbara IBRA – shrubland sites – total number of sites and dates assessed

Number of shrubland sites assessed in all sub-IBRAs	19
Number of shrubland sites in PIL1 (Chichester)	1
Number of shrubland sites in PIL2 (Fortescue)	8
Number of shrubland sites in PIL3 (Hamersley)	**10**
Number of shrubland sites in PIL4 (Roebourne)	0
Date 1: first assessment (installation): PIL3	16/5/95 to 26/7/98
Date 2: second assessment: PIL3	12/7/99 to 15/8/05
Above average seasonal quality: PIL3– percentage of sites	100%
Average seasonal quality: PIL3 – percentage of sites	0%
Below average seasonal quality: PIL3 – percentage of sites	0%

Table 1:138. Pilbara IBRA – grassland sites – total number of sites and dates assessed.

Number of grassland sites assessed (plus 4 but with no seasonal quality value available)	175
Number of grassland sites in PIL1 (Chichester)	82
Number of grassland sites in PIL2 (Fortescue)	24
Number of grassland sites in PIL3 (Hamersley)	25
Number of grassland sites in PIL4 (Roebourne)	48
First assessment (installation)	13/05/94 to 23/10/96
Second assessment	17/04/97 to 30/08/99
Third assessment	30/07/00 to 29/06/02
Fourth assessment	15/09/03 to 15/08/05

Table 1:139. Pilbara IBRA – grassland sites – seasonal category and number of sites assessed in each cycle.

	Cycle1	Cycle 2	Cycle 3
Number of grassland sites assessed	18	112	79
Above average seasonal quality - – percentage of sites	100%	55%	0%
Average seasonal quality - – percentage of sites	0%	30%	48%
Below average seasonal quality – percentage of sites	0%	15%	52%

Change in landscape function – shrubland sites

Population growth rate (i.e. density)

Table 1:140. Pilbara3 sub-IBRA – shrubland sites – summary of population growth rate (i.e. density)

Average Population growth rate +/- standard error of the mean	1.33 +/- 0.22
PGR at least 1.0 – percentage of sites	70%
PGR <0.90 – percentage of sites	20%
PGR <0.50 – percentage of sites	10%

Figure 1:43. Change in number of plants on each site (population growth rate) between Date 1 and Date 2 – Pilbara3 sub-IBRA.

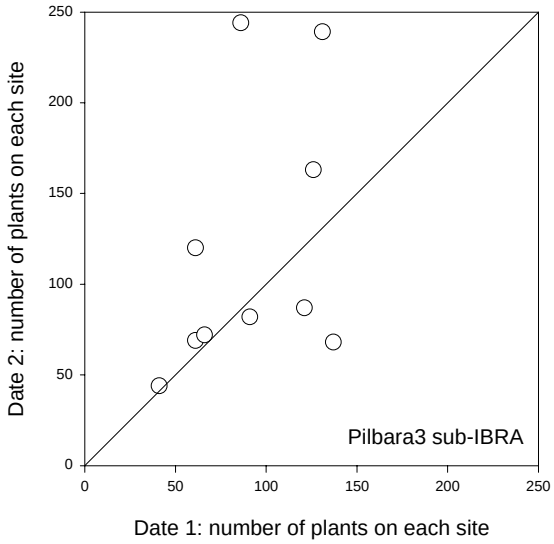


Table 1:141. Pilbara3 sub-IBRA – percentage of sites in each seasonal category showing change in shrub density (shrubland sites)

Seasonal Quality	Species group	Decline. Density < 95%	No change. Density between 95% and 105%	Increase. Density >=105%	Number of sites
All years	All	30%	0%	70%	10
Above average	All	30%	0%	70%	10
Average	All	n/a	n/a	n/a	0
Below average	All	n/a	n/a	n/a	0

Canopy area

Table 1:142. Pilbara3 sub-IBRA – summary of canopy area (shrubland sites)

Average change in cover +/- standard error of the mean	1.10 +/- 0.07
Cover: ratio Date 2 to Date 1 at least 1.0 – percentage of sites	70%
Cover: ratio Date 2 to Date 1 <0.90 – percentage of sites	20%
Cover: ratio Date 2 to Date 1 <0.50 – percentage of sites	0%
Average cover ratio Date 2 to Date 1 for above average seasonal quality	1.10
Average cover ratio Date 2 to Date 1 for average seasonal quality	n/a
Average cover ratio Date 2 to Date 1 for below average seasonal quality	n/a

Figure 1:44. Change in total canopy area between Date 1 and Date 2 – Pilbara3 sub-IBRA.

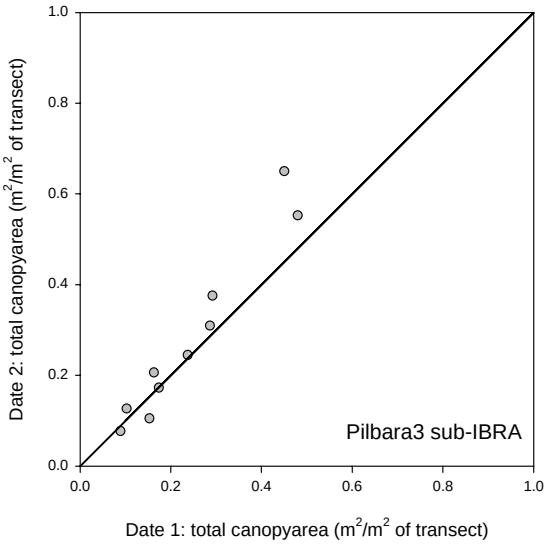


Table 1:143. Pilbara3 sub-IBRA – percentage of shrubland sites in each seasonal category showing change in canopy area of shrubs

Seasonal Quality	Species group	Decline. Total canopy area <0.90	No change. 0.90>= total canopy area <1.10	Increase. total canopy area >=1.10	Number of sites
All years	All	20%	30%	50%	10
Above average	All	20%	30%	50%	10
Average	All	n/a	n/a	n/a	0
Below average	All	n/a	n/a	n/a	0

Canopy area but restricted to plants less than 1.5 m in height

Table 1:144 Pilbara3 sub-IBRA – summary of canopy area (shrubland sites), but restricted to plants less than 1.5 m in height

Average change in cover +/- standard error of the mean	1.54 +/- 0.17
Cover: ratio Date 2 to Date 1 at least 1.0 – percentage of sites	80%
Cover: ratio Date 2 to Date 1 <0.90 – percentage of sites	20%
Cover: ratio Date 2 to Date 1 <0.50 – percentage of sites	0%
Average cover ratio Date 2 to Date 1 for above average seasonal quality	1.54
Average cover ratio Date 2 to Date 1 for average seasonal quality	n/a
Average cover ratio Date 2 to Date 1 for below average seasonal quality	n/a

Figure 1:45. Canopy area by site, but restricted to plants less than 1.5 m in height – Pilbara3 sub-IBRA.

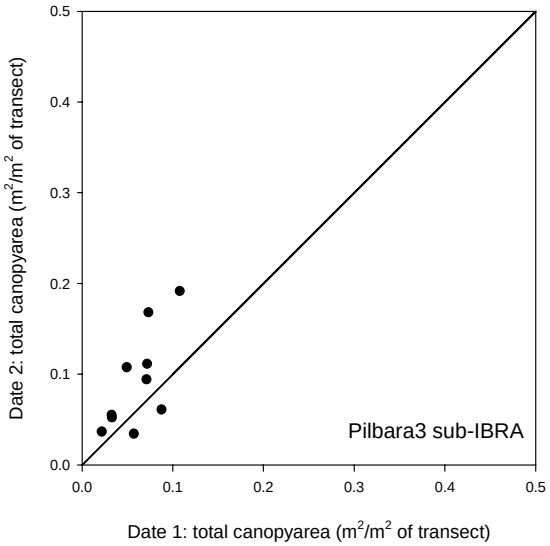


Table 1:145. Pilbara3 sub-IBRA – percentage of shrubland sites in each seasonal category showing change in canopy area of shrubs, but restricted to plants less than 1.5 m in height

Seasonal Quality	Species group	Decline. Total canopy area <0.90	No change. 0.90>= total canopy area <1.10	Increase. total canopy area >=1.10	Number of sites
All years	All	7%	17%	76%	29
Above average	All	4%	13%	83%	23
Average	All	n/a	n/a	n/a	5
Below average	All	n/a	n/a	n/a	1

Resource Capture Index

Table 1:146. Pilbara3 sub-IBRA – summary of resource capture index, shrubland sites.

Number of sites with useable data at both dates	4
Average change in Resource Capture Index +/- standard error of the mean	n/a
Cover: ratio Date 2 to Date 1 at least 1.0 – percentage of sites	n/a
Cover: ratio Date 2 to Date 1 <0.90 – percentage of sites	n/a
Cover: ratio Date 2 to Date 1 <0.50 – percentage of sites	n/a
Average cover ratio Date 2 to Date 1 for above average seasonal quality	n/a
Average cover ratio Date 2 to Date 1 for average seasonal quality	n/a
Average cover ratio Date 2 to Date 1 for below average seasonal quality	n/a

Figure 1:46. Change in Resource Capture Index between Date 1 and Date 2 – Pilbara3 sub-IBRA.

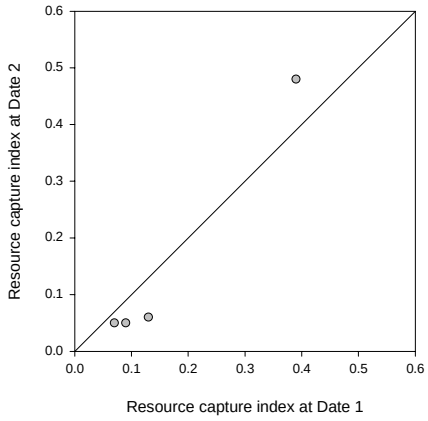


Table 1:147. Resource capture index – percentage of sites in each seasonal category showing change in the index – Pilbara3 sub-IBRA, shrubland sites

Seasonal Quality	Species group	Decline. RCI < 0.90	No change. 0.90 ≤ RCI <1.10	Increase. RCI ≥ 1.10	Number of sites
All years	All	n/a	n/a	n/a	4
Above average	All	n/a	n/a	n/a	4
Average	All	n/a	n/a	n/a	0
Below average	All	n/a	n/a	n/a	0

Proportional landscape function - stability, infiltration and nutrient cycling indices

Table 1:148. Summary - proportional landscape function indices – Pilbara3 sub-IBRA.

	Stability index	Infiltration index	Nutrient cycling index
Number of sites with useable data at both dates	4	4	4
Date 1 average +/- standard error of the mean	n/a	n/a	n/a
Date 2 average +/- standard error of the mean	n/a	n/a	n/a
Ratio of index: average +/- standard error of the mean	n/a	n/a	n/a
Ratio of index: Date 2 to Date 1 at least 1.0 – percentage of sites	n/a	n/a	n/a
Ratio of index: : Date 2 to Date 1 <0.90 – percentage of sites	n/a	n/a	n/a
Ratio of index: Date 2 to Date 1 <0.50 – percentage of sites	n/a	n/a	n/a
Average of index ratio: Date 2 to Date 1 for above average	n/a	n/a	n/a

seasonal quality			
Average of index ratio: Date 2 to Date 1 for average seasonal quality	n/a	n/a	n/a
Average of index ratio: Date 2 to Date 1 for below average seasonal quality	n/a	n/a	n/a

Figure 1:47. Proportional landscape function - stability, infiltration and nutrient cycling indices at Date 1 and Date 2 – Pilbara3 sub-IBRA. The top panes show all data, the lower panes show expanded views over limited ranges.

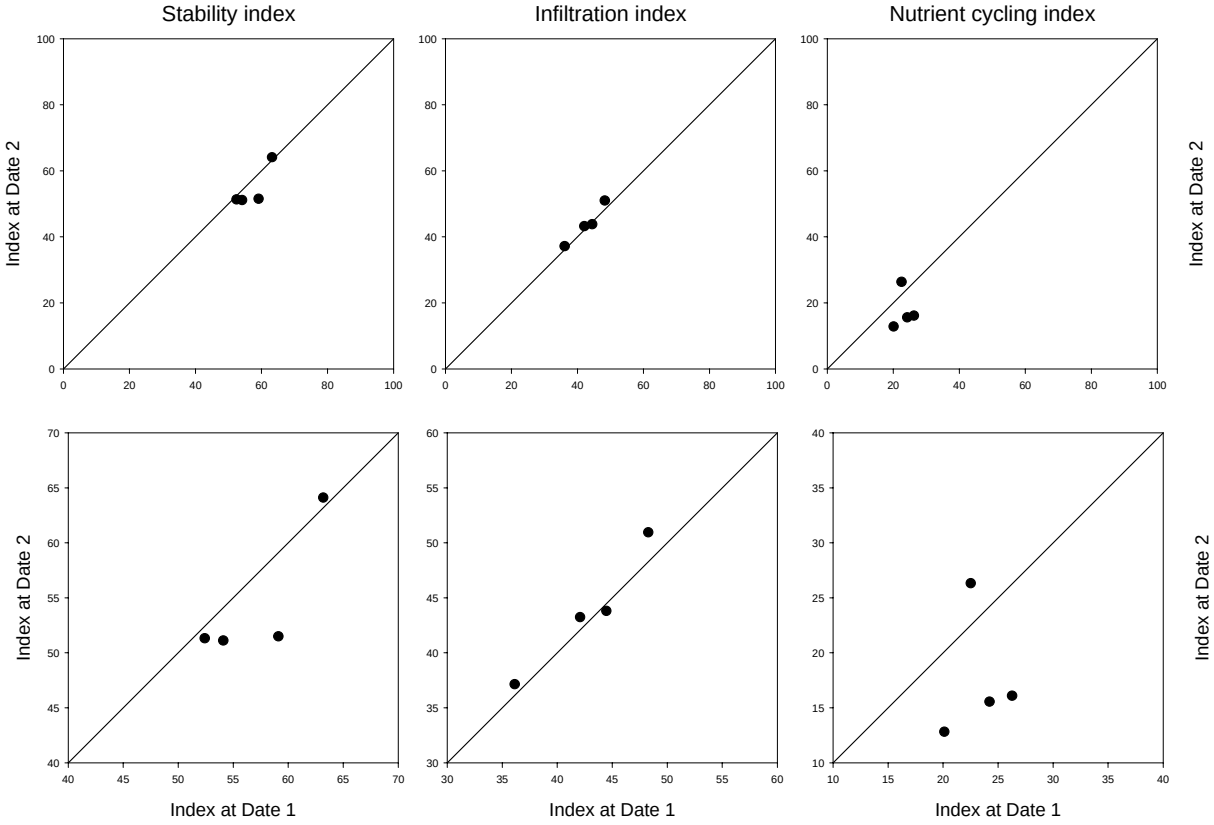


Table 1:149. Proportional landscape function - stability index - Carnarvon IBRA. Ratio of index at Date 2 to index at Date 1 (Ratio of Stability Index – RSI).

Seasonal Quality	Species group	Decline. RSI < 0.90	No change. 0.90>= RSI <1.10	Increase. RSI >=1.10	Number of sites
All years	All	n/a	n/a	n/a	4
Above average	All	n/a	n/a	n/a	4
Average	All	n/a	n/a	n/a	0
Below average	All	n/a	n/a	n/a	0

Table 1:150. Proportional landscape function - infiltration index – Pilbara3 sub-IBRA. Ratio of index at Date 2 to index at Date 1 (Ratio of Infiltration Index – RII).

Seasonal Quality	Species group	Decline. RII < 0.90	No change. 0.90>= RII <1.10	Increase. RII >=1.10	Number of sites
All years	All	n/a	n/a	n/a	4
Above average	All	n/a	n/a	n/a	4
Average	All	n/a	n/a	n/a	0
Below average	All	n/a	n/a	n/a	0

Table 1:151. Proportional landscape function – nutrient cycling index – Pilbara3 sub-IBRA. Ratio of index at Date 2 to index at Date 1 (Ratio of Nutrient Cycling Index – RNCI).

Seasonal Quality	Species group	Decline. RNCI < 0.90	No change. 0.90>= RNCI <1.10	Increase. RNCI >=1.10	Number of sites
All years	All				4
Above average	All	n/a	n/a	n/a	4
Average	All	n/a	n/a	n/a	0
Below average	All	n/a	n/a	n/a	0

Change in landscape function – grassland sites

Perennial grass frequency

Table 1:152. Pilbara IBRA – summary of perennial grass frequency.

	Cycle 1	Cycle 2	Cycle 3
Average frequency: first assessment of cycle +/- standard error of the mean	85.5 +/- 3.78	78.2 +/- 2.06	76.1 +/- 3.25
Average frequency: second assessment of cycle +/- standard error of the mean	89.4 +/- 4.46	83.5 +/- 1.86	68.5 +/- 3.32
Average frequency ratio between the two assessments +/- standard error of the mean	1.04 +/- 0.04	1.12 +/- 0.03	0.95 +/- 0.04
Frequency ratio at least 1.0 – percentage of sites	83%	79%	41%
Frequency ratio <0.90 – percentage of sites	6%	8%	39%
Frequency ratio <0.50 – percentage of sites	0%	2%	8%

Figure 1:48. Change in perennial grass frequency between each sampling cycle (C) – Pilbara IBRA.

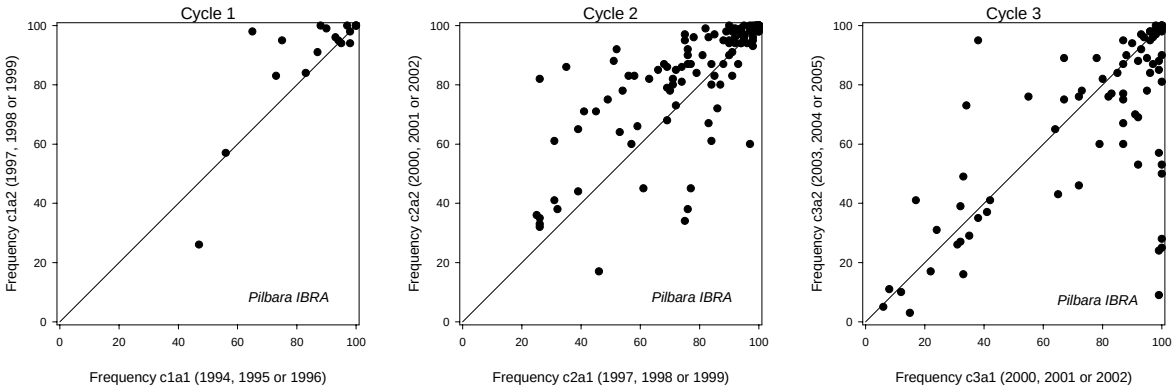


Table 1:153. Cycle 1 - percentage of sites in each seasonal category showing change in perennial grass frequency - Pilbara IBRA.

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency < 1.10	Increase. frequency ≥ 1.10	Number of sites
All years	All	6%	66%	28%	18
Above average	All	6%	66%	28%	18
Average	All	n/a	n/a	n/a	0
Below average	All	n/a	n/a	n/a	0

Table 1:154. Cycle 2 - percentage of sites in each seasonal category showing change in perennial grass frequency - Pilbara IBRA.

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency < 1.10	Increase. frequency ≥ 1.10	Number of sites
All years	All	8%	53%	39%	112
Above average	All	7%	46%	48%	61
Average	All	9%	56%	35%	34
Below average	All	12%	71%	18%	17

Table 1:155. Cycle 3 - percentage of sites in each seasonal category showing change in perennial grass frequency - Pilbara IBRA.

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency < 1.10	Increase. frequency ≥ 1.10	Number of sites
All years	All	39%	47%	14%	79
Above	All	n/a	n/a	n/a	0

average					
Average	All	24%	63%	13%	38
Below average	All	54%	32%	15%	41

Table 1:156. Weighted average across all three cycles - percentage of sites in each seasonal category showing change in perennial grass frequency. Only cycles containing at least 10 sites in each seasonal quality category were used. Pilbara IBRA.

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency < 1.10	Increase. frequency ≥ 1.10	Number of site by year combinations	Cycles used
All years	All	20%	52%	29%	209	1,2,3
Above average	All	7%	51%	43%	79	1,2
Average	All	17%	60%	23%	72	2,3
Below average	All	42%	43%	16%	58	2,3

Crown cover, woody species taller than 1m

Averages of frequency ratios can not be calculated because of the large number of crown cover estimates of zero (i.e. denominator = zero).

Table 1:157. Pilbara IBRA – summary of crown cover

Average crown cover cycle 3, assessment1 (c3a1)	2.72
Average crown cover cycle 3, assessment2 (c3a2)	3.14
* Crown cover: ratio c3a2 to c3a1, percentage of sites at least 1.0	66%
* Crown cover: ratio c3a2 to c3a1, percentage of sites <0.90	22%
* Crown cover: ratio c3a2 to c3a1, percentage of sites <0.50	10%

* Sites with zero crown cover at both c3a1 and c3a2 have not been included

Figure 1:49. Change in crown cover between each sampling cycle (C) – Pilbara IBRA.

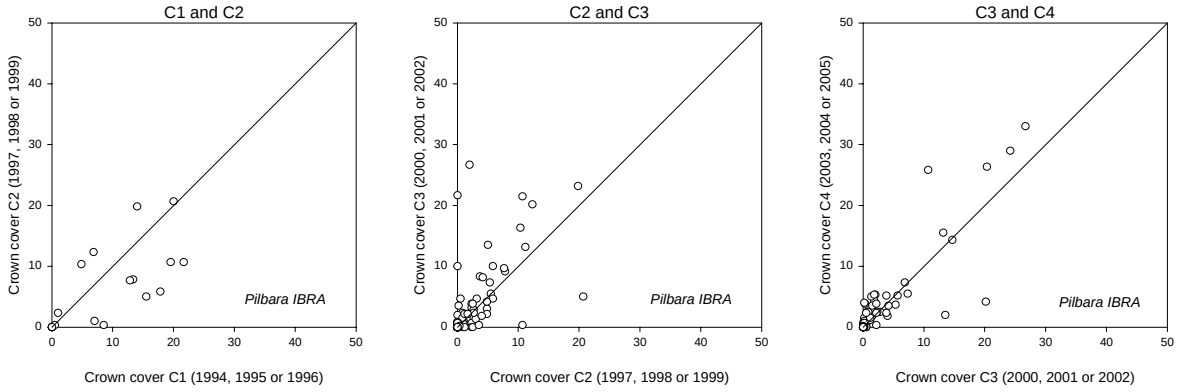


Table 1:158. Cycle 3 – percentage of sites in each seasonal quality category showing change in crown cover - Pilbara IBRA. Sites with zero crown cover have not been included.

Seasonal Quality	Species group	Crown cover <0.90	No change. ≤0.90 crown cover <1.10	Crown cover ≥1.10	Number of sites
All years	All	22%	20%	59%	41
Above average	All	n/a	n/a	n/a	0
Average	All	17%	33%	50%	18
Below average	All	26%	9%	65%	23

Resource Capture Index

Table 1:159. Pilbara IBRA – summary of resource capture index.

Number of sites assessed in cycle 3, assessment 1 (c3a1) and cycle 3, assessment 2 (c3a2)	75
Average Resource Capture Index - c3a1	0.11
Average Resource Capture Index – c3a2	0.09
Average ratio of Resource Capture Index – c3a2 to c3a1 +/- standard error of the mean	1.31 +/- 0.18
Resource Capture Index: ratio c3a2 to c3a1, percentage of sites at least 1.0	52%
Resource Capture Index: ratio c3a2 to c3a1, percentage of sites <0.90	45%
Resource Capture Index: ratio c3a2 to c3a1, percentage of sites <0.50	23%
Average Resource Capture Index: ratio c3a2 to c3a1 for above average seasonal quality	n/a
Average Resource Capture Index: ratio c3a2 to c3a1 for average seasonal quality	1.27
Average Resource Capture Index: ratio c3a2 to c3a1 for below average seasonal quality	1.35

Figure 1:50. Change in Resource Capture Index, cycle 3 – Pilbara IBRA.

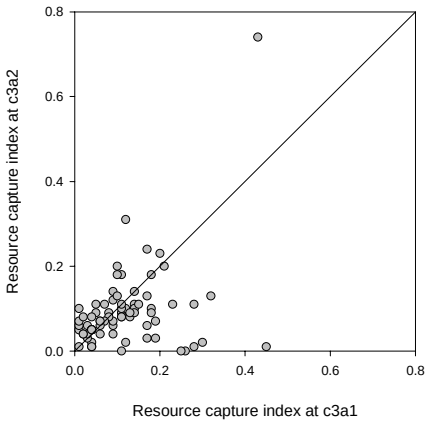


Table 1:160. Resource capture index – percentage of sites in each seasonal category showing change in the index - Pilbara IBRA, cycle 3.

Seasonal Quality	Species group	Decline. RCI < 0.90	No change. 0.90 ≤ RCI <1.10	Increase. RCI >=1.10	Number of sites
All years	All	45%	13%	41%	75
Above average	All	n/a	n/a	n/a	0
Average	All	34%	16%	50%	38
Below average	All	57%	11%	32%	37

Proportional landscape function - stability, infiltration and nutrient cycling indices

Table 1:161. Proportional landscape function indices – Pilbara IBRA, cycle 3.

	Stability index	Infiltration index	Nutrient cycling index
Number of sites assessed in c3a1 and c3a2	73	73	73
c3a1 average +/- standard error of the mean	46.4 +/- 0.91	38.1 +/- 0.75	23.4 +/- 0.68
c3a2 average +/- standard error of the mean	45.0 +/- 0.89	37.0 +/- 0.94	21.0 +/- 0.78
Ratio of index: average +/- standard error of the mean	0.99 +/- 0.02	0.98 +/- 0.02	0.92 +/- 0.03
Ratio of index: c3a2 to c3a1 percentage of sites at least 1.0	41%		36%
Ratio of index: c3a2 to c3a1 percentage of sites <0.90	30%		47%
Ratio of index: c3a2 to c3a1 percentage of sites <0.50	3%		5%
Average of index ratio: c3a2 to c3a1 for above average seasonal quality	n/a	n/a	n/a
Average of index ratio: c3a2 to c3a1 for average seasonal quality	0.96 +/- 0.02	0.95 +/- 0.02	0.89 +/- 0.04
Average of index ratio: c3a2 to c3a1 for below average seasonal	1.00 +/- 0.04	1.00 +/- 0.03	0.94 +/- 0.04

quality

Figure 1:51. Proportional landscape function - stability, infiltration and nutrient cycling indices, cycle3 – Pilbara IBRA. The top panes show all data, the lower panes show expanded views over limited ranges.

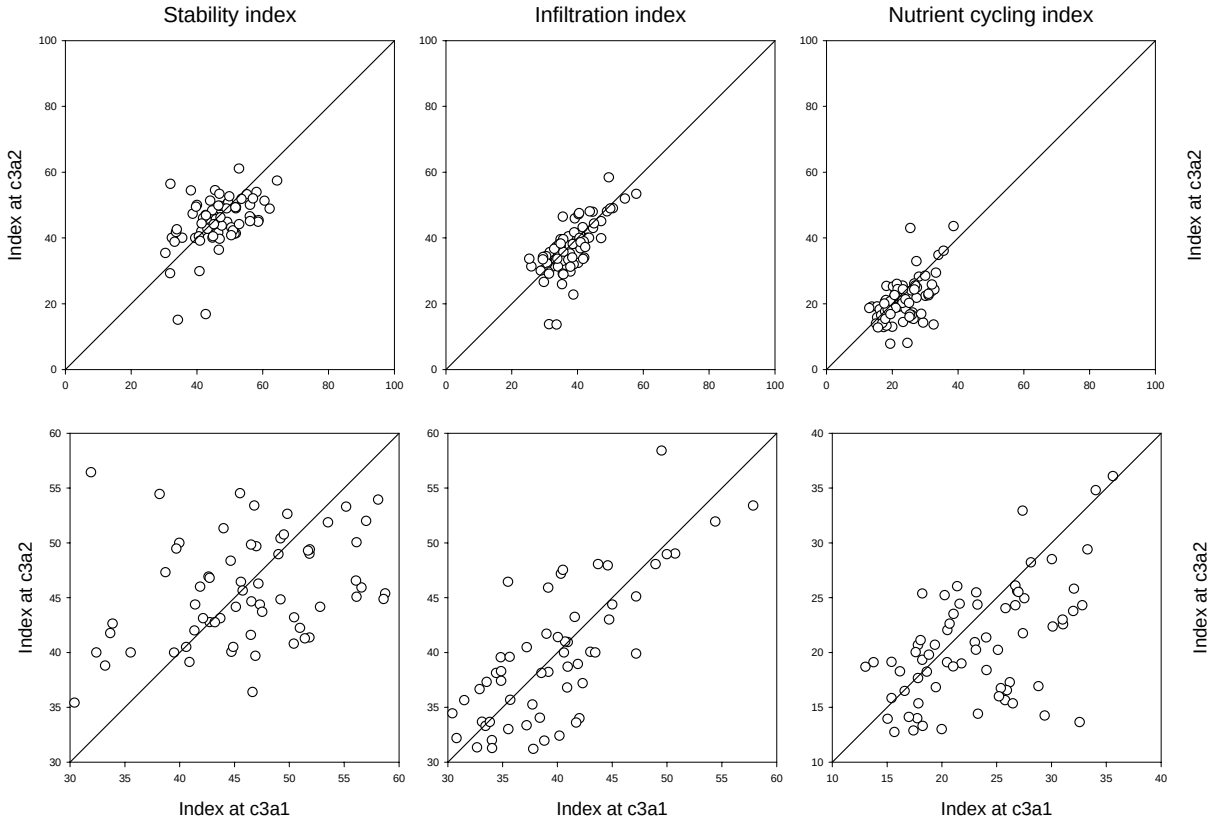


Table 1:162. Proportional landscape function - stability index –Pilbara IBRA. Ratio of stability index (RSI) at cycle 3, assessment 2 (c3a2) to index at cycle 3, assessment 1 (c3a1).

Seasonal Quality	Species group	Decline. RSI < 0.90	No change. 0.90>= RSI <1.10	Increase. RSI >=1.10	Number of sites
All years	All	30%	48%	22%	73
Above average	All	n/a	n/a	n/a	0
Average	All	32%	53%	15%	34
Below average	All	28%	44%	28%	39

Table 1:163. Proportional landscape function - infiltration index –Pilbara IBRA. Ratio of infiltration index (RII) at cycle 3, assessment 2 (c3a2) to index at cycle 3, assessment 1 (c3a1).

Seasonal Quality	Species group	Decline. RII < 0.90	No change. 0.90>= RII <1.10	Increase. RII >=1.10	Number of sites

All years	All	25%	55%	21%	73
Above average	All	n/a	n/a	n/a	0
Average	All	35%	50%	15%	34
Below average	All	15%	56%	28%	39

Table 1:164. Proportional landscape function – nutrient cycling index – Pilbara IBRA. Ratio of nutrient cycling index (RNCI) at cycle 3, assessment 2 (c3a2) to index at cycle 3, assessment 1 (c3a1).

Seasonal Quality	Species group	Decline. RNCI < 0.90	No change. 0.90>= RNCI <1.10	Increase. RNCI >=1.10	Number of sites
All years	All	47%	32%	22%	73
Above average	All	n/a	n/a	n/a	0
Average	All	53%	29%	18%	34
Below average	All	41%	33%	26%	39

Change in sustainable management of the pastoral estate – shrubland sites

Population growth rate (i.e. density) of Decreaser, Intermediate and Increaser species

Table 1:165. Summary of population growth rate of decreaser, intermediate and increaser species on shrubland sites – Pilbara3 sub-IBRA

PGR +/- standard error of the mean	1.41 +/- 0.43	1.21 +/- 0.13	2.50 +/- 0.47
PGR: Date 2 to Date 1 at least 1.0 – percentage of sites	40%	80%	90%
PGR: Date 2 to Date 1 <0.90 – percentage of sites	60%	20%	0%
PGR: Date 2 to Date 1 <0.50 – percentage of sites	20%	0%	0%
Average PGR Date 2 to Date 1 for above average seasonal quality	1.41	1.21	2.50
Average PGR Date 2 to Date 1 for average seasonal quality	n/a	n/a	n/a
Average PGR Date 2 to Date 1 for below average seasonal quality	n/a	n/a	n/a

Figure 1:52. Change in number of shrubs on each site by response category (shrubland sites), Pilbara3 sub-IBRA.

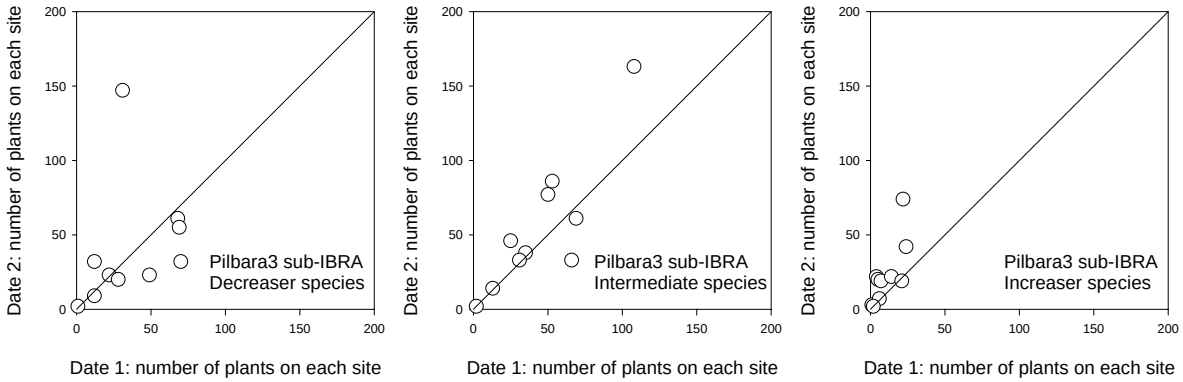


Table 1:166. Change in density between date 1 and date 2 of decreaser, intermediate and increaser shrub species – percentage of sites by seasonal category – Pilbara3 sub-IBRA.

Seasonal Quality	Species group	Decline. Density < 0.95	No change. 0.95>= density <1.05	Increase. Density >=1.05	Number of sites
All years	Decreaser	60%	10%	30%	10
	Intermediate	20%	40%	40%	10
	Increaser	0%	30%	70%	10
Above average	Decreaser	60%	10%	30%	10
	Intermediate	20%	40%	40%	10
	Increaser	0%	30%	70%	10
Average	Decreaser	n/a	n/a	n/a	0
	Intermediate	n/a	n/a	n/a	0
	Increaser	n/a	n/a	n/a	0
Below average	Decreaser	n/a	n/a	n/a	0
	Intermediate	n/a	n/a	n/a	0
	Increaser	n/a	n/a	n/a	0

Canopy area of Decreaser, Intermediate and Increaser species but restricted to plants less than 1.5 m in height

Table 1:167. Pilbara3 sub-IBRA – summary of canopy area for decreaser, intermediate and increaser species but restricted to plants less than 1.5 m in height.

Average change in cover +/- standard error of the mean	2.26 +/- 0.72	1.62 +/- 0.23	6.38 +/- 3.98
Cover: ratio Date 2 to Date 1 at least 1.0 – percentage of sites	60%	80%	80%
Cover: ratio Date 2 to Date 1 <0.90 – percentage of sites	40%	20%	10%
Cover: ratio Date 2 to Date 1 <0.50 – percentage of sites	10%	10%	0%
Average cover ratio Date 2 to Date 1 for above average seasonal quality	2.26	1.62	6.38

Average cover ratio Date 2 to Date 1 for average seasonal quality	n/a	n/a	n/a
Average cover ratio Date 2 to Date 1 for below average seasonal quality	n/a	n/a	n/a

Figure 1:53. Canopy area by site – Decreaser, Intermediate and Increaser species but restricted to plants less than 1.5 m in height – Pilbara3 sub-IBRA.

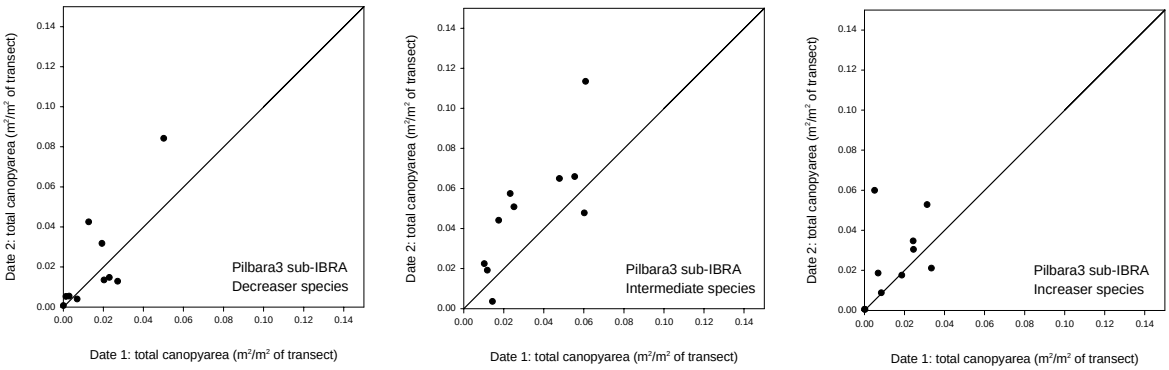


Table 1:168. Pilbara3 sub-IBRA – percentage of sites in each seasonal category showing change in canopy area for decreaser, intermediate and increaser species but restricted to plants less than 1.5 m in height.

Seasonal Quality	Species group	Decline. Total canopy area <0.90	No change. 0.90>= total canopy area <1.10	Increase. total canopy area >=1.10	Number of sites
All years	Decreaser	40%	0%	60%	10
	Intermediate	20%	0%	80%	10
	Increaser	10%	20%	70%	10
Above average	Decreaser	40%	0%	60%	10
	Intermediate	20%	0%	80%	10
	Increaser	10%	20%	70%	10
Average	Decreaser	n/a	n/a	n/a	0
	Intermediate	n/a	n/a	n/a	0
	Increaser	n/a	n/a	n/a	0
Below average	Decreaser	n/a	n/a	n/a	0
	Intermediate	n/a	n/a	n/a	0
	Increaser	n/a	n/a	n/a	0

Change in sustainable management of the pastoral estate – grassland sites

Frequency of Decreaser, Intermediate and Increaser perennial grass species

Table 1:169. Summary of frequency of decreaser, intermediate and increaser perennial grass species, Pilbara IBRA, cycle 3.

Average change in frequency +/- standard error of the mean	0.97 +/- 0.05	4.83 +/- 3.96	1.57 +/- 0.46
Frequency: ratio c3a2 to c3a1, percentage of sites ≥ 1.0	40%	43%	n/a
Frequency: ratio c3a2 to c3a1, percentage of sites <0.90	40%	48%	n/a
Frequency: ratio c3a2 to c3a1, percentage of sites <0.50	9%	19%	n/a
Average change in frequency: c3a2 to c3a1, above average seasonal quality	n/a	n/a	n/a
Average change in frequency: c3a2 to c3a1, average seasonal quality	0.99	0.94	0.92
Average change in frequency: c3a2 to c3a1, below average seasonal quality	0.95	n/a	n/a

Figure 1:54. Change in perennial grass frequency between, cycle 3 – decreaser, intermediate and increaser species

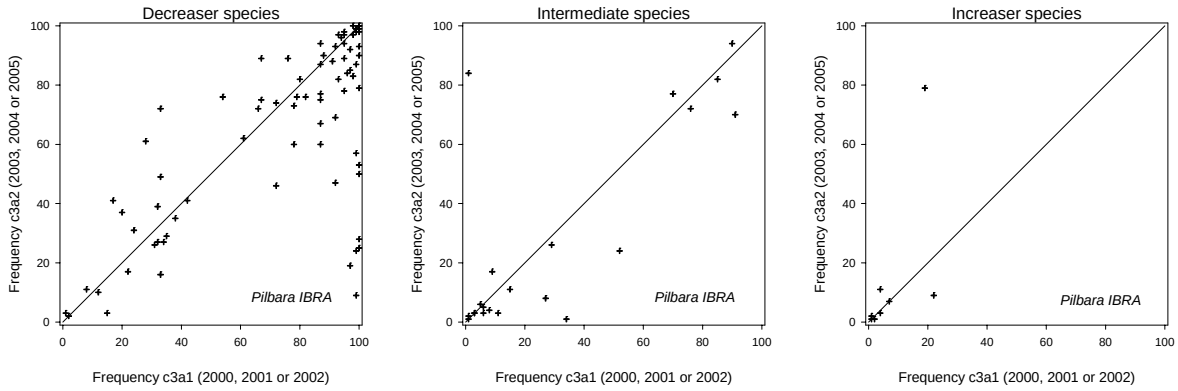


Table 1:170. Change in frequency of decreaser, intermediate and increaser perennial grass species – percentage of sites in each seasonal category – Pilbara IBRA, cycle 1

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency <1.10	Increase. frequency ≥1.10	Number of sites
All years	Decreaser	6%	65%	29%	17
	Intermediate	n/a	n/a	n/a	8
	Increaser	n/a	n/a	n/a	3
Above average	Decreaser	6%	65%	29%	17
	Intermediate	n/a	n/a	n/a	8
	Increaser	n/a	n/a	n/a	3
Average	Decreaser	n/a	n/a	n/a	0
	Intermediate	n/a	n/a	n/a	0
	Increaser	n/a	n/a	n/a	0
Below average	Decreaser	n/a	n/a	n/a	0
	Intermediate	n/a	n/a	n/a	0
	Increaser	n/a	n/a	n/a	0

Table 1:171. Change in frequency of decreaser, intermediate and increaser perennial grass species – percentage of sites in each seasonal category - Pilbara IBRA, cycle 2

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency <1.10	Increase. frequency ≥1.10	Number of sites
All years	Decreaser	10%	50%	40%	107
	Intermediate	19%	19%	61%	31
	Increaser	33%	33%	33%	12
Above average	Decreaser	8%	40%	52%	60
	Intermediate	22%	17%	61%	18
	Increaser	n/a	n/a	n/a	3
Average	Decreaser	13%	55%	32%	31
	Intermediate	10%	20%	70%	10
	Increaser	n/a	n/a	n/a	6
Below average	Decreaser	13%	75%	13%	16
	Intermediate	n/a	n/a	n/a	3
	Increaser	n/a	n/a	n/a	3

Table 1:172. Change in frequency of decreaser, intermediate and increaser perennial grass species – percentage of sites in each seaconal category - Pilbara IBRA, cycle 3

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency <1.10	Increase. frequency ≥1.10	Number of sites
All years	Decreaser	40%	43%	17%	77
	Intermediate	48%	29%	24%	21
	Increaser	n/a	n/a	n/a	8
Above average	Decreaser	n/a	n/a	n/a	0
	Intermediate	n/a	n/a	n/a	0
	Increaser	n/a	n/a	n/a	0
Average	Decreaser	22%	65%	14%	37
	Intermediate	43%	36%	21%	14
	Increaser	n/a	n/a	n/a	3
Below average	Decreaser	58%	23%	20%	40
	Intermediate	n/a	n/a	n/a	7
	Increaser	n/a	n/a	n/a	5

Table 1:173. Weighted average across all three cycles - change in frequency of decreaser, intermediate and increaser perennial grass species – percentage of sites in each seasonal category - Pilbara IBRA.

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency <1.10	Increase. frequency ≥1.10	Number of sites	Cycles used
All years	Decreaser	21%	49%	30%	201	1,2,3
	Intermediate	31%	23%	46%	52	2,3
	Increaser	33%	33%	33%	12	1
Above average	Decreaser	8%	46%	47%	77	1,2
	Intermediate	22%	17%	61%	18	2
	Increaser	n/a	n/a	n/a	n/a	n/a
Average	Decreaser	18%	60%	22%	68	2,3
	Intermediate	33%	29%	41%	24	2,3

	Increaser	n/a	n/a	n/a	n/a	n/a
Below average	Decreaser	45%	38%	18%	56	2,3
	Intermediate	n/a	n/a	n/a	n/a	n/a
	Increaser	n/a	n/a	n/a	n/a	n/a

Change in vegetation richness and occurrence – shrubland sites

Native shrub species richness

Table 1:174. Pilbara3 sub-IBRA – summary of native shrub species richness

Number of sites assessed	10
Average number of species per site – Date 1	9.6 +/- 0.64
Average number of species per site – Date 2	10.3 +/- 0.82
Average ratio of species richness: Date 2 to Date 1 +/- standard error of the mean	1.07 +/- 0.05
Species richness: ratio Date 2 to Date 1 at least 1.0 – percentage of sites	80%
Species richness: ratio Date 2 to Date 1 <0.90 – percentage of sites	20%
Species richness: ratio Date 2 to Date 1 <0.50 – percentage of sites	0%

Figure 1:55. Change in shrub species richness on each site between Date 1 and Date 2 – Pilbara3 sub-IBRA. Bubble size represents number of sites at each x,y point.

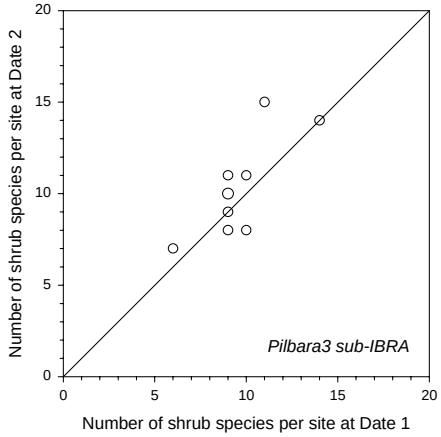


Table 1:175. Native species shrub richness Pilbara3 sub-IBRA- date 2 to divided by date 1.

Seasonal Quality	Species group	Decline. Richness index < 0.80	No change. 0.80 ≤ Richness index <1.20	Increase. Richness index ≥1.20	Number of sites

All years	All	0%	80%	20%	10
Above average	All	0%	80%	20%	10
Average	All	n/a	n/a	n/a	0
Below average	All	n/a	n/a	n/a	0

Frequency of occurrence

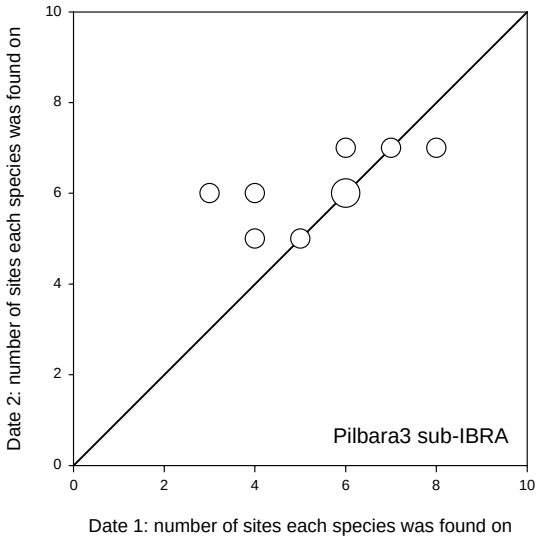
Table 1:176. Pilbara3 sub-IBRA – shrubland sites – species found on at least five sites at Date 1 or Date 2.

Number of species	9
Occurrence ratio Date 2 to Date 1 at least 1.0 – percentage of species	89%
Occurrence ratio Date 2 to Date 1 >1.10 – percentage of species	44%
Occurrence ratio Date 2 to Date 1 < 0.90 – percentage of species	11%
Occurrence ratio Date 2 to Date 1 < 0.50 – percentage of species	11%
Average change in occurrence ratio	1.20

Table 1:177. Species with occurrence ratio greater than 1.1 or less than 0.90 and found on at least 10 sites at Date 1 or Date 2 – Pilbara3 sub-IBRA.

SPECIES_NAME	DESIR	TR_C	No_pop	No_pop	OR
Nil					

Figure 1:56. Frequency of occurrence for all species found on at least five sites in the Pilbara3 sub-IBRA.



Change in vegetation richness and occurrence – grassland sites

Native perennial species richness

Table 1:178. Pilbara IBRA – summary of native perennial species richness, cycle 3

Number of sites assessed in cycle 3, assessment 1 and cycle3 assessment 2 (c3a1 & c3a2)	77
Average number of native perennial species per site at c3a1 – for sites assessed in both c3a1 and c3a2: +/- standard error of the mean	2.6 +/- 0.18
Average number of native perennial species per site in c3a2 – for sites assessed in both c3a1 and c3a2: +/- standard error of the mean	2.4 +/- 0.17
Average ratio of species richness: c3a2 to c3a1: +/- standard error of the mean	1.03 +/- 0.06
Species richness: ratio c3a2 to c3a1, percentage of sites at least 1.0	70%
Species richness: ratio c3a2 to c3a1, percentage of sites <0.90	30%
Species richness: ratio c3a2 to c3a1, percentage of sites <0.50	6%

Figure 1:57. Change in species richness on each site between each sampling cycle – Pilbara IBRA. Bubble size represents number of sites at each x,y point.

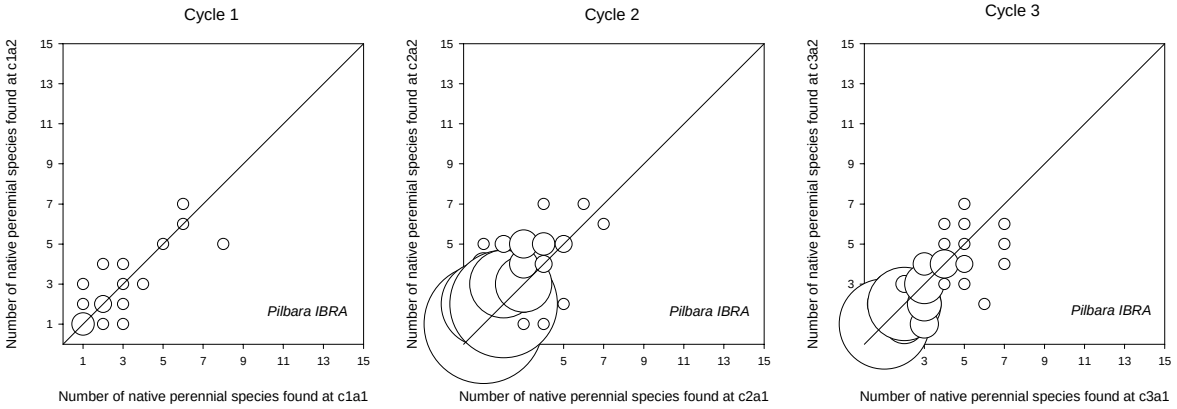


Table 1:179. Cycle 1 - native perennial species richness Pilbara IBRA - c1a2 divided by c1a1.

Seasonal Quality	Species group	Decline. Richness index < 0.80	No change. 0.80 ≤ Richness index <1.20	Increase. Richness index ≥1.20	Number of sites
All years	All	28%	50%	22%	18
Above average	All	28%	50%	22%	18
Average	All	n/a	n/a	n/a	0
Below average	All	n/a	n/a	n/a	0

Table 1:180. Cycle 2 - native perennial species richness Pilbara IBRA - c2a2 divided by c2a1.

Seasonal Quality	Species group	Decline. Richness index < 0.80	No change. 0.80 ≤ Richness index <1.20	Increase. Richness index ≥1.20	Number of sites
All years	All	7%	48%	45%	111
Above average	All	7%	45%	48%	60
Average	All	0%	59%	41%	34
Below average	All	24%	35%	41%	17

Table 1:181. Cycle 3 - native perennial species richness Pilbara IBRA - c3a2 divided by c3a1.

Seasonal Quality	Species group	Decline. Richness index < 0.80	No change. 0.80 ≤ Richness index <1.20	Increase. Richness index ≥1.20	Number of sites
All years	All	26%	53%	21%	77
Above average	All	n/a	n/a	n/a	0
Average	All	30%	51%	19%	37
Below average	All	23%	55%	23%	40

Table 1:182. Weighted average across all three cycles - native perennial species richness Pilbara IBRA.

Seasonal Quality	Species group	Decline. Richness index < 0.80	No change. 0.80 ≤ Richness index <1.20	Increase. Richness index ≥1.20	Number of sites	Cycles used
All years	All	16%	50%	34%	206	1,2,3
Above average	All	12%	46%	42%	78	1,2,3
Average	All	16%	55%	30%	71	2,3
Below average	All	23%	49%	28%	57	2,3

Frequency of occurrence – native species

Table 1:183. Pilbara IBRA – species found on at least five sites at either the first or second assessment of each cycle and on at least one site at the first assessment date of each cycle.

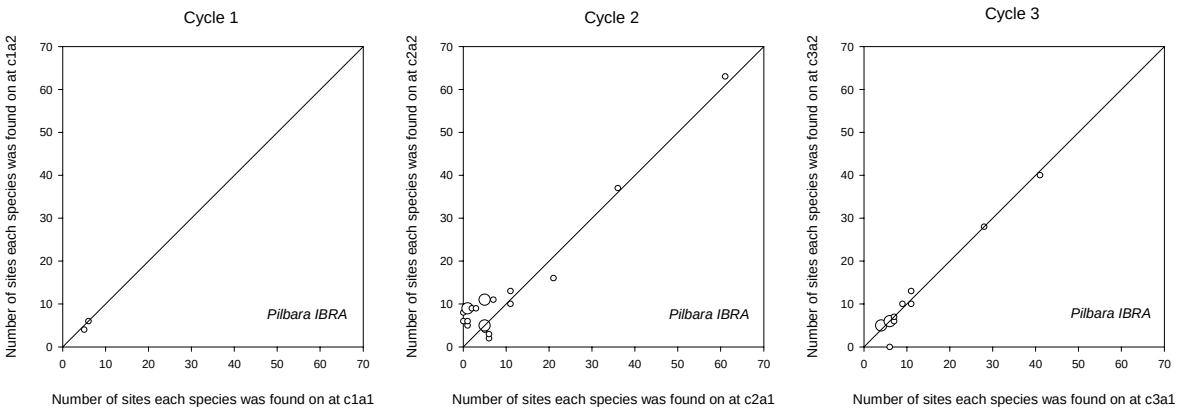
	c1a1 & c1a2	c2a1 & c2a2	c3a1 & c3a2
Number of species	2	19	12
Average number of sites each species was found on	n/a	10.2 +/- 3.42	11.7 +/- 3.25
Average number of sites each species was found on	n/a	12.5 +/- 3.29	11.4 +/- 3.29

Occurrence ratio at least 1.0 – percentage of species	n/a	74%	67%
Occurrence ratio >1.10 – percentage of species	n/a	53%	33%
Occurrence ratio < 0.90 – percentage of species	n/a	21%	17%
Occurrence ratio < 0.50 – percentage of species	n/a	5%	8%
Average occurrence ratio +/- standard error of the mean	n/a	2.69 +/- 0.63	0.96 +/- 0.09

Table 1:184. Native species found on WARMS sites within the Pilbara IBRA. Data were filtered to include only those species found on at least five sites at any of the assessments, and on at least one site at the first assessment of each of the three sampling cycles. The table shows the number of sites each species was found on and the number of sites assessed at the first and second assessment of each cycle.

SPECIES_NAME	c1a1 & c1a2	c2a1 & c2a2	c3a1 & c3a2	ratio c1a2/ c1a1	ratio c2a2/ c2a1	ratio c3a1/ c3a2
Acacia ancistrocarpa	1 then 1 of 18	1 then 9 of 112	4 then 2 of 79	1.00	9.00	0.50
Acacia bivenosa		1 then 5 of 112	3 then 1 of 79		5.00	0.33
Acacia inaequilatera		3 then 9 of 112	7 then 6 of 79		3.00	0.86
Acacia translucens	1 then 1 of 18	2 then 9 of 112	9 then 10 of 79	1.00	4.50	1.11
Acacia victoriae	5 then 4 of 18	5 then 11 of 112	6 then 6 of 79	0.80	2.20	1.00
Chrysopogon fallax	1 then 3 of 18	21 then 16 of 112	11 then 13 of 79	3.00	0.76	1.18
Eragrostis setifolia	2 then 4 of 18	6 then 3 of 112	6 then 0 of 79	2.00	0.50	0.00
Eragrostis xerophila	6 then 6 of 18	36 then 37 of 112	41 then 40 of 79	1.00	1.03	0.98
Eriachne benthamii	1 then 1 of 18	5 then 11 of 112	11 then 10 of 79	1.00	2.20	0.91
Eriachne flaccida	1 then 2 of 18	6 then 2 of 112		2.00	0.33	
Eriachne helmsii		11 then 13 of 112	3 then 0 of 79		1.18	0.00
Eriachne obtusa		5 then 4 of 112	3 then 4 of 79		0.80	1.33
Hakea suberea		1 then 6 of 112	4 then 2 of 79		6.00	0.50
Indigofera monophylla		1 then 9 of 112	4 then 5 of 79		9.00	1.25
Solanum lasiophyllum	2 then 1 of 18	1 then 3 of 112	6 then 6 of 79	0.50	3.00	1.00
Triodia basedowii	2 then 2 of 18	5 then 5 of 112	4 then 5 of 79	1.00	1.00	1.25
Triodia longiceps	1 then 1 of 18	5 then 5 of 112	3 then 2 of 79	1.00	1.00	0.67
Triodia pungens	3 then 3 of 18	61 then 63 of 112	28 then 28 of 79	1.00	1.03	1.00
Triodia schinzii	1 then 1 of 18	7 then 11 of 112	4 then 3 of 79	1.00	1.57	0.75
Triodia wiseana	1 then 1 of 18	11 then 10 of 112	7 then 7 of 79	1.00	0.91	1.00

Figure 1:58. Frequency of occurrence for all native species found on at least five sites at either the first or second sampling, for each cycle – Pilbara IBRA. Bubble size represents number of sites at each x,y point.



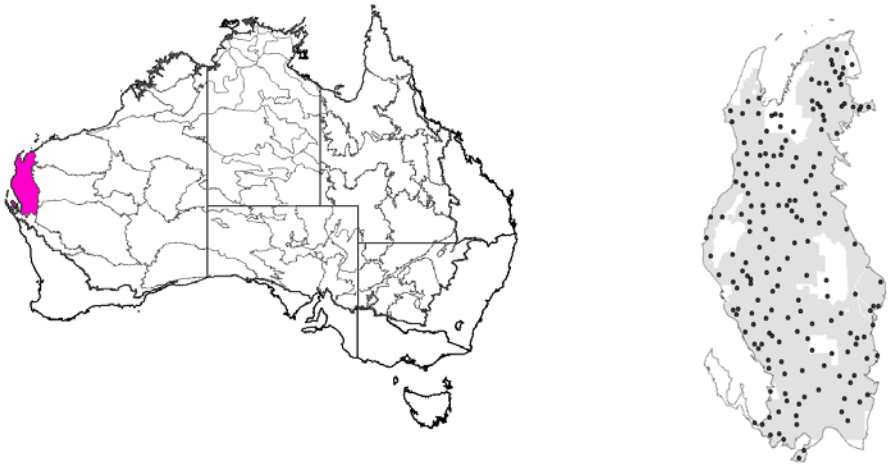
Southern shrublands region

The southern shrublands region is a general term for the Carnarvon, Coolgardie, Gascoyne, Murchison, Nullarbor and Yalgoo IBRAs. Carnarvon IBRA

Carnarvon IBRA

For shrubland sites, data from both Carnarvon sub-IBRAs were pooled and the complete Carnarvon IBRA is reported. For grassland sites, only Carnarvon1 sub-IBRA is reported

Figure 1:59. Location of Carnarvon IBRA (left) and WARMS sites in the IBRA (right). Greyed areas are pastoral tenure.



Site and seasonal summary

Table 1:185. Carnarvon IBRA – shrubland sites – total number of sites and dates assessed

Number of shrubland sites assessed	127
Number of shrubland sites in CAR1 (Cape Range)	13
Number of shrubland sites in CAR2 (Wooramel)	114
Date 1: first assessment (installation)	23/5/94 to 5/6/00
Date 2: second assessment	1/6/00 to 3/6/05
Above average seasonal quality – percentage of sites	48%
Average seasonal quality – percentage of sites	46%
Below average seasonal quality – percentage of sites	6%

Table 1:186. Carnarvon1 sub-IBRA – grassland sites – total number of sites and dates assessed.

Number of grassland sites assessed	55
Number of grassland sites assessed in CAR1 (Cape Range)	**48**
Number of grassland sites assessed in CAR2 (Wooramel)	7
First assessment (installation): CAR1	17/05/94 to 25/11/96
Second assessment: CAR1	10/03/97 to 13/09/99
Third assessment: CAR1	22/06/00 to 02/07/02
Fourth assessment: CAR1	17/06/04 to 03/06/05

Table 1:187. Carnarvon1 sub-IBRA – grassland sites – seasonal category and number of sites assessed in each cycle.

	Cycle1	Cycle 2	Cycle 3
Number of grassland sites assessed	35	30	29
Above average seasonal quality - – percentage of sites	100%	3%	0%
Average seasonal quality - – percentage of sites	0%	0%	0%
Below average seasonal quality – percentage of sites	0%	97%	100%

Change in landscape function – shrubland sites

Population growth rate (i.e. density)

Table 1:188. Carnarvon IBRA – shrubland sites – summary of population growth rate (i.e. density)

Average Population growth rate +/- standard error of the mean	1.20 +/- 0.03
PGR at least 1.0 – percentage of sites	75%
PGR <0.90 – percentage of sites	12%
PGR <0.50 – percentage of sites	2%

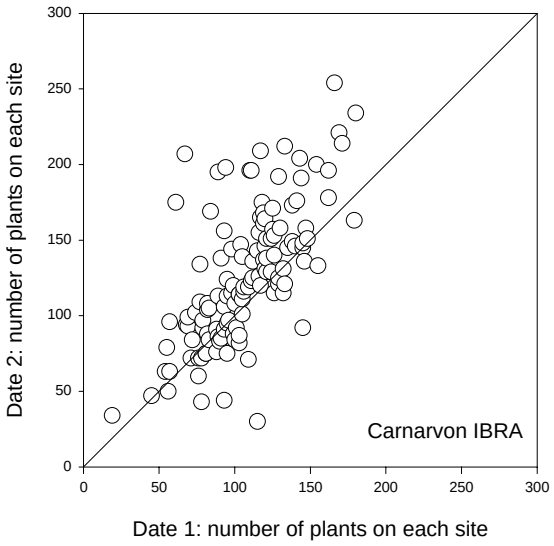


Table 1:189. Carnarvon IBRA – percentage of sites in each seasonal category showing change in shrub density (shrubland sites)

Seasonal Quality	Species group	Decline. Density < 95%	No change. Density between 95% and 105%	Increase. Density >=105%	Number of sites
All years	All	21%	13%	65%	127
Above average	All	5%	3%	92%	61
Average	All	36%	22%	42%	59
Below average	All	n/a	n/a	n/a	7

Canopy area

Table 1:190. Carnarvon IBRA – summary of canopy area (shrubland sites)

Average change in cover +/- standard error of the mean	1.55 +/- 0.05
Cover: ratio Date 2 to Date 1 at least 1.0 – percentage of sites	94%
Cover: ratio Date 2 to Date 1 <0.90 – percentage of sites	5%
Cover: ratio Date 2 to Date 1 <0.50 – percentage of sites	0%
Average cover ratio Date 2 to Date 1 for above average seasonal quality	1.76
Average cover ratio Date 2 to Date 1 for average seasonal quality	1.34
Average cover ratio Date 2 to Date 1 for below average seasonal quality	1.32

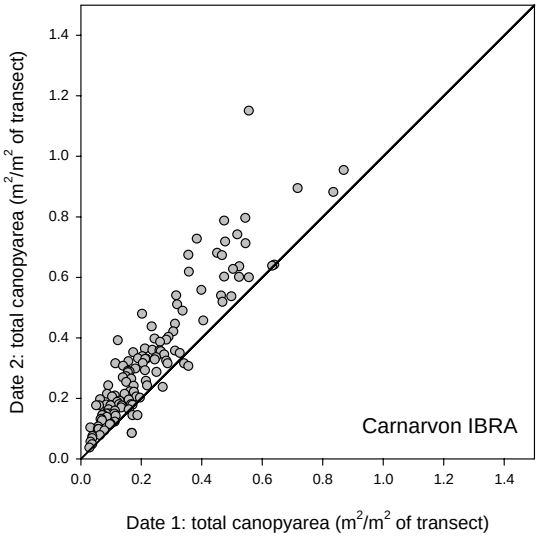


Table 1:191. Carnarvon IBRA – percentage of shrubland sites in each seasonal category showing change in canopy area of shrubs

Seasonal Quality	Species group	Decline. Total canopy area < 0.90	No change. 0.90>= total canopy area <1.10	Increase. total canopy area >=1.10	Number of sites
All years	All	5%	11%	84%	127
Above average	All	2%	5%	93%	61
Average	All	7%	17%	76%	59
Below average	All	n/a	n/a	n/a	7

Canopy area but restricted to plants less than 1.5 m in height

Table 1:192 Carnarvon IBRA – summary of canopy area (shrubland sites), but restricted to plants less than 1.5 m in height

Average change in cover +/- standard error of the mean	1.66 +/- 0.05
Cover: ratio Date 2 to Date 1 at least 1.0 – percentage of sites	90%
Cover: ratio Date 2 to Date 1 <0.90 – percentage of sites	6%
Cover: ratio Date 2 to Date 1 <0.50 – percentage of sites	1%
Average cover ratio Date 2 to Date 1 for above average seasonal quality +/- standard error of the mean	1.90 +/- 0.08
Average cover ratio Date 2 to Date 1 for average seasonal quality +/- standard error of the mean	1.46 +/- 0.06
Average cover ratio Date 2 to Date 1 for below average seasonal quality +/- standard error of the mean	n/a

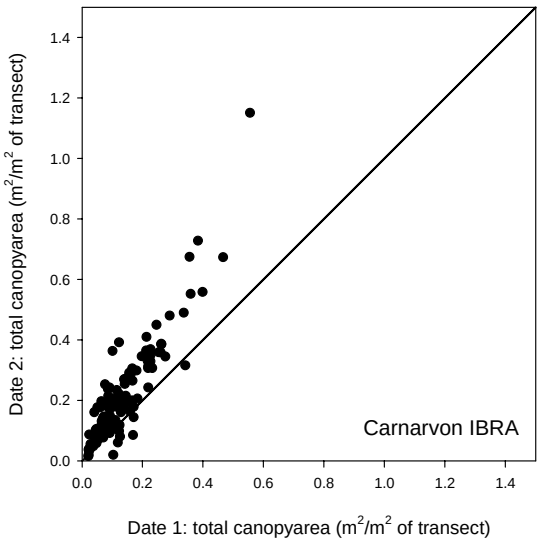


Table 1:193. Carnarvon IBRA – percentage of shrubland sites in each seasonal category showing change in canopy area of shrubs, but restricted to plants less than 1.5 m in height

Seasonal Quality	Species group	Decline. Total canopy area <0. 90	No change. 0.90>= total canopy area <1.10	Increase. total canopy area >=1.10	Number of sites
All years	All	6%	6%	88%	127
Above average	All	2%	2%	97%	61
Average	All	10%	8%	81%	59
Below average	All	n/a	n/a	n/a	7

Resource Capture Index

Table 1:194. Carnarvon IBRA – summary of resource capture index, shrubland sites.

Number of sites with useable data at both dates	32
Average change in Resource Capture Index +/- standard error of the mean	0.65 +/- 0.06
Cover: ratio Date 2 to Date 1 at least 1.0 – percentage of sites	13%
Cover: ratio Date 2 to Date 1 <0.90 – percentage of sites	81%
Cover: ratio Date 2 to Date 1 <0.50 – percentage of sites	28%

Average cover ratio Date 2 to Date 1 for above average seasonal quality	n/a
Average cover ratio Date 2 to Date 1 for average seasonal quality	0.61
Average cover ratio Date 2 to Date 1 for below average seasonal quality	n/a

Figure 1:60. Change in Resource Capture Index between Date 1 and Date 2 – Carnarvon IBRA.

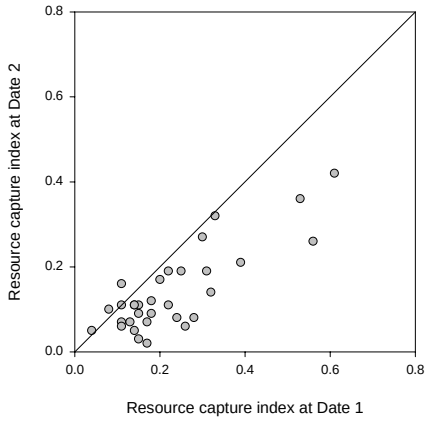


Table 1:195. Resource capture index – percentage of sites in each seasonal category showing change in the index – Carnarvon IBRA, shrubland sites

Seasonal Quality	Species group	Decline. RCI < 0.90	No change. 0.90 ≤ RCI <1.10	Increase. RCI ≥ 1.10	Number of sites
All years	All	81%	9%	9%	32
Above average	All	n/a	n/a	n/a	5
Average	All	88%	8%	4%	25
Below average	All	n/a	n/a	n/a	2

Proportional landscape function - stability, infiltration and nutrient cycling indices

Table 1:196. Summary - proportional landscape function indices – Carnarvon IBRA.

	Stability index	Infiltration index	Nutrient cycling index
Number of sites with useable data at both dates	34	34	34
Date 1 average +/- standard error of the mean	52.4 +/- 0.93	43.1 +/- 0.77	24.5 +/- 0.89
Date 2 average +/- standard error of the mean	50.4 +/- 0.85	41.6 +/- 0.73	19.1 +/- 0.62
Ratio of index: average +/- standard error of the mean	0.97 +/- 0.02	0.97 +/- 0.02	0.80 +/- 0.03
Ratio of index: Date 2 to Date 1 at least 1.0 – percentage of sites	24%	24%	9%
Ratio of index: : Date 2 to Date 1 <0.90 – percentage of sites	21%	15%	79%

Ratio of index: Date 2 to Date 1 <0.50 – percentage of sites	0%	0%	3%
Average of index ratio: Date 2 to Date 1 for above average seasonal quality	n/a	n/a	n/a
Average of index ratio: Date 2 to Date 1 for average seasonal quality	0.98 +/- 0.02	0.97 +/- 0.02	0.785 +/ 0.03
Average of index ratio: Date 2 to Date 1 for below average seasonal quality	n/a	n/a	n/a

Figure 1:61. Proportional landscape function - stability, infiltration and nutrient cycling indices at Date 1 and Date 2 – Carnarvon IBRA. The top panes show all data, the lower panes show expanded views over limited ranges.

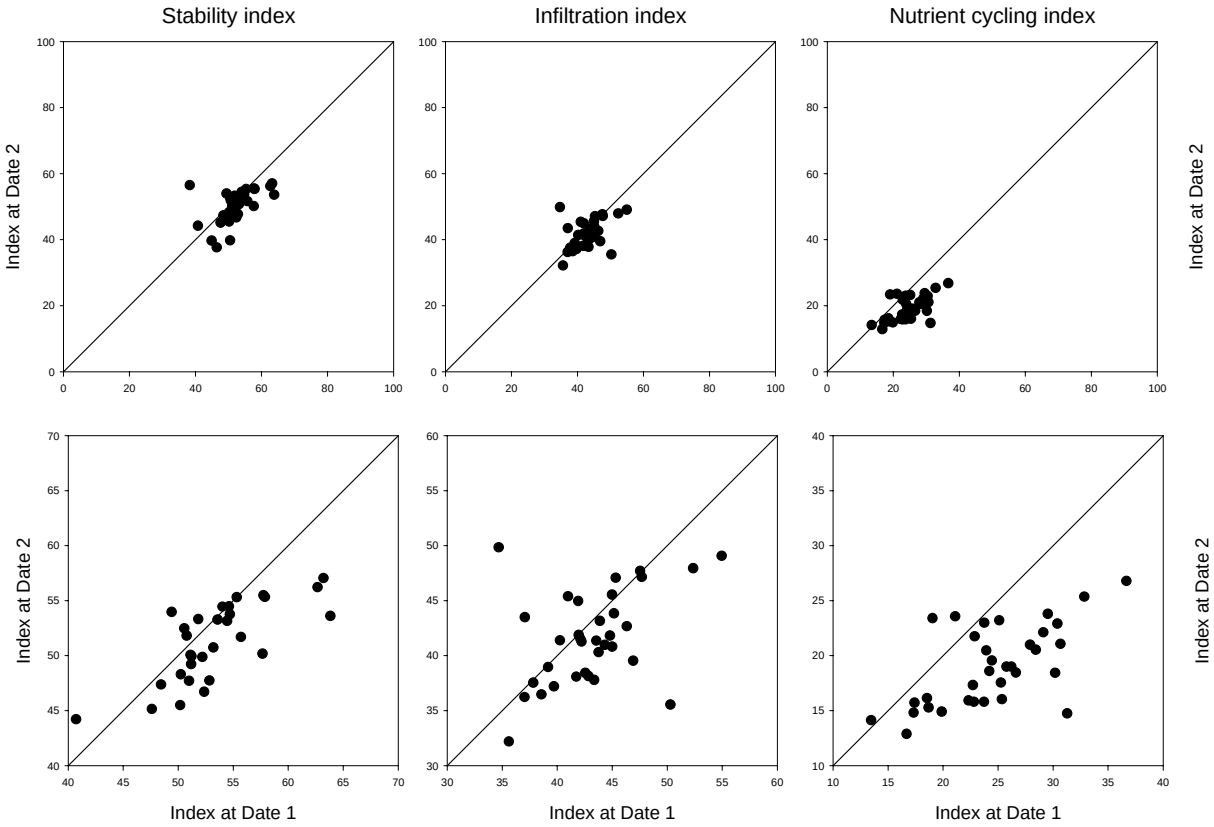


Table 1:197. Proportional landscape function - stability index - Carnarvon IBRA. Ratio of index at Date 2 to index at Date 1 (Ratio of Stability Index – RSI).

Seasonal Quality	Species group	Decline. RSI < 0.90	No change. 0.90>= RSI <1.10	Increase. RSI >=1.10	Number of sites
All years	All	21%	76%	3%	34
Above average	All	n/a	n/a	n/a	6
Average	All	19%	77%	4%	26
Below	All	n/a	n/a	n/a	2

average					

Table 1:198. Proportional landscape function - infiltration index - Carnarvon IBRA. Ratio of index at Date 2 to index at Date 1 (Ratio of Infiltration Index – RII).

Seasonal Quality	Species group	Decline. RII < 0.90	No change. 0.90>= RII <1.10	Increase. RII >=1.10	Number of sites
All years	All	15%	76%	9%	34
Above average	All	n/a	n/a	n/a	6
Average	All	19%	77%	4%	26
Below average	All	n/a	n/a	n/a	2

Table 1:199. Proportional landscape function – nutrient cycling index - Carnarvon IBRA. Ratio of index at Date 2 to index at Date 1 (Ratio of Nutrient Cycling Index – RNCI).

Seasonal Quality	Species group	Decline. RNCI < 0.90	No change. 0.90>= RNCI <1.10	Increase. RNCI >=1.10	Number of sites
All years	All	79%	15%	6%	34
Above average	All	n/a	n/a	n/a	6
Average	All	85%	8%	8%	26
Below average	All	n/a	n/a	n/a	2

Change in landscape function – grassland sites

Perennial grass frequency

Table 1:200. Carnarvon1 sub-IBRA – summary of perennial grass frequency.

	Cycle 1	Cycle 2	Cycle 3
Average frequency: first assessment of cycle +/- standard error of the mean	76.3 +/- 4.09	83.3 +/- 3.38	77.1 +/- 4.08
Average frequency: second assessment of cycle +/- standard error of the mean	87.0 +/- 2.90	78.9 +/- 3.87	58.2 +/- 5.10
Average frequency ratio between the two assessments +/- standard error of the mean	1.25 +/- 0.07	0.96 +/- 0.04	0.78 +/- 0.06
Frequency ratio at least 1.0 – percentage of sites	89%	40%	24%
Frequency ratio <0.90 – percentage of sites	0%	23%	62%
Frequency ratio <0.50 – percentage of sites	0%	3%	21%

Figure 1:62. Change in perennial grass frequency between each sampling cycle (C) – Carnarvon1 sub-IBRA.

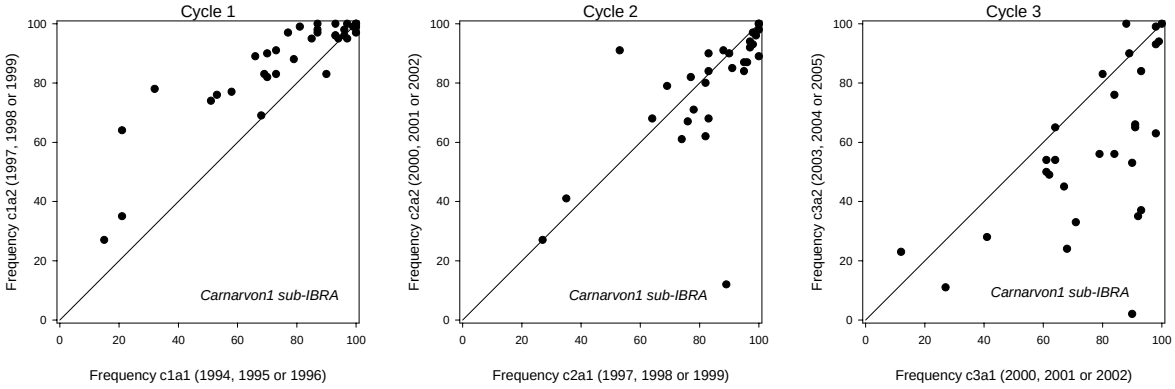


Table 1:201. Cycle 1 - percentage of sites in each seasonal category showing change in perennial grass frequency – Carnarvon1 sub-IBRA.

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency < 1.10	Increase. frequency ≥ 1.10	Number of sites
All years	All	0%	43%	57%	35
Above average	All	0%	43%	57%	35
Average	All	n/a	n/a	n/a	0
Below average	All	n/a	n/a	n/a	0

Table 1:202. Cycle 2 - percentage of sites in each seasonal category showing change in perennial grass frequency – Carnarvon1 sub-IBRA.

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency < 1.10	Increase. frequency ≥ 1.10	Number of sites
All years	All	23%	67%	10%	30
Above average	All	n/a	n/a	n/a	1
Average	All	n/a	n/a	n/a	0
Below average	All	24%	69%	7%	29

Table 1:203. Cycle 3 - percentage of sites in each seasonal category showing change in perennial grass frequency – Carnarvon1 sub-IBRA.

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency <	Increase. frequency ≥ 1.10	Number of sites

			1.10		
All years	All	62%	31%	7%	29
Above average	All	n/a	n/a	n/a	0
Average	All	n/a	n/a	n/a	0
Below average	All	62%	31%	7%	29

Table 1:204. Weighted average across all three cycles - percentage of sites in each seasonal category showing change in perennial grass frequency. Only cycles containing at least 10 sites in each seasonal quality category were used. Carnarvon1 sub-IBRA.

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency < 1.10	Increase. frequency ≥ 1.10	Number of site by year combinations	Cycles used
All years	All	26%	47%	27%	94	1,2,3
Above average	All	0%	43%	57%	35	1
Average	All	n/a	n/a	n/a	n/a	n/a
Below average	All	43%	50%	7%	58	2,3

Crown cover, woody species taller than 1m

Averages of frequency ratios can not be calculated because of the large number of crown cover estimates of zero (i.e. denominator = zero).

Table 1:205. Carnarvon1 sub-IBRA – summary of crown cover

Average crown cover cycle 3, assessment1 (c3a1)	4.55
Average crown cover cycle 3, assessment2 (c3a2)	5.33
* Crown cover: ratio c3a2 to c3a1, percentage of sites at least 1.0	52%
* Crown cover: ratio c3a2 to c3a1, percentage of sites <0.90	33%
* Crown cover: ratio c3a2 to c3a1, percentage of sites <0.50	10%

* Sites with zero crown cover at both c3a1 and c3a2 have not been included

Table 1:206. Cycle 3 – percentage of sites in each seasonal quality category showing change in crown cover – Carnarvon1 sub-IBRA. Sites with zero crown cover have not been included.

Seasonal Quality	Species group	Crown cover <0.90	No change. ≤0.90 crown cover <1.10	Crown cover ≥1.10	Number of sites
All years	All	33%	14%	52%	21
Above average	All	n/a	n/a	n/a	0

Average	All	n/a	n/a	n/a	0
Below average	All	33%	14%	52%	21

Resource Capture Index

Table 1:207. Carnarvon1 sub-IBRA – summary of resource capture index.

Number of sites assessed in cycle 3, assessment 1 (c3a1) and cycle 3, assessment 2 (c3a2)	25
Average Resource Capture Index - c3a1	0.12
Average Resource Capture Index – c3a2	0.09
Average ratio of Resource Capture Index – c3a2 to c3a1 +/- standard error of the mean	1.04 +/- 1.17
Resource Capture Index: ratio c3a2 to c3a1, percentage of sites at least 1.0	44%
Resource Capture Index: ratio c3a2 to c3a1, percentage of sites <0.90	52%
Resource Capture Index: ratio c3a2 to c3a1, percentage of sites <0.50	28%
Average Resource Capture Index: ratio c3a2 to c3a1 for above average seasonal quality	n/a
Average Resource Capture Index: ratio c3a2 to c3a1 for average seasonal quality	n/a
Average Resource Capture Index: ratio c3a2 to c3a1 for below average seasonal quality	1.04

Figure 1:63. Change in Resource Capture Index, cycle 3 – Carnarvon1 sub-IBRA.

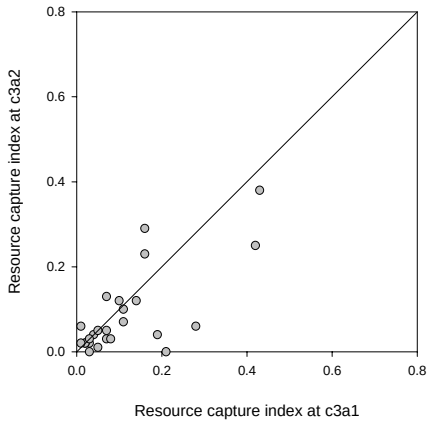


Table 1:208. Resource capture index – percentage of sites in each seasonal category showing change in the index – Carnarvon1 sub-IBRA, cycle 3.

Seasonal Quality	Species group	Decline. RCI < 0.90	No change. 0.90 ≤ RCI <1.10	Increase. RCI >=1.10	Number of sites
All years	All	52%	24%	24%	25

Above average	All	n/a	n/a	n/a	0
Average	All	n/a	n/a	n/a	0
Below average	All	52%	24%	24%	25

Proportional landscape function - stability, infiltration and nutrient cycling indices

Table 1:209. Proportional landscape function indices – Carnarvon1 sub-IBRA, cycle 3.

	Stability index	Infiltration index	Nutrient cycling index
Number of sites assessed in c3a1 and c3a2	28	28	28
c3a1 average +/- standard error of the mean	45.4 +/- 1.56	39.1 +/- 0.93	20.6 +/- 0.86
c3a2 average +/- standard error of the mean	44.3 +/- 1.05	38.8 +/- 0.92	21.3 +/- 0.88
Ratio of index: average +/- standard error of the mean	0.99 +/- 0.03	1.00 +/- 0.02	1.05 +/- 0.03
Ratio of index: c3a2 to c3a1 percentage of sites at least 1.0	32%	39%	64%
Ratio of index: c3a2 to c3a1 percentage of sites <0.90	25%	11%	18%
Ratio of index: c3a2 to c3a1 percentage of sites <0.50	0%	0%	0%
Average of index ratio: c3a2 to c3a1 for above average seasonal quality	n/a	n/a	n/a
Average of index ratio: c3a2 to c3a1 for average seasonal quality	n/a	n/a	n/a
Average of index ratio: c3a2 to c3a1 for below average seasonal quality	0.99 +/- 0.03	1.00 +/- 0.02	1.05 +/- 0.03

Figure 1:64. Proportional landscape function - stability, infiltration and nutrient cycling indices, cycle3 – Carnarvon1 sub-IBRA. The top panes show all data, the lower panes show expanded views over limited ranges.

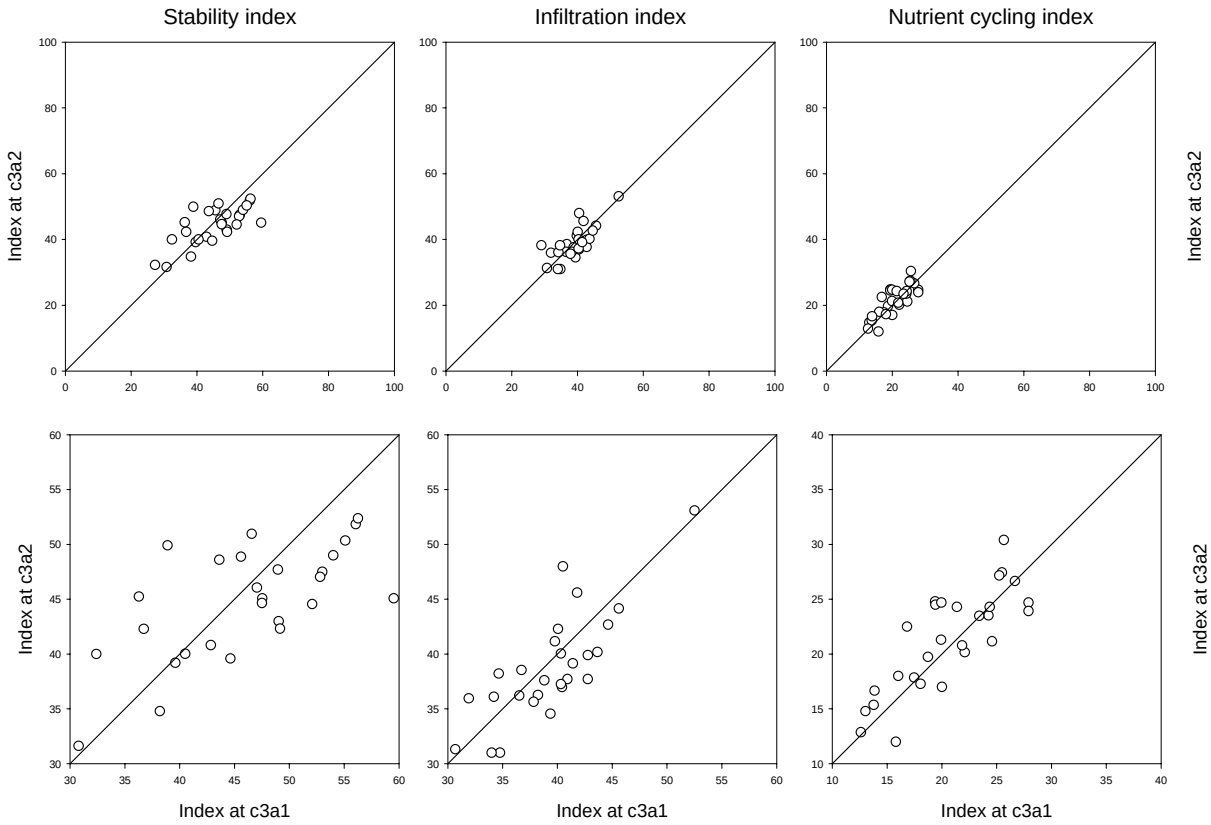


Table 1:210. Proportional landscape function - stability index – Carnarvon1 sub-IBRA. Ratio of stability index (RSI) at cycle 3, assessment 2 (c3a2) to index at cycle 3, assessment 1 (c3a1).

Seasonal Quality	Species group	Decline. RSI < 0.90	No change. 0.90>= RSI <1.10	Increase. RSI >=1.10	Number of sites
All years	All	25%	54%	21%	28
Above average	All	n/a	n/a	n/a	0
Average	All	n/a	n/a	n/a	0
Below average	All	25%	54%	21%	28

Table 1:211. Proportional landscape function - infiltration index – Carnarvon1 sub-IBRA. Ratio of infiltration index (RII) at cycle 3, assessment 2 (c3a2) to index at cycle 3, assessment 1 (c3a1).

Seasonal Quality	Species group	Decline. RII < 0.90	No change. 0.90>= RII <1.10	Increase. RII >=1.10	Number of sites
All years	All	11%	75%	14%	28
Above average	All	n/a	n/a	n/a	0
Average	All	n/a	n/a	n/a	0
Below	All	11%	75%	14%	28

average

Table 1:212. Proportional landscape function – nutrient cycling index – Carnarvon1 sub-IBRA. Ratio of nutrient cycling index (RNCI) at cycle 3, assessment 2 (c3a2) to index at cycle 3, assessment 1 (c3a1).

Seasonal Quality	Species group	Decline. RNCI < 0.90	No change. 0.90>= RNCI <1.10	Increase. RNCI >=1.10	Number of sites
All years	All	18%	46%	36%	28
Above average	All	n/a	n/a	n/a	0
Average	All	n/a	n/a	n/a	0
Below average	All	18%	46%	36%	28

Change in sustainable management of the pastoral estate – shrubland sites

Population growth rate (i.e. density) of Decreaser, Intermediate and Increaser species

Table 1:213. Summary of population growth rate of decreaser, intermediate and increaser species on shrubland sites – Carnarvon IBRA

PGR +/- standard error of the mean	1.23 +/- 0.06	1.39 +/- 0.09	1.36 +/- 0.10
PGR: Date 2 to Date 1 at least 1.0 – percentage of sites	71%	71%	79%
PGR: Date 2 to Date 1 <0.90 – percentage of sites	18%	19%	19%
PGR: Date 2 to Date 1 <0.50 – percentage of sites	2%	18%	11%
Average PGR Date 2 to Date 1 for above average seasonal quality	1.45	1.62	1.57
Average PGR Date 2 to Date 1 for average seasonal quality	1.05	1.22	1.23
Average PGR Date 2 to Date 1 for below average seasonal quality	0.92	0.99	0.93

Figure 1:65. Change in number of shrubs on each site by response category (shrubland sites), Carnarvon IBRA.

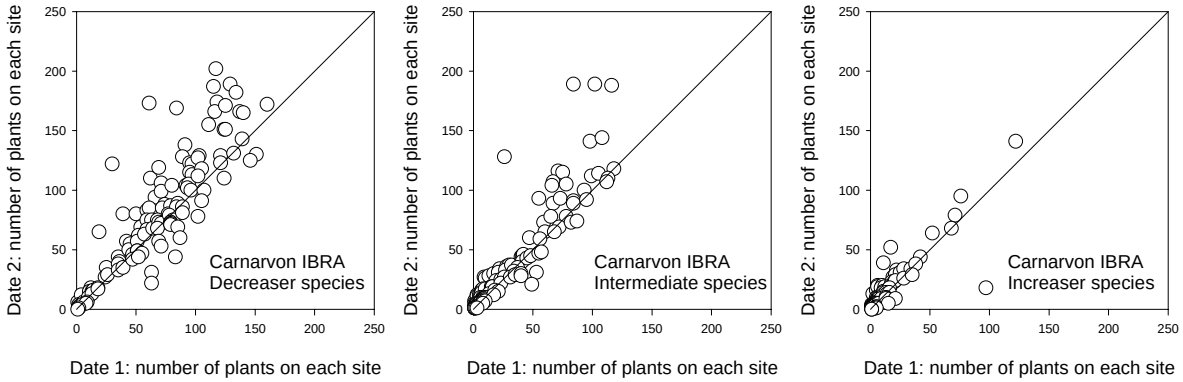


Table 1:214. Change in density between date 1 and date 2 of decreaser, intermediate and increaser shrub species – percentage of sites by seasonal category – Carnarvon IBRA.

Seasonal Quality	Species group	Decline. Density < 0.95	No change. 0.95>= density <1.05	Increase. Density >=1.05	Number of sites
All years	Decreaser	25%	17%	58%	121
	Intermediate	21%	24%	54%	112
	Increaser	21%	24%	55%	84
Above average	Decreaser	9%	11%	81%	57
	Intermediate	12%	22%	67%	51
	Increaser	14%	19%	68%	37
Average	Decreaser	39%	25%	37%	57
	Intermediate	30%	24%	46%	54
	Increaser	26%	29%	45%	42
Below average	Decreaser	n/a	n/a	n/a	7
	Intermediate	n/a	n/a	n/a	7
	Increaser	n/a	n/a	n/a	5

Canopy area of Decreaser, Intermediate and Increaser species but restricted to plants less than 1.5 m in height

Table 1:215. Carnarvon IBRA – summary of canopy area for decreaser, intermediate and increaser species but restricted to plants less than 1.5 m in height.

Average change in cover +/- standard error of the mean	1.86 +/- 0.19	3.14 +/- 0.74	7.49 +/- 4.32*
Cover: ratio Date 2 to Date 1 at least 1.0 – percentage of sites	85%	94%	85%
Cover: ratio Date 2 to Date 1 <0.90 – percentage of sites	13%	5%	13%
Cover: ratio Date 2 to Date 1 <0.50 – percentage of sites	5%	1%	10%
Average cover ratio Date 2 to Date 1 for above average seasonal quality	2.43	4.55	2.83
Average cover ratio Date 2 to Date 1 for average seasonal	1.38	2.02	12.73**

quality			
Average cover ratio Date 2 to Date 1 for below average seasonal quality	n/a	n/a	n/a

* This increase was driven by large increase of one Senna on one site. With that site excluded, the average and standard error were 3.23 +/- 0.88

** This increase was driven by large increase of one Senna on one site. With that site excluded, the average was 3.82

Figure 1:66. Canopy area by site – Decreaser, Intermediate and Increaser species but restricted to plants less than 1.5 m in height – Carnarvon IBRA.

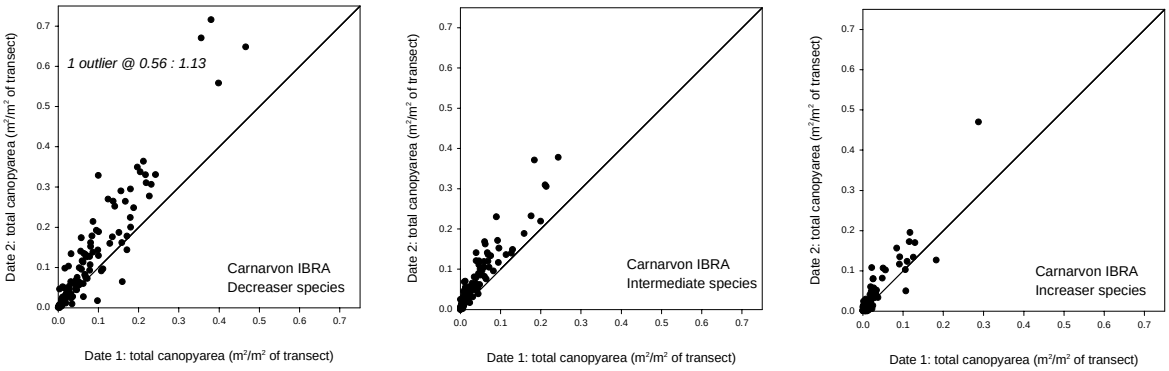


Table 1:216. Carnarvon IBRA – percentage of sites in each seasonal category showing change in canopy area for decreaser, intermediate and increaser species but restricted to plants less than 1.5 m in height.

Seasonal Quality	Species group	Decline. Total canopy area <0.90	No change. 0.90 ≤ total canopy area <1.10	Increase. total canopy area ≥1.10	Number of sites
All years	Decreaser	13%	8%	79%	120
	Intermediate	5%	4%	91%	110
	Increaser	13%	8%	80%	80
Above average	Decreaser	5%	2%	93%	56
	Intermediate	4%	2%	94%	50
	Increaser	8%	8%	84%	37
Average	Decreaser	18%	14%	68%	57
	Intermediate	8%	6%	87%	53
	Increaser	13%	8%	79%	38
Below average	Decreaser	n/a	n/a	n/a	7
	Intermediate	n/a	n/a	n/a	7
	Increaser	n/a	n/a	n/a	5

Change in sustainable management of the pastoral estate – grassland sites

Frequency of Decreaser, Intermediate and Increaser perennial grass species

Table 1:217. Summary of frequency of decreaser, intermediate and increaser perennial grass species, Carnarvon1 sub-IBRA, cycle 3.

Average change in frequency +/- standard error of the mean	0.84 +/- 0.58	n/a	n/a
Frequency: ratio c3a2 to c3a1, percentage of sites ≥ 1.0	29%	n/a	n/a
Frequency: ratio c3a2 to c3a1, percentage of sites <0.90	68%	n/a	n/a
Frequency: ratio c3a2 to c3a1, percentage of sites <0.50	21%	n/a	n/a
Average change in frequency: c3a2 to c3a1, above average seasonal quality	n/a	n/a	n/a
Average change in frequency: c3a2 to c3a1, average seasonal quality	n/a	n/a	n/a
Average change in frequency: c3a2 to c3a1, below average seasonal quality	0.84	n/a	n/a

Figure 1:67. Change in perennial grass frequency between, cycle 3 – decreaser, intermediate and increaser species

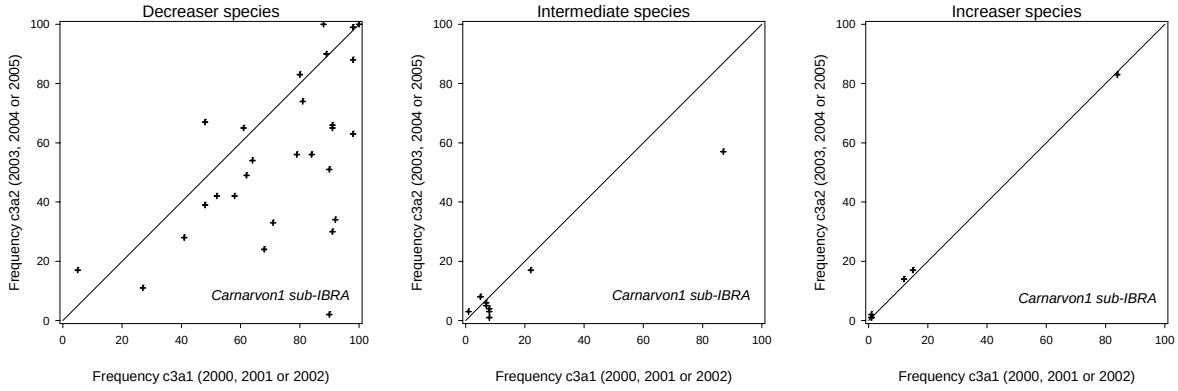


Table 1:218. Change in frequency of decreaser, intermediate and increaser perennial grass species – percentage of sites in each seasonal category – Carnarvon1 sub-IBRA, cycle 1

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency <1.10	Increase. frequency ≥1.10	Number of sites
All years	Decreaser	16%	13%	71%	31
	Intermediate	25%	30%	45%	20
	Increaser	n/a	n/a	n/a	5
Above average	Decreaser	16%	13%	71%	31
	Intermediate	25%	30%	45%	20
	Increaser	n/a	n/a	n/a	5
Average	Decreaser	n/a	n/a	n/a	0
	Intermediate	n/a	n/a	n/a	0

	Increaser	n/a	n/a	n/a	0
Below average	Decreaser	n/a	n/a	n/a	0
	Intermediate	n/a	n/a	n/a	0
	Increaser	n/a	n/a	n/a	0

Table 1:219. Change in frequency of decreaser, intermediate and increaser perennial grass species – percentage of sites in each seasonal category - Carnarvon1 sub-IBRA, cycle 2

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency <1.10	Increase. frequency ≥1.10	Number of sites
All years	Decreaser	27%	54%	19%	26
	Intermediate	38%	38%	23%	13
	Increaser	n/a	n/a	n/a	3
Above average	Decreaser	n/a	n/a	n/a	1
	Intermediate	n/a	n/a	n/a	0
	Increaser	n/a	n/a	n/a	0
Average	Decreaser	n/a	n/a	n/a	0
	Intermediate	n/a	n/a	n/a	0
	Increaser	n/a	n/a	n/a	0
Below average	Decreaser	28%	56%	16%	25
	Intermediate	38%	38%	23%	13
	Increaser	n/a	n/a	n/a	3

Table 1:220. Change in frequency of decreaser, intermediate and increaser perennial grass species – percentage of sites in each seasonal category - Carnarvon1 sub-IBRA, cycle 3

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency <1.10	Increase. frequency ≥1.10	Number of sites
All years	Decreaser	68%	21%	11%	28
	Intermediate	n/a	n/a	n/a	9
	Increaser	n/a	n/a	n/a	6
Above average	Decreaser	n/a	n/a	n/a	0
	Intermediate	n/a	n/a	n/a	0
	Increaser	n/a	n/a	n/a	0
Average	Decreaser	n/a	n/a	n/a	0
	Intermediate	n/a	n/a	n/a	0
	Increaser	n/a	n/a	n/a	0
Below average	Decreaser	68%	21%	11%	28
	Intermediate	n/a	n/a	n/a	9
	Increaser	n/a	n/a	n/a	6

Table 1:221. Weighted average across all three cycles - change in frequency of decreaser, intermediate and increaser perennial grass species – percentage of sites in each seasonal category - Carnarvon1 sub-IBRA.

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency <1.10	Increase. frequency ≥1.10	Number of sites	Cycles used
All years	Decreaser	36%	28%	35%	85	1,2,3

	Intermediate	30%	33%	36%	33	1,2
	Increaser	n/a	n/a	n/a	n/a	n/a
Above average	Decreaser	16%	13%	71%	31	1
	Intermediate	25%	30%	45%	20	1
	Increaser	n/a	n/a	n/a	n/a	n/a
Average	Decreaser	n/a	n/a	n/a	n/a	n/a
	Intermediate	n/a	n/a	n/a	n/a	n/a
	Increaser	n/a	n/a	n/a	n/a	n/a
Below average	Decreaser	49%	38%	13%	53	2,3
	Intermediate	38%	38%	23%	13	2
	Increaser	n/a	n/a	n/a	n/a	n/a

Change in vegetation richness and occurrence – shrubland sites

Native shrub species richness

Table 1:222. Carnarvon IBRA – summary of native shrub species richness

Number of sites assessed	127
Average number of species per site – Date 1	7.5 +/- 0.32
Average number of species per site – Date 2	7.8 +/- 0.32
Average ratio of species richness: Date 2 to Date 1 +/- standard error of the mean	1.09 +/- 0.03
Species richness: ratio Date 2 to Date 1 at least 1.0 – percentage of sites	86%
Species richness: ratio Date 2 to Date 1 <0.90 – percentage of sites	13%
Species richness: ratio Date 2 to Date 1 <0.50 – percentage of sites	2%

Figure 1:68. Change in shrub species richness on each site between Date 1 and Date 2 – Carnarvon IBRA. Bubble size represents number of sites at each x,y point.

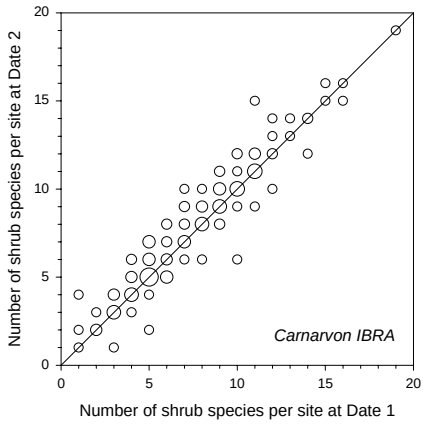


Table 1:223. Native species shrub richness Carnarvon IBRA- date 2 to divided by date 1.

Seasonal Quality	Species group	Decline. Richness index < 0.80	No change. 0.80 ≤ Richness index <1.20	Increase. Richness index ≥1.20	Number of sites
All years	All	4%	77%	19%	127
Above average	All	3%	66%	31%	61
Average	All	5%	86%	8%	59
Below average	All	n/a	n/a	n/a	7

Frequency of occurrence

Table 1:224. Carnarvon IBRA – shrubland sites – species found on at least five sites at Date 1 or Date 2.

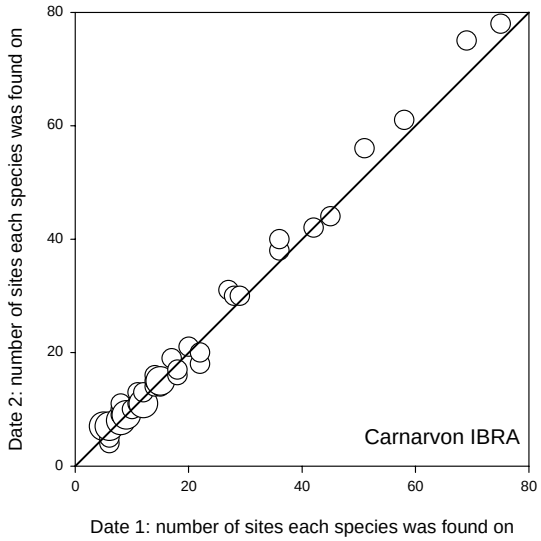
Number of species	42
Occurrence ratio Date 2 to Date 1 at least 1.0 – percentage of sites	76%
Occurrence ratio Date 2 to Date 1 >1.10 – percentage of species	29%
Occurrence ratio Date 2 to Date 1 < 0.90 – percentage of species	10%
Occurrence ratio Date 2 to Date 1 < 0.50 – percentage of species	0%
Average change in occurrence ratio	1.05

Table 1:225. Species with occurrence ratio greater than 1.1 or less than 0.90 and found on at least 10 sites at Date 1 or Date 2 – Carnarvon IBRA

SPECIES_NAME	DESIR	TR_C	No_pop	No_pop	OR
Solanum orbiculatum	U	1	8	11	1.38
Eremophila clarkei	I	4	8	10	1.25

Senna glutinosa subsp. chatelainiana	D	1	11	13	1.18
Hakea preissii	U	3	27	31	1.15
Acacia sclerosperma	I	3	14	16	1.14
Eremophila latrobei	D	4	17	19	1.12
Acacia victoriae	U	2	36	40	1.11
Atriplex bunburyana	D	3	18	16	0.89
Senna artemisioides subsp. x sturtii	U	3	22	18	0.82

Figure 1:69. Frequency of occurrence for all species found on at least five sites in the Carnarvon IBRA.



Change in vegetation richness and occurrence – grassland sites

Native perennial species richness

Table 1:226. Carnarvon1 sub-IBRA – summary of native perennial species richness, cycle 3

Number of sites assessed in cycle 3, assessment 1 and cycle3 assessment 2 (c3a1 & c3a2)	29
Average number of native perennial species per site at c3a1 – for sites assessed in both c3a1 and c3a2: +/- standard error of the mean	3.7 +/- 0.45
Average number of native perennial species per site in c3a2 – for sites assessed in both c3a1 and c3a2: +/- standard error of the mean	3.1 +/- 0.17
Average ratio of species richness: c3a2 to c3a1: +/- standard error of the mean	0.91 +/- 0.08

Species richness: ratio c3a2 to c3a1, percentage of sites at least 1.0	48%
Species richness: ratio c3a2 to c3a1, percentage of sites <0.90	52%
Species richness: ratio c3a2 to c3a1, percentage of sites <0.50	3%

Figure 1:70. Change in species richness on each site between each sampling cycle – Carnarvon1 sub-IBRA. Bubble size represents number of sites at each x,y point.

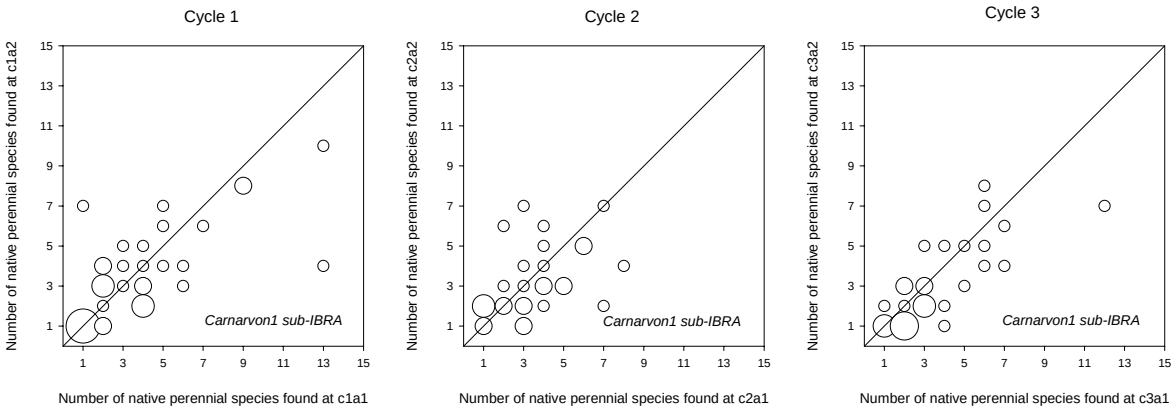


Table 1:227. Cycle 1 - native perennial species richness Carnarvon1 sub-IBRA - c1a2 divided by c1a1.

Seasonal Quality	Species group	Decline. Richness index < 0.80	No change. 0.80 ≤ Richness index <1.20	Increase. Richness index ≥1.20	Number of sites
All years	All	32%	35%	32%	34
Above average	All	32%	35%	32%	34
Average	All	n/a	n/a	n/a	0
Below average	All	n/a	n/a	n/a	0

Table 1:228. Cycle 2 - native perennial species richness Carnarvon1 sub-IBRA - c2a2 divided by c2a1.

Seasonal Quality	Species group	Decline. Richness index < 0.80	No change. 0.80 ≤ Richness index <1.20	Increase. Richness index ≥1.20	Number of sites
All years	All	38%	31%	31%	29
Above average	All	n/a	n/a	n/a	1
Average	All	n/a	n/a	n/a	0
Below average	All	36%	32%	32%	28

Table 1:229. Cycle 3 - native perennial species richness Carnarvon1 sub-IBRA - c3a2 divided by c3a1.

Seasonal Quality	Species group	Decline. Richness index < 0.80	No change. 0.80 ≤ Richness index <1.20	Increase. Richness index ≥1.20	Number of sites
All years	All	45%	34%	21%	29
Above average	All	n/a	n/a	n/a	0
Average	All	n/a	n/a	n/a	0
Below average	All	45%	34%	21%	29

Table 1:230. Weighted average across all three cycles - native perennial species richness Carnarvon1 sub-IBRA.

Seasonal Quality	Species group	Decline. Richness index < 0.80	No change. 0.80 ≤ Richness index <1.20	Increase. Richness index ≥1.20	Number of sites	Cycles used
All years	All	38%	33%	28%	92	1,2,3
Above average	All	32%	35%	32%	34	1
Average	All	n/a	n/a	n/a	n/a	n/a
Below average	All	41%	33%	15%	57%	2,3

Frequency of occurrence – native species

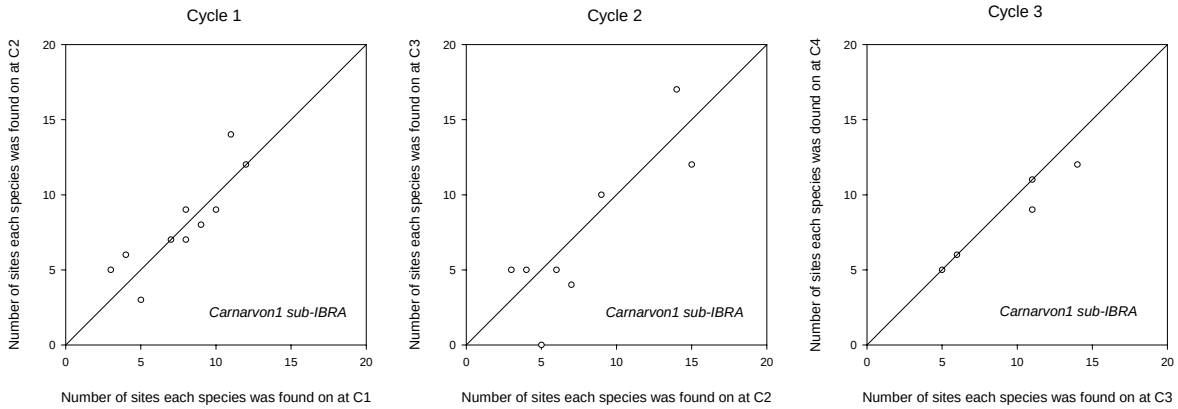
Table 1:231. Carnarvon1 sub-IBRA – species found on at least five sites at either the first or second assessment of each cycle and on at least one site at the first assessment date of each cycle.

	c1a1 & c1a2	c2a1 & c2a2	c3a1 & c3a2
Number of species	10	8	5
Average number of sites each species was found on	7.7 +/- 0.94	n/a	n/a
Average number of sites each species was found on	8.0 +/- 1.14	n/a	n/a
Occurrence ratio at least 1.0 – percentage of species	60%	n/a	n/a
Occurrence ratio >1.10 – percentage of species	40%	n/a	n/a
Occurrence ratio < 0.90 – percentage of species	30%	n/a	n/a
Occurrence ratio < 0.50 – percentage of species	0%	n/a	n/a
Average occurrence ratio +/- standard error of the mean	1.08 +/- 0.10	n/a	n/a

Table 1:232. Native species found on WARMS sites within the Carnarvon 1 sub-IBRA. Data were filtered to include only those species found on at least five sites at any of the assessments, and on at least one site at the first assessment of each of the three sampling cycles. The table shows the number of sites each species was found on and the number of sites assessed at the first and second assessment of each cycle.

SPECIES_NAME	c1a1 & c1a2	c2a1 & c2a2	c3a1 & c3a2	ratio c1a2/ c1a1	ratio c2a2/ c2a1	ratio c3a1/ c3a2
Acacia tetragonophylla	4 then 4 of 35	3 then 5 of 30	3 then 2 of 29	1.00	1.67	0.67
Acacia victoriae	12 then 12 of 35	14 then 17 of 30	14 then 12 of 29	1.00	1.21	0.86
Chrysopogon fallax	8 then 9 of 35	7 then 4 of 30	5 then 5 of 29	1.13	0.57	1.00
Eragrostis setifolia	3 then 5 of 35	5 then 0 of 30	1 then 0 of 29	1.67	0.00	0.00
Eragrostis xerophila	11 then 14 of 35	15 then 12 of 30	11 then 11 of 29	1.27	0.80	1.00
Eriachne benthamii	10 then 9 of 35	9 then 10 of 30	3 then 3 of 29	0.90	1.11	1.00
Senna artemisioides subsp. oligophylla	8 then 7 of 35	6 then 5 of 30	6 then 6 of 29	0.88	0.83	1.00
Solanum lasiophyllum	5 then 3 of 35	1 then 1 of 30	4 then 1 of 29	0.60	1.00	0.25
Triodia basedowii	7 then 7 of 35	3 then 2 of 30	2 then 4 of 29	1.00	0.67	2.00
Triodia lanigera	4 then 6 of 35	3 then 0 of 30	3 then 3 of 29	1.50	0.00	1.00
Triodia pungens	9 then 8 of 35	4 then 5 of 30	11 then 9 of 29	0.89	1.25	0.82

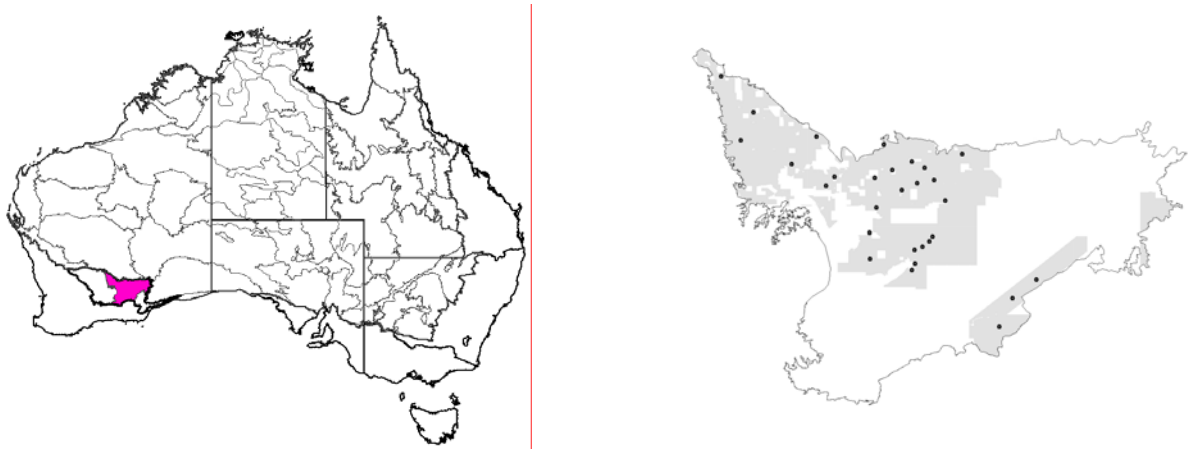
Figure 1:71. Frequency of occurrence for all native species found on at least five sites at either the first or second sampling, for each cycle – Carnarvon1 sub-IBRA. Bubble size represents number of sites at each x,y point.



Coolgardie3 sub-IBRA

For shrubland sites, only Coolgardie3 sub-IBRA (Eastern Goldfields) is considered.

Figure 1:72. Location of Coolgardie3 sub-IBRA (left) and WARMS sites in the sub-IBRA (right). Greyed areas are pastoral tenure.



Site and seasonal summary

Table 1:233. Coolgardie IBRA – shrubland sites – total number of sites and dates assessed

Number of shrubland sites assessed in all sub-IBRAs	40
Number of shrubland sites in COO1 (Mardabilla)	2
Number of shrubland sites in COO2 (Southern Cross)	9
Number of shrubland sites in COO3 (Eastern Goldfields)	**29**
Date 1: first assessment (installation) COO3	18/04/95 to 17/12/97
Date 2: second assessment COO3	14/04/00 to 24/11/02
Above average seasonal quality COO3– percentage of sites	79%
Average seasonal quality COO3 – percentage of sites	17%
Below average seasonal quality COO3 – percentage of sites	3%

Change in landscape function

Population growth rate (i.e. density)

Table 1:234. Coolgardie3 sub-IBRA – shrubland sites – summary of population growth rate (i.e. density)

Average Population growth rate +/- standard error of the mean	1.11 +/- 0.05

PGR at least 1.0 – percentage of sites	66%
PGR <0.90 – percentage of sites	3%
PGR <0.50 – percentage of sites	0%

Figure 1:73. Change in number of plants on each site (population growth rate) between Date 1 and Date 2 – Coolgardie3 sub-IBRA.

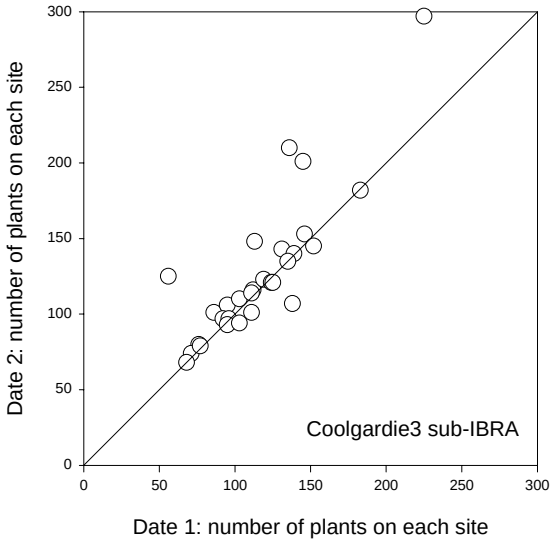


Table 1:235. Coolgardie3 sub-IBRA – percentage of sites in each seasonal category showing change in shrub density (shrubland sites)

Seasonal Quality	Species group	Decline. Density < 95%	No change. Density between 95% and 105%	Increase. Density >=105%	Number of sites
All years	All	10%	52%	38%	29
Above average	All	9%	48%	43%	23
Average	All	n/a	n/a	n/a	5
Below average	All	n/a	n/a	n/a	1

Canopy area

Table 1:236. Coolgardie3 sub-IBRA – summary of canopy area (shrubland sites)

Average change in cover +/- standard error of the mean	1.28 +/- 0.07
Cover: ratio Date 2 to Date 1 at least 1.0 – percentage of sites	93%
Cover: ratio Date 2 to Date 1 <0.90 – percentage of sites	7%
Cover: ratio Date 2 to Date 1 <0.50 – percentage of sites	0%

Average cover ratio Date 2 to Date 1 for above average seasonal quality	1.34
Average cover ratio Date 2 to Date 1 for average seasonal quality	n/a
Average cover ratio Date 2 to Date 1 for below average seasonal quality	n/a

Figure 1:74. Change in total canopy area between Date 1 and Date 2 – Coolgardie3 sub-IBRA.

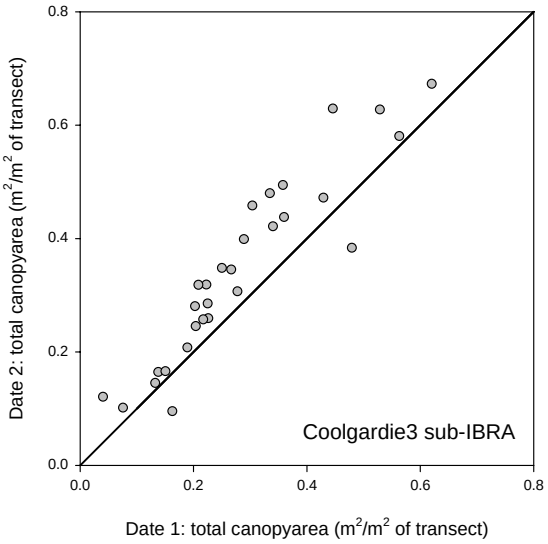


Table 1:237. Coolgardie3 sub-IBRA – percentage of shrubland sites in each seasonal category showing change in canopy area of shrubs

Seasonal Quality	Species group	Decline. Total canopy area <0.90	No change. 0.90>= total canopy area <1.10	Increase. total canopy area >=1.10	Number of sites
All years	All	7%	17%	76%	29
Above average	All	4%	13%	83%	23
Average	All	n/a	n/a	n/a	5
Below average	All	n/a	n/a	n/a	1

Canopy area but restricted to plants less than 1.5 m in height

Table 1:238 Coolgardie3 sub-IBRA – summary of canopy area (shrubland sites), but restricted to plants less than 1.5 m in height

Average change in cover +/- standard error of the mean	1.28 +/- 0.07

Cover: ratio Date 2 to Date 1 at least 1.0 – percentage of sites	93%
Cover: ratio Date 2 to Date 1 <0.90 – percentage of sites	7%
Cover: ratio Date 2 to Date 1 <0.50 – percentage of sites	0%
Average cover ratio Date 2 to Date 1 for above average seasonal quality	1.34
Average cover ratio Date 2 to Date 1 for average seasonal quality	n/a
Average cover ratio Date 2 to Date 1 for below average seasonal quality	n/a

Figure 1:75. Canopy area by site, but restricted to plants less than 1.5 m in height – Coolgardie3 sub-IBRA.

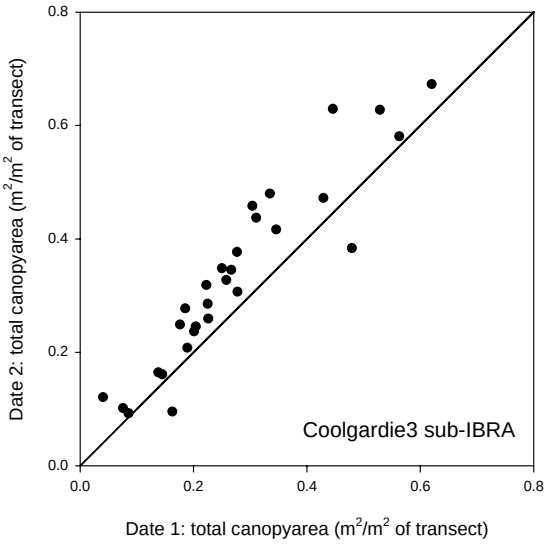


Table 1:239. Coolgardie3 sub-IBRA – percentage of shrubland sites in each seasonal category showing change in canopy area of shrubs, but restricted to plants less than 1.5 m in height

Seasonal Quality	Species group	Decline. Total canopy area < 90	No change. 0.90>= total canopy area <1.10	Increase. total canopy area >=1.10	Number of sites
All years	All	20%	0%	80%	10
Above average	All	20%	0%	80%	10
Average	All	n/a	n/a	n/a	0
Below average	All	n/a	n/a	n/a	0

Resource Capture Index

Table 1:240. Coolgardie IBRA – summary of resource capture index, shrubland sites.

Number of sites with useable data at both dates	28
Average change in Resource Capture Index +/- standard error of the mean	0.84 +/- 0.06
Cover: ratio Date 2 to Date 1 at least 1.0 – percentage of sites	18%
Cover: ratio Date 2 to Date 1 <0.90 – percentage of sites	68%
Cover: ratio Date 2 to Date 1 <0.50 – percentage of sites	14%
Average cover ratio Date 2 to Date 1 for above average seasonal quality	0.90
Average cover ratio Date 2 to Date 1 for average seasonal quality	n/a
Average cover ratio Date 2 to Date 1 for below average seasonal quality	n/a

Figure 1:76. Change in Resource Capture Index between Date 1 and Date 2 – Coolgardie3 sub-IBRA.

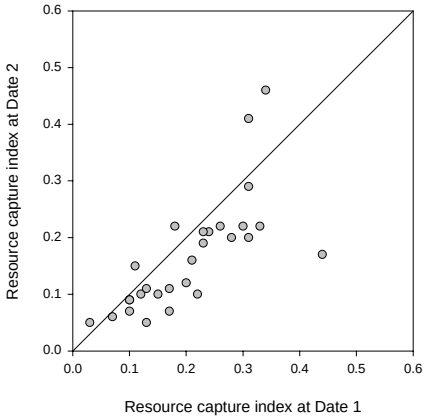


Table 1:241. Resource capture index – percentage of sites in each seasonal category showing change in the index – Coolgardie3 sub-IBRA, shrubland sites

Seasonal Quality	Species group	Decline. RCI < 0.90	No change. 0.90 ≤ RCI <1.10	Increase. RCI ≥ 1.10	Number of sites
All years	All	68%	14%	18%	28
Above average	All	59%	18%	23%	22
Average	All	n/a	n/a	n/a	5
Below average	All	n/a	n/a	n/a	1

Proportional landscape function - stability, infiltration and nutrient cycling indices

Table 1:242. Summary - proportional landscape function indices – Coolgardie3 sub-IBRA.

	Stability index	Infiltration index	Nutrient cycling index
Number of sites with useable data at both dates	29	29	29
Date 1 average +/- standard error of the mean	54.8 +/- 084	41.9 +/- 1.25	24.5 +/- 0.89
Date 2 average +/- standard error of the mean	59.6 +/- 1.00	45.1 +/- 1.09	23.8 +/- 1.03
Ratio of index: average +/- standard error of the mean	1.09 +/- 0.01	1.09 +/- 0.03	1.32 +/- 0.06
Ratio of index: Date 2 to Date 1 at least 1.0 – percentage of sites	93%	76%	86%
Ratio of index: : Date 2 to Date 1 <0.90 – percentage of sites	0%	3%	7%
Ratio of index: Date 2 to Date 1 <0.50 – percentage of sites	0%	0%	0%
Average of index ratio: Date 2 to Date 1 for above average seasonal quality	1.09 +/- 0.01	1.08 +/- 0.02	1.38 +/- 0.07
Average of index ratio: Date 2 to Date 1 for average seasonal quality	n/a	n/a	n/a
Average of index ratio: Date 2 to Date 1 for below average seasonal quality	n/a	n/a	n/a

Figure 1:77. Proportional landscape function - stability, infiltration and nutrient cycling indices at Date 1 and Date 2 – Coolgardie3 sub-IBRA. The top panes show all data, the lower panes show expanded views over limited ranges.

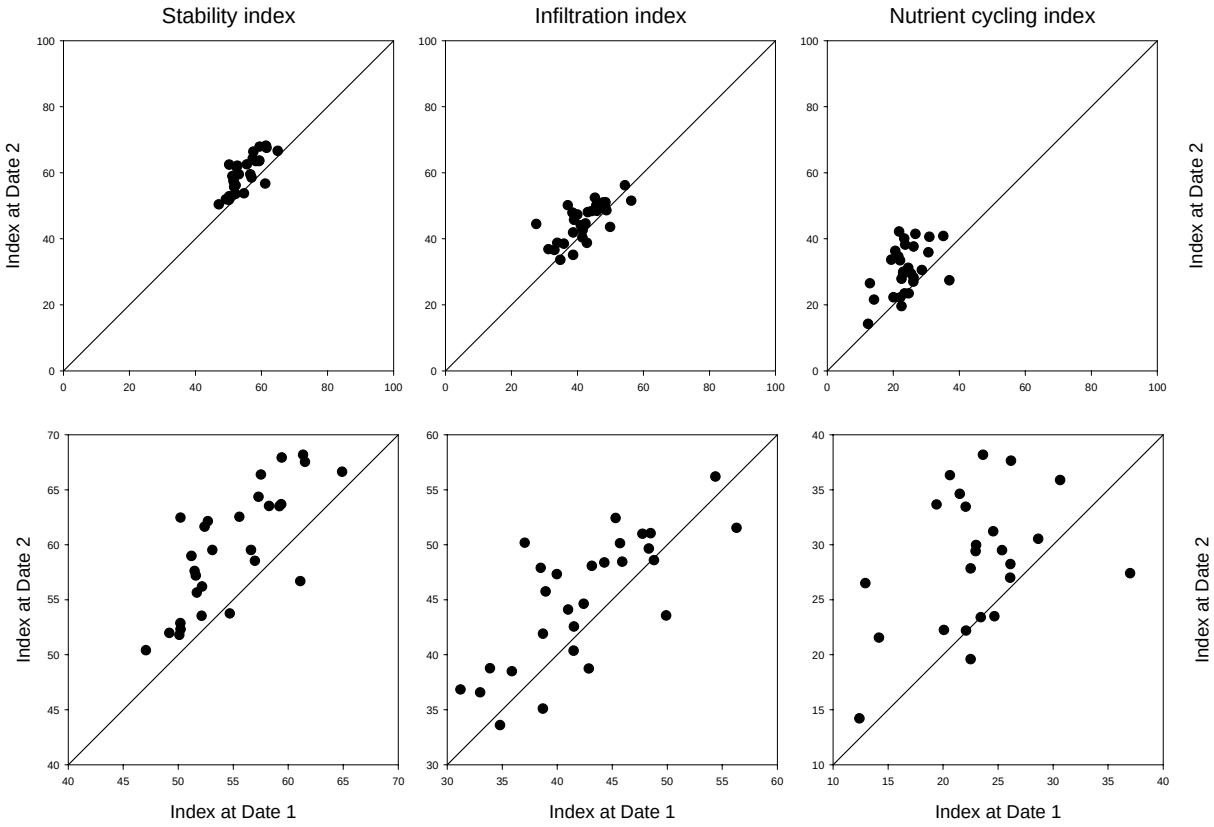


Table 1:243. Proportional landscape function - stability index – Coolgardie3 sub-IBRA. Ratio of index at Date 2 to index at Date 1 (Ratio of Stability Index – RSI).

Seasonal Quality	Species group	Decline. RSI < 0.90	No change. 0.90>= RSI <1.10	Increase. RSI >=1.10	Number of sites
All years	All	0%	59%	41%	29
Above average	All	0%	57%	43%	23
Average	All	n/a	n/a	n/a	5
Below average	All	n/a	n/a	n/a	1

Table 1:244. Proportional landscape function - infiltration index – Coolgardie3 sub-IBRA. Ratio of index at Date 2 to index at Date 1 (Ratio of Infiltration Index – RII).

Seasonal Quality	Species group	Decline. RII < 0.90	No change. 0.90>= RII <1.10	Increase. RII >=1.10	Number of sites
All years	All	3%	66%	31%	29
Above average	All	0%	65%	35%	23
Average	All	n/a	n/a	n/a	5
Below average	All	n/a	n/a	n/a	1

Table 1:245. Proportional landscape function – nutrient cycling index – Coolgardie3 sub-IBRA. Ratio of index at Date 2 to index at Date 1 (Ratio of Nutrient Cycling Index – RNCI).

Seasonal Quality	Species group	Decline. RNCI < 0.90	No change. 0.90>= RNCI <1.10	Increase. RNCI >=1.10	Number of sites
All years	All	7%	21%	72%	29
Above average	All	0%	22%	78%	23
Average	All	n/a	n/a	n/a	5
Below average	All	n/a	n/a	n/a	1

Change in sustainable management of the pastoral estate

Population growth rate (i.e. density) of Decreaser, Intermediate and Increaser species

Table 1:246. Summary of population growth rate of decreaser, intermediate and increaser species on shrubland sites – Coolgardie3 sub-IBRA

PGR +/- standard error of the mean	1.28 +/- 0.15	1.10 +/- 0.07	n/a
PGR: Date 2 to Date 1 at least 1.0 – percentage of sites	63%	92%	n/a
PGR: Date 2 to Date 1 <0.90 – percentage of sites	11%	0%	n/a
PGR: Date 2 to Date 1 <0.50 – percentage of sites	0%	0%	n/a
Average PGR Date 2 to Date 1 for above average seasonal quality	1.34	1.12	n/a
Average PGR Date 2 to Date 1 for average seasonal quality	n/a	n/a	n/a
Average PGR Date 2 to Date 1 for below average seasonal quality	n/a	n/a	n/a

Figure 1:78. Change in number of shrubs on each site by response category (shrubland sites), Coolgardie3 sub-IBRA.

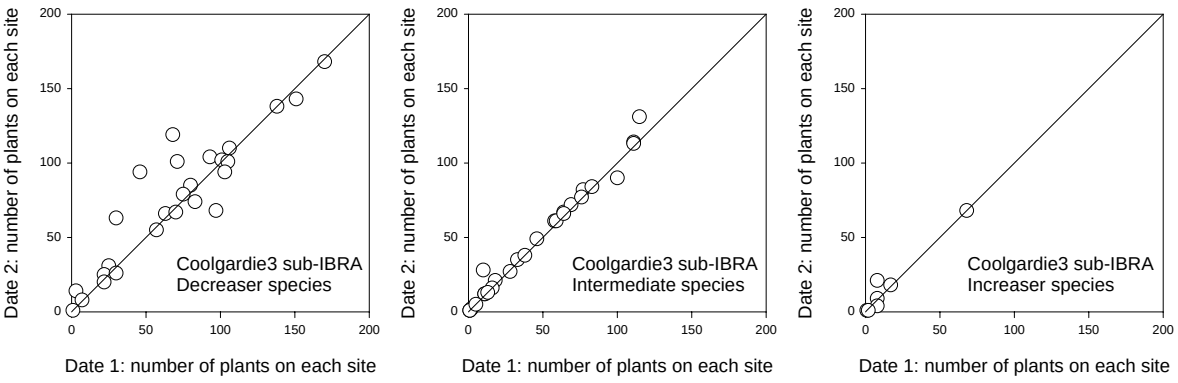


Table 1:247. Change in density between date 1 and date 2 of decreaser, intermediate and increaser shrub species – percentage of sites by seasonal category – Coolgardie3 sub-IBRA.

Seasonal Quality	Species group	Decline. Density < 0.95	No change. 0.95>= density <1.05	Increase. Density >=1.05	Number of sites
All years	Decreaser	22%	33%	44%	27
	Intermediate	4%	62%	35%	26
	Increaser	n/a	n/a	n/a	7
Above average	Decreaser	23%	27%	50%	22
	Intermediate	0%	67%	33%	21
	Increaser	n/a	n/a	n/a	4
Average	Decreaser	n/a	n/a	n/a	5
	Intermediate	n/a	n/a	n/a	5
	Increaser	n/a	n/a	n/a	2
Below average	Decreaser	n/a	n/a	n/a	0
	Intermediate	n/a	n/a	n/a	0
	Increaser	n/a	n/a	n/a	1

Canopy area of Decreaser, Intermediate and Increaser species but restricted to plants less than 1.5 m in height

Table 1:248. Coolgardie3 sub-IBRA – summary of canopy area for decreaser, intermediate and increaser species but restricted to plants less than 1.5 m in height.

Average change in cover +/- standard error of the mean	2.07 +/- 0.65	1.45 +/- 0.16	n/a
Cover: ratio Date 2 to Date 1 at least 1.0 – percentage of sites	93%	85%	n/a
Cover: ratio Date 2 to Date 1 <0.90 – percentage of sites	7%	8%	n/a
Cover: ratio Date 2 to Date 1 <0.50 – percentage of sites	4%	4%	n/a
Average cover ratio Date 2 to Date 1 for above average seasonal quality	2.27	1.42	n/a
Average cover ratio Date 2 to Date 1 for average seasonal quality	n/a	n/a	n/a
Average cover ratio Date 2 to Date 1 for below average seasonal quality	n/a	n/a	n/a

Figure 1:79. Canopy area by site – Decreaser, Intermediate and Increaser species but restricted to plants less than 1.5 m in height – Coolgardie3 sub-IBRA.

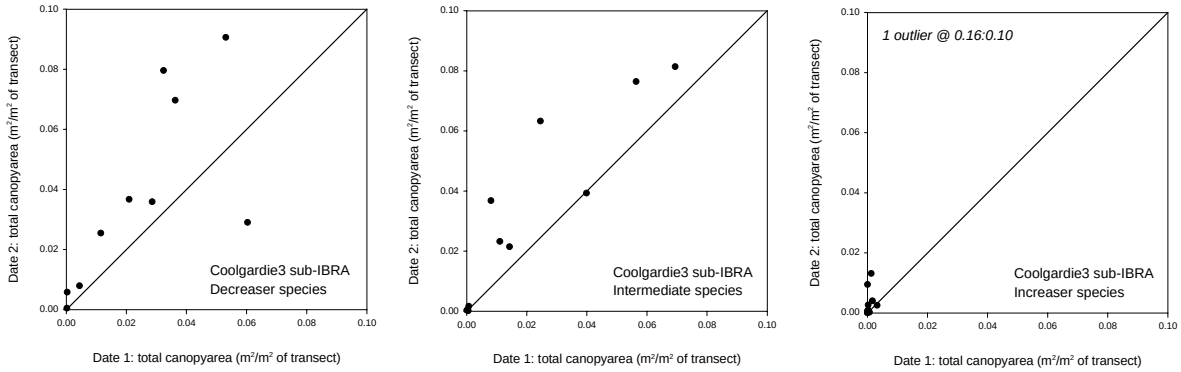


Table 1:249. Coolgardie3 sub-IBRA – percentage of sites in each seasonal category showing change in canopy area for decreaser, intermediate and increaser species but restricted to plants less than 1.5 m in height.

Seasonal Quality	Species group	Decline. Total canopy area <0.90	No change. 0.90>= total canopy area <1.10	Increase. total canopy area >=1.10	Number of sites
All years	Decreaser	7%	19%	74%	27
	Intermediate	7%	19%	74%	27
	Increaser	20%	0%	80%	15

Above average	Decreaser	5%	14%	82%	22
	Intermediate	9%	14%	77%	22
	Increaser	9%	0%	91%	11
Average	Decreaser	n/a	n/a	n/a	5
	Intermediate	n/a	n/a	n/a	5
	Increaser	n/a	n/a	n/a	3
Below average	Decreaser	n/a	n/a	n/a	0
	Intermediate	n/a	n/a	n/a	0
	Increaser	n/a	n/a	n/a	1

Change in vegetation richness and occurrence

Native shrub species richness

Table 1:250. Coolgardie3 sub-IBRA – summary of native shrub species richness

Number of sites assessed	29
Average number of species per site – Date 1	5.8 +/- 0.58
Average number of species per site – Date 2	6.5 +/- 0.57
Average ratio of species richness: Date 2 to Date 1 +/- standard error of the mean	1.19 +/- 0.05
Species richness: ratio Date 2 to Date 1 at least 1.0 – percentage of sites	93%
Species richness: ratio Date 2 to Date 1 <0.90 – percentage of sites	3%
Species richness: ratio Date 2 to Date 1 <0.50 – percentage of sites	0%

Figure 1:80. Change in shrub species richness on each site between Date 1 and Date 2 – Coolgardie3 sub-IBRA. Bubble size represents number of sites at each x,y point.

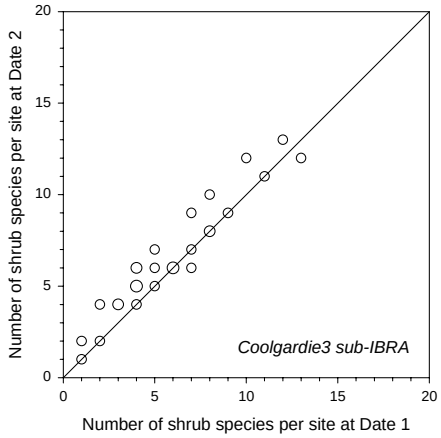


Table 1:251. Native species shrub richness Coolgardie3 sub-IBRA- date 2 to divided by date 1.

Seasonal Quality	Species group	Decline. Richness index < 0.80	No change. 0.80 ≤ Richness index <1.20	Increase. Richness index ≥1.20	Number of sites
All years	All	0%	59%	41%	29
Above average	All	0%	52%	48%	23
Average	All	n/a	n/a	n/a	5
Below average	All	n/a	n/a	n/a	1

Frequency of occurrence

Table 1:252. Coolgardie3 sub-IBRA – shrubland sites – species found on at least five sites at Date 1 or Date 2.

Number of species	17
Occurrence ratio Date 2 to Date 1 at least 1.0 – percentage of species	94%
Occurrence ratio Date 2 to Date 1 >1.10 – percentage of species	35%
Occurrence ratio Date 2 to Date 1 < 0.90 – percentage of species	6%
Occurrence ratio Date 2 to Date 1 < 0.50 – percentage of species	0%
Average change in occurrence ratio	1.25

Table 1:253. Species with occurrence ratio greater than 1.1 or less than 0.90 and found on at least 10 sites at Date 1 or Date 2 – Coolgardie3 sub-IBRA.

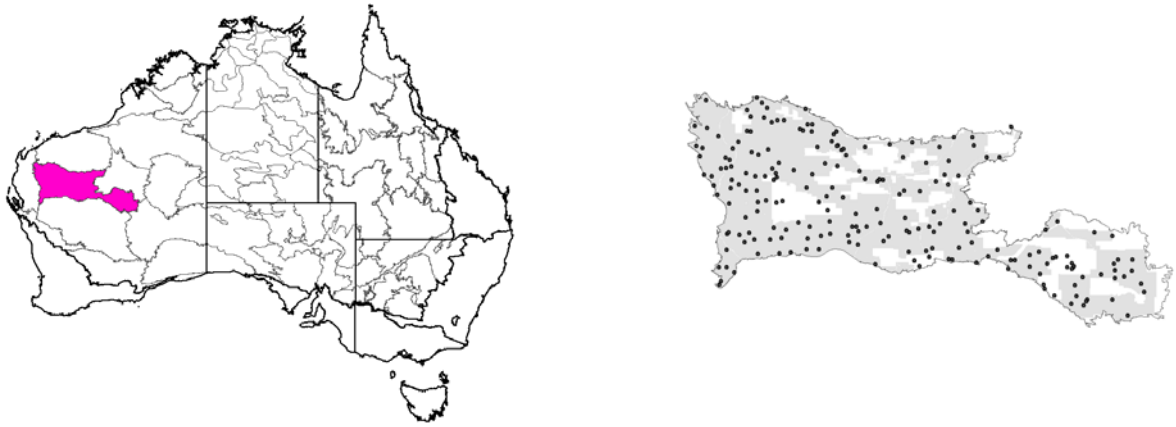
SPECIES_NAME	DESIR	TR_C	No_pop	No_pop	OR
Solanum lasiophyllum	I	2	5	12	2.40
Solanum orbiculatum	U	1	5	10	2.00
Maireana georgei	D	2	11	13	1.18
Frankenia species	D	4	12	13	1.08

Figure 1:81. Frequency of occurrence for all species found on at least five sites in the Coolgardie3 sub-IBRA.

Gascoyne IBRA

For shrubland sites, data from all three Gascoyne sub-IBRAs were pooled and the complete Gascoyne IBRA is reported. For grassland sites, only Gascoyne1 sub-IBRA is reported.

Figure 1:82. Location of Gascoyne IBRA (left) and WARMS sites in the IBRA (right). Greyed areas are pastoral tenure.



Site and seasonal summary

Table 1:254. Gascoyne IBRA – shrubland sites – total number of sites and dates assessed

Number of shrubland sites assessed	195
Number of shrubland sites in GAS1 (Ashburton)	30
Number of shrubland sites in GAS2 (Carnegie)	49
Number of shrubland sites in GAS3 (Augustusl)	116
Date 1: first assessment (installation)	2/12/93 to 25/4/01
Date 2: second assessment	25/8/99 to 26/9/05
Above average seasonal quality – percentage of sites	86%
Average seasonal quality – percentage of sites	10%
Below average seasonal quality – percentage of sites	4%

Table 1:255. Gascoyne IBRA – grassland sites – total number of sites and dates assessed.

Number of grassland sites assessed	16
Number of grassland sites assessed in GAS1 (Ashburton)	**13**
Number of grassland sites assessed in GAS2 (Carnegie)	0
Number of grassland sites assessed in GAS3 (Augustusl)	3
First assessment (installation): GAS1	17/05/95 to 13/08/96

Second assessment: GAS1	14/08/99 to 31/08/99
Third assessment: GAS1	16/07/00 to 29/06/02
Fourth assessment: GAS1	21/06/04 to 28/05/05

Table 1:256. Gascoyne1 sub-IBRA – grassland sites – seasonal category and number of sites assessed in each cycle.

	Cycle1	Cycle 2	Cycle 3
Number of grassland sites assessed	11	11	2
Above average seasonal quality - – percentage of sites	100%	18%	n/a
Average seasonal quality - – percentage of sites	0%	27%	n/a
Below average seasonal quality – percentage of sites	0%	55%	n/a

Change in landscape function – shrubland sites

Population growth rate (i.e. density)

Table 1:257. Gascoyne IBRA – shrubland sites – summary of population growth rate (i.e. density)

Average Population growth rate +/- standard error of the mean	1.65 +/- 0.17
PGR at least 1.0 – percentage of sites	84%
PGR <0.90 – percentage of sites	10%
PGR <0.50 – percentage of sites	3%

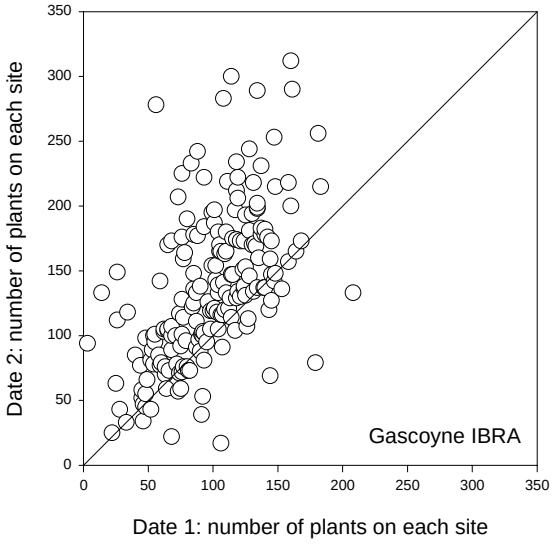


Table 1:258. Gascoyne IBRA – percentage of sites in each seasonal category showing change in shrub density (shrubland sites)

Seasonal Quality	Species group	Decline. Density < 95%	No change. Density between 95% and 105%	Increase. Density >=105%	Number of sites
All years	All	12%	11%	77%	195
Above average	All	8%	10%	82%	167
Average	All	40%	15%	45%	20
Below average	All	n/a	n/a	n/a	8

Canopy area

Table 1:259. Gascoyne IBRA – summary of canopy area (shrubland sites)

Average change in cover +/- standard error of the mean	1.72 +/- 0.05
Cover: ratio Date 2 to Date 1 at least 1.0 – percentage of sites	94%
Cover: ratio Date 2 to Date 1 <0.90 – percentage of sites	3%
Cover: ratio Date 2 to Date 1 <0.50 – percentage of sites	0%
Average cover ratio Date 2 to Date 1 for above average seasonal quality	1.79
Average cover ratio Date 2 to Date 1 for average seasonal quality	1.30
Average cover ratio Date 2 to Date 1 for below average seasonal quality	n/a

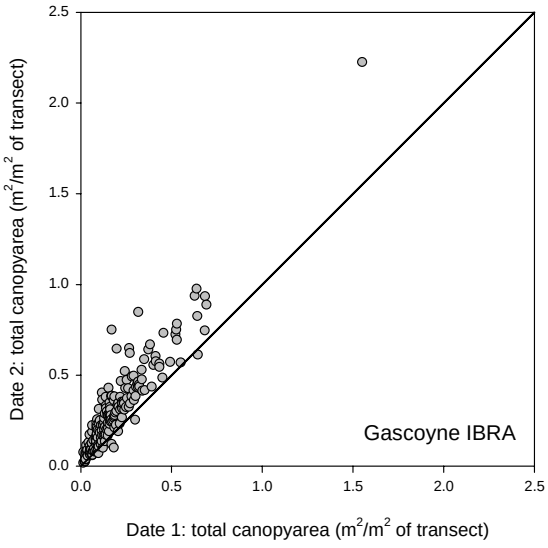


Table 1:260. Gascoyne IBRA – percentage of shrubland sites in each seasonal category showing change in canopy area of shrubs

Seasonal Quality	Species group	Decline. Total canopy area < 0.90	No change. 0.90>= total canopy area <1.10	Increase. total canopy area >=1.10	Number of sites
All years	All	3%	7%	90%	195
Above average	All	2%	2%	95%	167
Average	All	10%	30%	60%	20
Below average	All	n/a	n/a	n/a	8

Canopy area but restricted to plants less than 1.5 m in height

Table 1:261 Gascoyne IBRA – summary of canopy area (shrubland sites), but restricted to plants less than 1.5 m in height

Average change in cover +/- standard error of the mean	2.23 +/- 0.08
Cover: ratio Date 2 to Date 1 at least 1.0 – percentage of sites	94%
Cover: ratio Date 2 to Date 1 <0.90 – percentage of sites	5%
Cover: ratio Date 2 to Date 1 <0.50 – percentage of sites	1%
Average cover ratio Date 2 to Date 1 for above average seasonal quality +/- standard error of the mean	2.37 +/- 0.09
Average cover ratio Date 2 to Date 1 for average seasonal quality +/- standard error of the mean	1.30 +/- 0.11
Average cover ratio Date 2 to Date 1 for below average seasonal quality +/- standard error of the mean	n/a

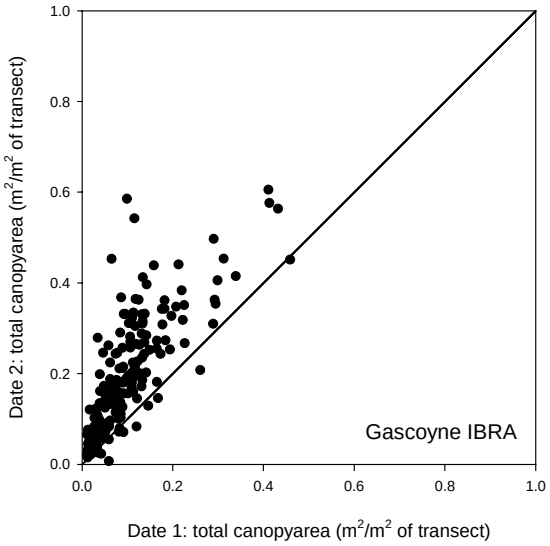


Table 1:262. Gascoyne IBRA – percentage of shrubland sites in each seasonal category showing change in canopy area of shrubs, but restricted to plants less than 1.5 m in height

Seasonal Quality	Species group	Decline. Total canopy area < 0.90	No change. 0.90 ≤ total canopy area < 1.10	Increase. total canopy area ≥ 1.10	Number of sites
All years	All	5%	5%	91%	195
Above average	All	3%	1%	96%	167
Average	All	20%	25%	55%	20
Below average	All	n/a	n/a	n/a	8

Resource Capture Index

Table 1:263. Gascoyne IBRA – summary of resource capture index, shrubland sites.

Number of sites with useable data at both dates	62
Average change in Resource Capture Index +/- standard error of the mean	0.95 +/- 0.11
Cover: ratio Date 2 to Date 1 at least 1.0 – percentage of sites	35%
Cover: ratio Date 2 to Date 1 <0.90 – percentage of sites	61%
Cover: ratio Date 2 to Date 1 <0.50 – percentage of sites	18%
Average cover ratio Date 2 to Date 1 for above average seasonal quality	0.90
Average cover ratio Date 2 to Date 1 for average seasonal quality	1.17
Average cover ratio Date 2 to Date 1 for below average seasonal quality	n/a

Figure 1:83. Change in Resource Capture Index between Date 1 and Date 2 – Gascoyne IBRA.

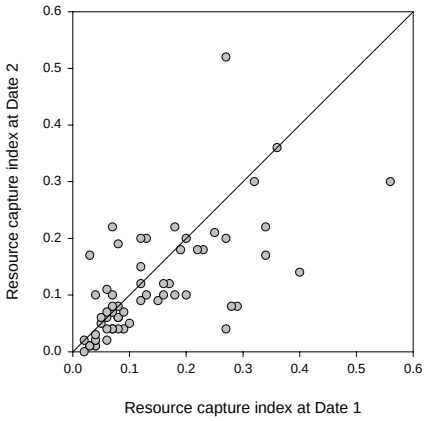


Table 1:264. Resource capture index – percentage of sites in each seasonal category showing change in the index – Gascoyne IBRA, shrubland sites

Seasonal Quality	Species group	Decline. RCI < 0.90	No change. 0.90 ≤ RCI < 1.10	Increase. RCI ≥ 1.10	Number of sites
All years	All	61%	16%	23%	62
Above average	All	59%	15%	26%	39
Average	All	53%	26%	20%	15
Below average	All	n/a	n/a	n/a	8

Proportional landscape function - stability, infiltration and nutrient cycling indices

Table 1:265. Summary - proportional landscape function indices – Gascoyne IBRA.

	Stability index	Infiltration index	Nutrient cycling index
Number of sites with useable data at both dates	64	64	64
Date 1 average +/- standard error of the mean	50.0 +/- 1.19	39.5 +/- 1.07	18.2 +/- 0.73
Date 2 average +/- standard error of the mean	53.3 +/- 0.93	44.6 +/- 0.86	20.8 +/- 0.93
Ratio of index: average +/- standard error of the mean	1.10 +/- 0.03	1.18 +/- 0.04	1.33 +/- 0.10
Ratio of index: Date 2 to Date 1 at least 1.0 – percentage of sites	93%	76%	86%
Ratio of index: : Date 2 to Date 1 <0.90 – percentage of sites	0%	3%	7%
Ratio of index: Date 2 to Date 1 <0.50 – percentage of sites	0%	0%	0%
Average of index ratio: Date 2 to Date 1 for above average seasonal quality	1.17 +/- 0.05	1.27 +/- 0.06	1.62 +/- 0.13
Average of index ratio: Date 2 to Date 1 for average seasonal quality	0.98 +/- 0.05	1.04 +/- 0.06	0.88 +/- 0.13

Average of index ratio: Date 2 to Date 1 for below average seasonal quality	n/a	n/a	n/a

Figure 1:84. Proportional landscape function - stability, infiltration and nutrient cycling indices at Date 1 and Date 2 – Gascoyne IBRA. The top panes show all data, the lower panes show expanded views over limited ranges.

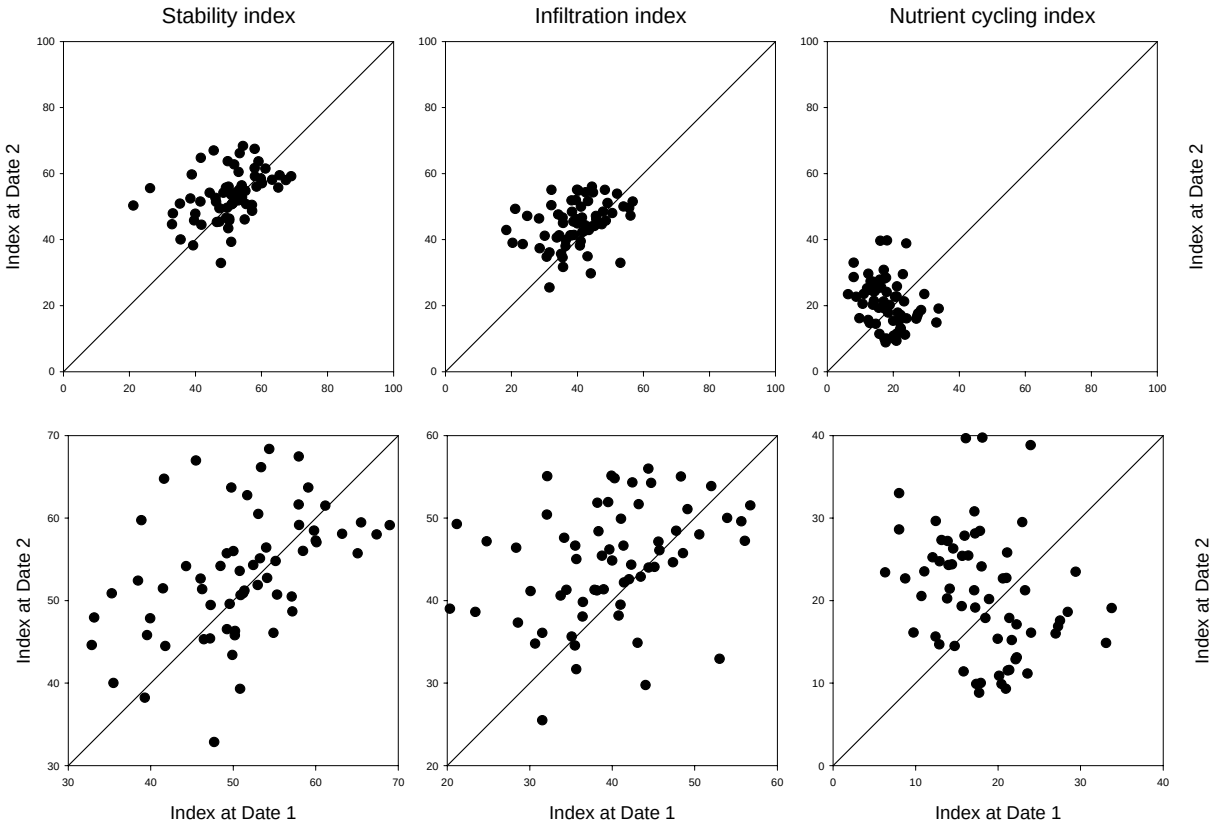


Table 1:266. Proportional landscape function - stability index – Gascoyne IBRA. Ratio of index at Date 2 to index at Date 1 (Ratio of Stability Index – RSI).

Seasonal Quality	Species group	Decline. RSI < 0.90	No change. 0.90>= RSI <1.10	Increase. RSI >=1.10	Number of sites
All years	All	14%	47%	39%	64
Above average	All	10%	37%	54%	41
Average	All	20%	67%	13%	15
Below average	All	n/a	n/a	n/a	8

Table 1:267. Proportional landscape function - infiltration index – Gascoyne IBRA. Ratio of index at Date 2 to index at Date 1 (Ratio of Infiltration Index – RII).

Seasonal Quality	Species group	Decline. RII < 0.90	No change. 0.90>= RII <1.10	Increase. RII >=1.10	Number of sites
All years	All	11%	39%	50%	64
Above average	All	5%	31%	63%	41
Average	All	27%	47%	27%	15
Below average	All	n/a	n/a	n/a	8

Table 1:268. Proportional landscape function – nutrient cycling index – Gascoyne IBRA. Ratio of index at Date 2 to index at Date 1 (Ratio of Nutrient Cycling Index – RNCI).

Seasonal Quality	Species group	Decline. RNCI < 0.90	No change. 0.90>= RNCI <1.10	Increase. RNCI >=1.10	Number of sites
All years	All	38%	8%	55%	64
Above average	All	20%	5%	76%	41
Average	All	67%	7%	27%	15
Below average	All	n/a	n/a	n/a	8

Change in landscape function – grassland sites

Perennial grass frequency

Table 1:269. Gascoyne1 sub-IBRA – summary of perennial grass frequency.

	Cycle 1	Cycle 2	Cycle 3
Average frequency: first assessment of cycle +/- standard error of the mean	96.6 +/- 1.52	96.0 +/- 1.82	n/a
Average frequency: second assessment of cycle +/- standard error of the mean	96.0 +/- 1.82	90.4 +/- 4.45	n/a
Average frequency ratio between the two assessments +/- standard error of the mean	1.00 +/- 0.03	0.94 +/- 0.03	n/a
Frequency ratio at least 1.0 – percentage of sites	55%	18%	n/a
Frequency ratio <0.90 – percentage of sites	9%	18%	n/a
Frequency ratio <0.50 – percentage of sites	0%	0%	n/a

Figure 1:85. Change in perennial grass frequency between each sampling cycle (C) – Gascoyne1 sub-IBRA.

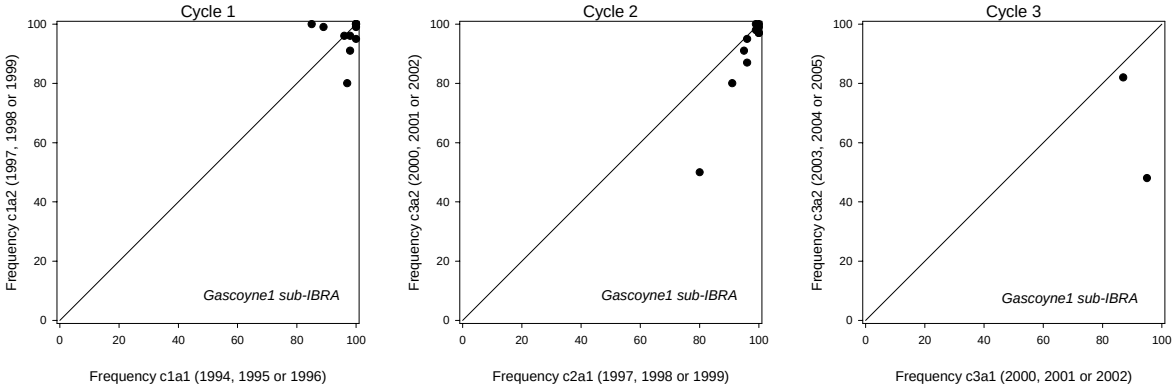


Table 1:270. Cycle 1 - percentage of sites in each seasonal category showing change in perennial grass frequency – Gascoyne1 sub-IBRA.

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency < 1.10	Increase. frequency ≥ 1.10	Number of sites
All years	All	9%	73%	18%	11
Above average	All	9%	73%	18%	11
Average	All	n/a	n/a	n/a	0
Below average	All	n/a	n/a	n/a	0

Table 1:271. Cycle 2 - percentage of sites in each seasonal category showing change in perennial grass frequency - Central Kimberley IBRA.

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency < 1.10	Increase. frequency ≥ 1.10	Number of sites
All years	All	18%	82%	0%	11
Above average	All	n/a	n/a	n/a	2
Average	All	n/a	n/a	n/a	3
Below average	All	n/a	n/a	n/a	6

Table 1:272. Cycle 3 - percentage of sites in each seasonal category showing change in perennial grass frequency – Gascoyne1 sub-IBRA.

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency < 1.10	Increase. frequency ≥ 1.10	Number of sites
All years	All	n/a	n/a	n/a	2

Above average	All	n/a	n/a	n/a	0
Average	All	n/a	n/a	n/a	0
Below average	All	n/a	n/a	n/a	2

Table 1:273. Weighted average across all three cycles - percentage of sites in each seasonal category showing change in perennial grass frequency. Only cycles containing at least 10 sites in each seasonal quality category were used. Gascoyne1 sub-IBRA.

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency < 1.10	Increase. frequency ≥ 1.10	Number of site by year combinations	Cycles used
All years	All	14%	78%	9%	22	1,2
Above average	All	9%	73%	18%	11	1
Average	All	n/a	n/a	n/a	n/a	n/a
Below average	All	n/a	n/a	n/a	n/a	n/a

Crown cover, woody species taller than 1m

Averages of frequency ratios can not be calculated because of the large number of crown cover estimates of zero (i.e. denominator = zero).

Table 1:274. Gascoyne1 sub-IBRA – summary of crown cover

Average crown cover cycle 3, assessment1 (c3a1)	n/a
Average crown cover cycle 3, assessment2 (c3a2)	n/a
* Crown cover: ratio c3a2 to c3a1, percentage of sites at least 1.0	n/a
* Crown cover: ratio c3a2 to c3a1, percentage of sites <0.90	n/a
* Crown cover: ratio c3a2 to c3a1, percentage of sites <0.50	n/a

* Sites with zero crown cover at both c3a1 and c3a2 have not been included

Table 1:275. Cycle 3 – percentage of sites in each seasonal quality category showing change in crown cover – Gascoyne1 sub-BRA. Sites with zero crown cover have not been included.

Seasonal Quality	Species group	Crown cover <0.90	No change. ≤0.90 crown cover <1.10	Crown cover ≥1.10	Number of sites
All years	All	n/a	n/a	n/a	1
Above average	All	n/a	n/a	n/a	0
Average	All	n/a	n/a	n/a	0

Below average	All	n/a	n/a	n/a	1

Resource Capture Index

Table 1:276. Gascoyne1 sub-IBRA – summary of resource capture index.

Number of sites assessed in cycle 3, assessment 1 (c3a1) and cycle 3, assessment 2 (c3a2)	2
Average Resource Capture Index - c3a1	n/a
Average Resource Capture Index – c3a2	n/a
Average ratio of Resource Capture Index – c3a2 to c3a1 +/- standard error of the mean	n/a
Resource Capture Index: ratio c3a2 to c3a1, percentage of sites at least 1.0	n/a
Resource Capture Index: ratio c3a2 to c3a1, percentage of sites <0.90	n/a
Resource Capture Index: ratio c3a2 to c3a1, percentage of sites <0.50	n/a
Average Resource Capture Index: ratio c3a2 to c3a1 for above average seasonal quality	n/a
Average Resource Capture Index: ratio c3a2 to c3a1 for average seasonal quality	n/a
Average Resource Capture Index: ratio c3a2 to c3a1 for below average seasonal quality	n/a

Figure 1:86. Change in Resource Capture Index, cycle 3 – Gascoyne1 sub-IBRA.

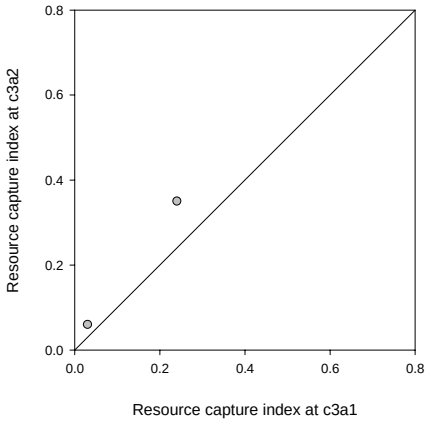


Table 1:277. Resource capture index – percentage of sites in each seasonal category showing change in the index - Central Kimberley IBRA, cycle 3.

Seasonal Quality	Species group	Decline. RCI < 0.90	No change. 0.90 ≤ RCI <1.10	Increase. RCI >=1.10	Number of sites
All years	All	n/a	n/a	n/a	2
Above average	All	n/a	n/a	n/a	0

Average	All	n/a	n/a	n/a	0
Below average	All				2

Proportional landscape function - stability, infiltration and nutrient cycling indices

Table 1:278. Proportional landscape function indices – Gascoyne1 sub-IBRA, cycle 3.

	Stability index	Infiltration index	Nutrient cycling index
Number of sites assessed in c3a1 and c3a2	2	2	2
c3a1 average +/- standard error of the mean	n/a	n/a	n/a
c3a2 average +/- standard error of the mean	n/a	n/a	n/a
Ratio of index: average +/- standard error of the mean	n/a	n/a	n/a
Ratio of index: c3a2 to c3a1 percentage of sites at least 1.0	n/a	n/a	n/a
Ratio of index: c3a2 to c3a1 percentage of sites <0.90	n/a	n/a	n/a
Ratio of index: c3a2 to c3a1 percentage of sites <0.50	n/a	n/a	n/a
Average of index ratio: c3a2 to c3a1 for above average seasonal quality	n/a	n/a	n/a
Average of index ratio: c3a2 to c3a1 for average seasonal quality	n/a	n/a	n/a
Average of index ratio: c3a2 to c3a1 for below average seasonal quality	n/a	n/a	n/a

Figure 1:87. Proportional landscape function - stability, infiltration and nutrient cycling indices, cycle3 – Gascoyne1 sub-IBRA. The top panes show all data, the lower panes show expanded views over limited ranges.

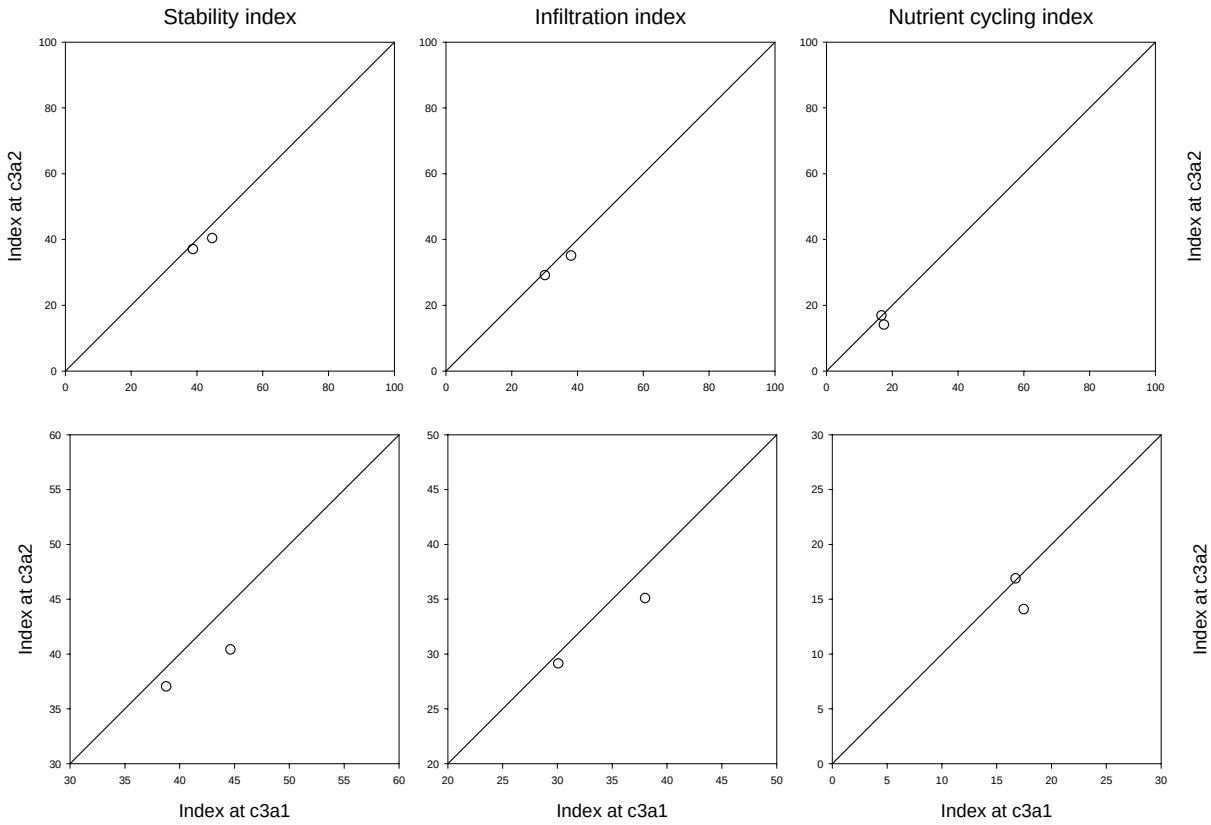


Table 1:279. Proportional landscape function - stability index – Gascoyne1 sub-IBRA. Ratio of stability index (RSI) at cycle 3, assessment 2 (c3a2) to index at cycle 3, assessment 1 (c3a1).

Seasonal Quality	Species group	Decline. RSI < 0.90	No change. 0.90>= RSI <1.10	Increase. RSI >=1.10	Number of sites
All years	All	n/a	n/a	n/a	2
Above average	All	n/a	n/a	n/a	0
Average	All	n/a	n/a	n/a	0
Below average	All	n/a	n/a	n/a	2

Table 1:280. Proportional landscape function - infiltration index – Gascoyne1 sub-IBRA. Ratio of infiltration index (RII) at cycle 3, assessment 2 (c3a2) to index at cycle 3, assessment 1 (c3a1).

Seasonal Quality	Species group	Decline. RII < 0.90	No change. 0.90>= RII <1.10	Increase. RII >=1.10	Number of sites
All years	All	n/a	n/a	n/a	2
Above average	All	n/a	n/a	n/a	0
Average	All	n/a	n/a	n/a	0
Below	All	n/a	n/a	n/a	2

average

Table 1:281. Proportional landscape function – nutrient cycling index – Gascoyne1 sub-IBRA. Ratio of nutrient cycling index (RNCI) at cycle 3, assessment 2 (c3a2) to index at cycle 3, assessment 1 (c3a1).

Seasonal Quality	Species group	Decline. RNCI < 0.90	No change. 0.90>= RNCI <1.10	Increase. RNCI >=1.10	Number of sites
All years	All	n/a	n/a	n/a	2
Above average	All	n/a	n/a	n/a	0
Average	All	n/a	n/a	n/a	0
Below average	All	n/a	n/a	n/a	2

Change in sustainable management of the pastoral estate – shrubland sites

Population growth rate (i.e. density) of Decreaser, Intermediate and Increaser species

Table 1:282. Summary of population growth rate of decreaser, intermediate and increaser species on shrubland sites – Gascoyne IBRA

PGR +/- standard error of the mean	1.91 +/- 0.19	1.48 +/- 0.07	1.93 +/- 0.20
PGR: Date 2 to Date 1 at least 1.0 – percentage of sites	77%	80%	89%
PGR: Date 2 to Date 1 <0.90 – percentage of sites	16%	18%	8%
PGR: Date 2 to Date 1 <0.50 – percentage of sites	5%	3%	2%
Average PGR Date 2 to Date 1 for above average seasonal quality	2.04	1.55	2.02
Average PGR Date 2 to Date 1 for average seasonal quality	1.03	1.13	1.35
Average PGR Date 2 to Date 1 for below average seasonal quality	n/a	n/a	n/a

Figure 1:88. Change in number of shrubs on each site by response category (shrubland sites), Gascoyne IBRA.

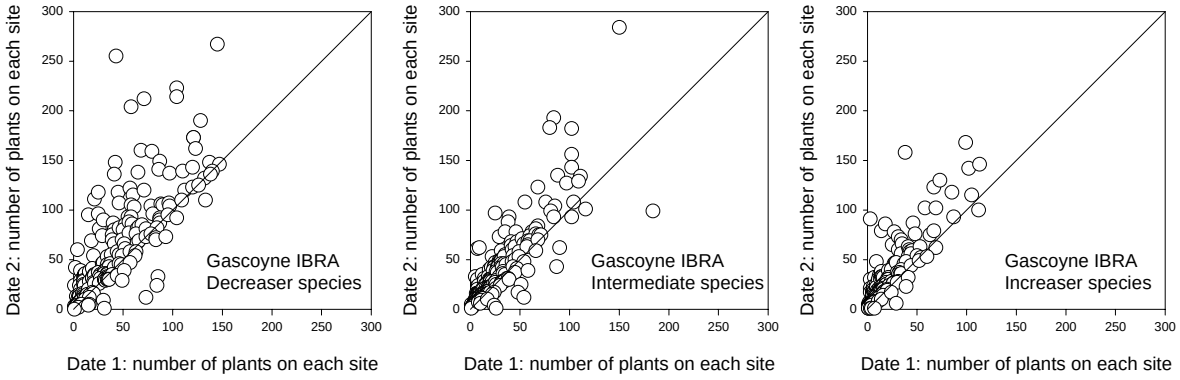


Table 1:283. Change in density between date 1 and date 2 of decreaser, intermediate and increaser shrub species – percentage of sites by seasonal category – Gascoyne IBRA.

Seasonal Quality	Species group	Decline. Density < 0.95	No change. 0.95 ≤ density ≤ 1.05	Increase. Density ≥ 1.05	Number of sites
All years	Decreaser	18%	14%	67%	187
	Intermediate	19%	8%	72%	190
	Increaser	10%	12%	78%	166
Above average	Decreaser	14%	12%	73%	161
	Intermediate	16%	8%	76%	162
	Increaser	9%	10%	82%	141
Average	Decreaser	50%	28%	22%	18
	Intermediate	40%	10%	50%	20
	Increaser	18%	18%	65%	17
Below average	Decreaser	n/a	n/a	n/a	8
	Intermediate	n/a	n/a	n/a	8
	Increaser	n/a	n/a	n/a	8

Canopy area of Decreaser, Intermediate and Increaser species but restricted to plants less than 1.5 m in height

Table 1:284. Gascoyne IBRA – summary of canopy area for decreaser, intermediate and increaser species but restricted to plants less than 1.5 m in height.

Average change in cover +/- standard error of the mean	3.36 +/- 0.36	3.16 +/- 0.26	3.11 +/- 0.39
Cover: ratio Date 2 to Date 1 at least 1.0 – percentage of sites	85%	94%	90%
Cover: ratio Date 2 to Date 1 <0.90 – percentage of sites	12%	8%	8%
Cover: ratio Date 2 to Date 1 <0.50 – percentage of sites	5%	4%	4%
Average cover ratio Date 2 to Date 1 for above average seasonal quality	3.69	3.43	3.27

Average cover ratio Date 2 to Date 1 for average seasonal quality	1.32	1.61	2.03
Average cover ratio Date 2 to Date 1 for below average seasonal quality	n/a	n/a	n/a

Figure 1:89. Canopy area by site – Decreaser, Intermediate and Increaser species but restricted to plants less than 1.5 m in height – Gascoyne IBRA.

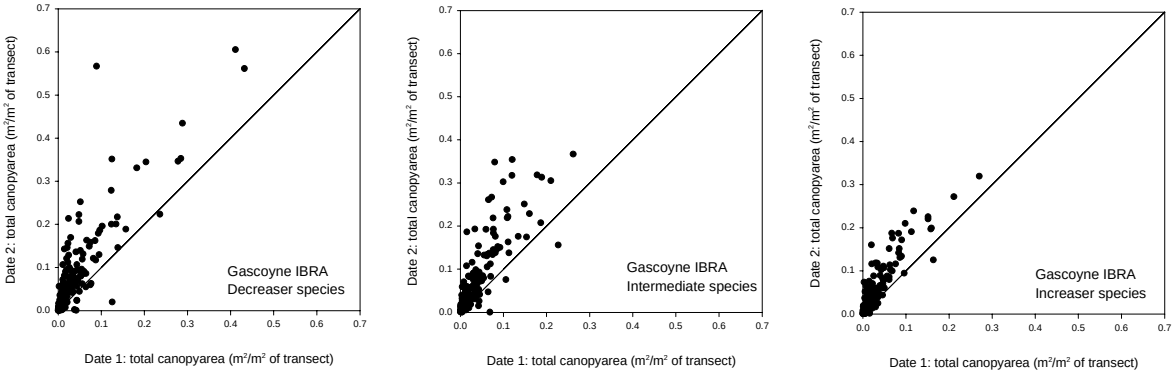


Table 1:285. Gascoyne IBRA – percentage of sites in each seasonal category showing change in canopy area for decreaser, intermediate and increaser species but restricted to plants less than 1.5 m in height.

Seasonal Quality	Species group	Decline. Total canopy area < 0.90	No change. 0.90 ≤ total canopy area < 1.10	Increase. total canopy area ≥ 1.10	Number of sites
All years	Decreaser	12%	5%	83%	187
	Intermediate	8%	2%	90%	188
	Increaser	8%	4%	88%	164
Above average	Decreaser	7%	2%	91%	161
	Intermediate	6%	1%	93%	160
	Increaser	9%	3%	88%	139
Average	Decreaser	56%	22%	22%	18
	Intermediate	20%	10%	70%	20
	Increaser	6%	18%	76%	17
Below average	Decreaser	n/a	n/a	n/a	8
	Intermediate	n/a	n/a	n/a	8
	Increaser	n/a	n/a	n/a	8

Change in sustainable management of the pastoral estate – grassland sites

Frequency of Decreaser, Intermediate and Increaser perennial grass species

Table 1:286. Summary of frequency of decreaser, intermediate and increaser perennial grass species, Gascoyne1 sub-IBRA, cycle 3.

Average change in frequency +/- standard error of the mean
Frequency: ratio c3a2 to c3a1, percentage of sites ≥ 1.0
Frequency: ratio c3a2 to c3a1, percentage of sites <0.90
Frequency: ratio c3a2 to c3a1, percentage of sites <0.50
Average change in frequency: c3a2 to c3a1, above average seasonal quality
Average change in frequency: c3a2 to c3a1, average seasonal quality
Average change in frequency: c3a2 to c3a1, below average seasonal quality

Figure 1:90. Change in perennial grass frequency between, cycle 3 – decreaser, intermediate and increaser species

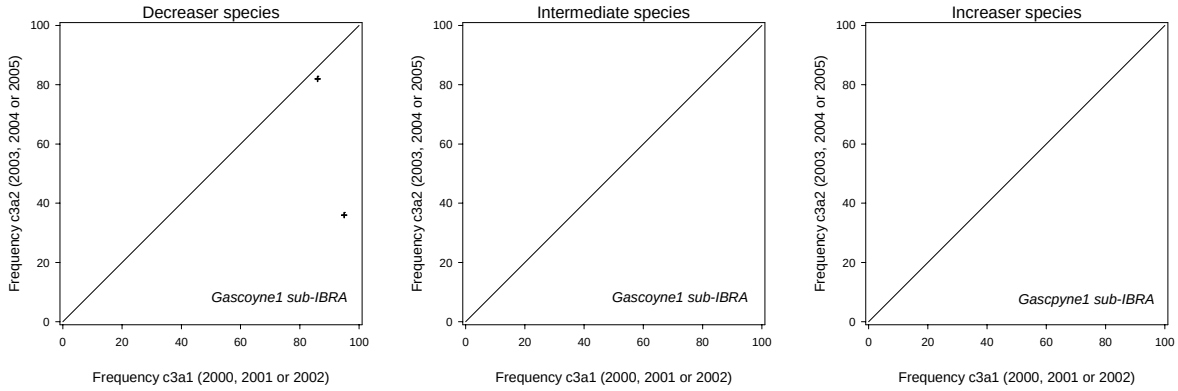


Table 1:287. Change in frequency of decreaser, intermediate and increaser perennial grass species – percentage of sites in each seasonal category – Gascoyne1 sub-IBRA, cycle 1

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency <1.10	Increase. frequency ≥1.10	Number of sites
All years	Decreaser	9%	73%	18%	11
	Intermediate	n/a	n/a	n/a	2
	Increaser	n/a	n/a	n/a	0
Above average	Decreaser	9%	73%	18%	11
	Intermediate	n/a	n/a	n/a	2
	Increaser	n/a	n/a	n/a	0
Average	Decreaser	n/a	n/a	n/a	0
	Intermediate	n/a	n/a	n/a	0
	Increaser	n/a	n/a	n/a	0
Below average	Decreaser	n/a	n/a	n/a	0
	Intermediate	n/a	n/a	n/a	0
	Increaser	n/a	n/a	n/a	0

Table 1:288. Change in frequency of decreaser, intermediate and increaser perennial grass species – percentage of sites in each seasonal category - Gascoyne1 sub-IBRA, cycle 2

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency <1.10	Increase. frequency ≥1.10	Number of sites
All years	Decreaser	18%	73%	9%	11
	Intermediate	n/a	n/a	n/a	1
	Increaser	n/a	n/a	n/a	0
Above average	Decreaser	n/a	n/a	n/a	2
	Intermediate	n/a	n/a	n/a	0
	Increaser	n/a	n/a	n/a	0
Average	Decreaser	n/a	n/a	n/a	3
	Intermediate	n/a	n/a	n/a	0
	Increaser	n/a	n/a	n/a	0
Below average	Decreaser	n/a	n/a	n/a	6
	Intermediate	n/a	n/a	n/a	1
	Increaser	n/a	n/a	n/a	0

Table 1:289. Change in frequency of decreaser, intermediate and increaser perennial grass species – percentage of sites in each seasonal category - Gascoyne1 sub-IBRA, cycle 3

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency <1.10	Increase. frequency ≥1.10	Number of sites
All years	Decreaser	n/a	n/a	n/a	2
	Intermediate	n/a	n/a	n/a	0
	Increaser	n/a	n/a	n/a	0
Above average	Decreaser	n/a	n/a	n/a	0
	Intermediate	n/a	n/a	n/a	0
	Increaser	n/a	n/a	n/a	0

Average	Decreaser	n/a	n/a	n/a	0
	Intermediate	n/a	n/a	n/a	0
	Increaser	n/a	n/a	n/a	0
Below average	Decreaser	n/a	n/a	n/a	2
	Intermediate	n/a	n/a	n/a	0
	Increaser	n/a	n/a	n/a	0

Table 1:290. Weighted average across all three cycles - change in frequency of decreaser, intermediate and increaser perennial grass species – percentage of sites in each seasonal category - Gascoyne1 sub-IBRA.

Seasonal Quality	Species group	Decline. frequency < 0.90	No change. 0.90 ≤ frequency <1.10	Increase. frequency ≥1.10	Number of sites	Cycles used
All years	Decreaser	14%	73%	14%	22	1
	Intermediate	n/a	n/a	n/a	n/a	n/a
	Increaser	n/a	n/a	n/a	n/a	n/a
Above average	Decreaser	9%	73%	18%	11	1,2
	Intermediate	n/a	n/a	n/a	n/a	n/a
	Increaser	n/a	n/a	n/a	n/a	n/a
Average	Decreaser	n/a	n/a	n/a	n/a	n/a
	Intermediate	n/a	n/a	n/a	n/a	n/a
	Increaser	n/a	n/a	n/a	n/a	n/a
Below average	Decreaser	n/a	n/a	n/a	n/a	n/a
	Intermediate	n/a	n/a	n/a	n/a	n/a
	Increaser	n/a	n/a	n/a	n/a	n/a

Change in vegetation richness and occurrence – shrubland sites

Native shrub species richness

Table 1:291. Gascoyne IBRA – summary of native shrub species richness

Number of sites assessed	195
Average number of species per site – Date 1	8.8 +/- 0.22
Average number of species per site – Date 2	9.9 +/- 0.24
Average ratio of species richness: Date 2 to Date 1 +/- standard error of the mean	1.14 +/- 0.02
Species richness: ratio Date 2 to Date 1 at least 1.0 – percentage of sites	87%
Species richness: ratio Date 2 to Date 1 <0.90 – percentage of sites	7%
Species richness: ratio Date 2 to Date 1 <0.50 – percentage of sites	0%

Figure 1:91. Change in shrub species richness on each site between Date 1 and Date 2 – Gascoyne IBRA. Bubble size represents number of sites at each x,y point.

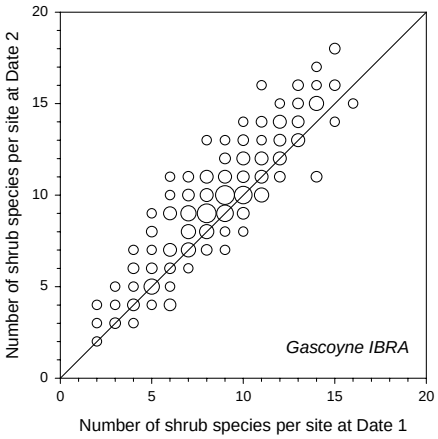


Table 1:292. Native species shrub richness Gascoyne IBRA- date 2 to divided by date 1.

Seasonal Quality	Species group	Decline. Richness index < 0.80	No change. 0.80 ≤ Richness index <1.20	Increase. Richness index ≥1.20	Number of sites
All years	All	4%	64%	32%	195
Above average	All	4%	62%	35%	167
Average	All	5%	75%	20%	20
Below average	All	n/a	n/a	n/a	8

Frequency of occurrence

Table 1:293. Gascoyne IBRA – shrubland sites – species found on at least five sites at Date 1 or Date 2.

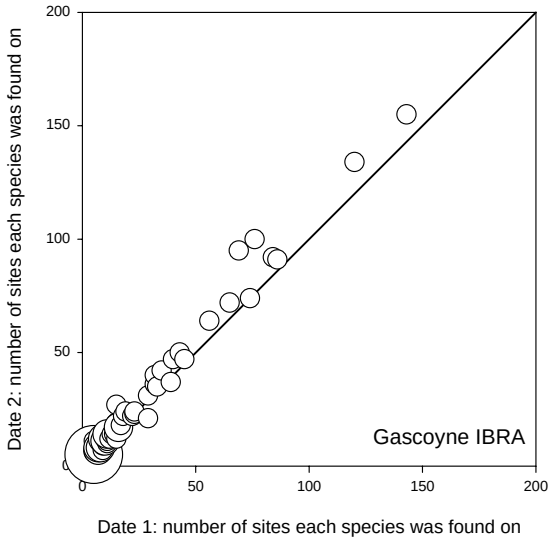
Number of species	75
Occurrence ratio Date 2 to Date 1 at least 1.0 – percentage of sites	87%
Occurrence ratio Date 2 to Date 1 >1.10 – percentage of species	49%
Occurrence ratio Date 2 to Date 1 < 0.90 – percentage of species	9%
Occurrence ratio Date 2 to Date 1 < 0.50 – percentage of species	0%
Average change in occurrence ratio	1.14

Table 1:294. Species with occurrence ratio greater than 1.1 or less than 0.90 and found on at least 10 sites at Date 1 or Date 2 – Gascoyne IBRA

SPECIES_NAME	DESIR	TR_C	No_pop	No_pop	OR
Psydrax suaveolens		3	5	11	2.20
Maireana georgei	D	2	15	27	1.80
Acacia tetragonophylla	I	3	69	95	1.38

Acacia citrinoviridis	I		9	12	1.33
Hakea preissii	U	3	9	12	1.33
Rhagodia eremaea	D	2	76	100	1.32
Eremophila platycalyx	I	3	10	13	1.30
Acacia pruinocarpa	I		11	14	1.27
Grevillea striata	I		11	14	1.27
Eremophila lanceolata		2	15	19	1.27
Frankenia species	D	4	19	24	1.26
Maireana villosa	D	2	32	40	1.25
Senna glutinosa subsp. pruinosa	I	2	18	22	1.22
Senna glutinosa subsp. chatelainiana	D	1	10	12	1.20
Senna artemisioides subsp. x sturtii	U	2	35	42	1.20
Eremophila freelingii	U		11	13	1.18
Senna artemisioides subsp. oligophylla	I	2	40	47	1.18
Eremophila fraseri	U	4	43	50	1.16
Acacia victoriae	U	2	56	64	1.14
Eremophila latrobei	D	4	32	36	1.13
Ptilotus obovatus	D	3	120	134	1.12
Senna artemisioides subsp. x sturtii	U	3	65	72	1.11
Maireana platycarpa	D	4	15	12	0.80
Sida calyxhymenia	D	3	29	21	0.72

Figure 1:92. Frequency of occurrence for all species found on at least five sites in the Gascoyne IBRA.



Change in vegetation richness and occurrence – grassland sites

Native perennial species richness

Table 1:295. Gascoyne1 sub-IBRA – summary of native perennial species richness, cycle 3

Number of sites assessed in cycle 3, assessment 1 and cycle3 assessment 2 (c3a1 & c3a2)	2
Average number of native perennial species per site at c3a1 – for sites assessed in both c3a1 and c3a2: +/- standard error of the mean	n/a
Average number of native perennial species per site in c3a2 – for sites assessed in both c3a1 and c3a2: +/- standard error of the mean	n/a
Average ratio of species richness: c3a2 to c3a1: +/- standard error of the mean	n/a
Species richness: ratio c3a2 to c3a1, percentage of sites at least 1.0	n/a
Species richness: ratio c3a2 to c3a1, percentage of sites <0.90	n/a
Species richness: ratio c3a2 to c3a1, percentage of sites <0.50	n/a

Figure 1:93. Change in species richness on each site between each sampling cycle – Gascoyne1 sub-IBRA. Bubble size represents number of sites at each x,y point.

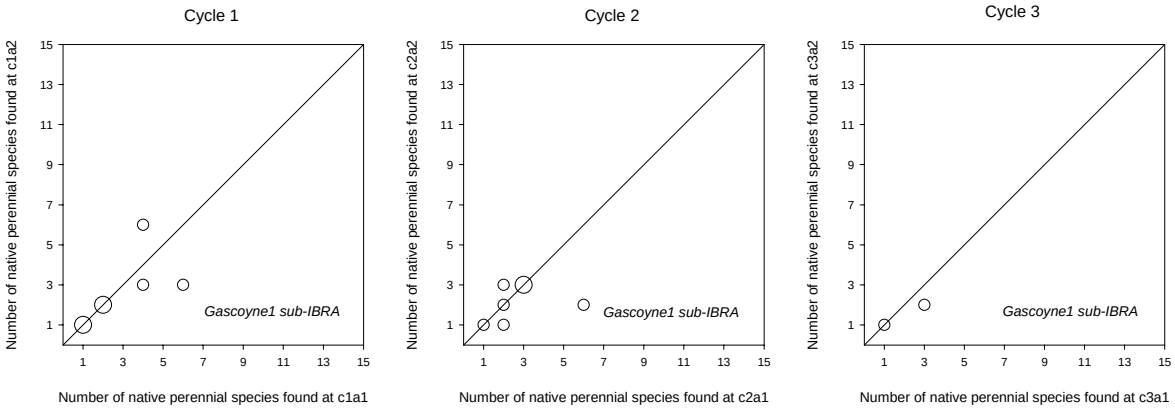


Table 1:296. Cycle 1 - native perennial species richness Gascoyne1 sub-IBRA - c1a2 divided by c1a1.

Seasonal Quality	Species group	Decline. Richness index < 0.80	No change. 0.80 ≤ Richness index <1.20	Increase. Richness index ≥1.20	Number of sites
All years	All	n/a	n/a	n/a	6
Above average	All	n/a	n/a	n/a	6
Average	All	n/a	n/a	n/a	0
Below average	All	n/a	n/a	n/a	0

Table 1:297. Cycle 2 - native perennial species richness Gascoyne1 sub-IBRA - c2a2 divided by c2a1.

Seasonal Quality	Species group	Decline. Richness index < 0.80	No change. 0.80 ≤ Richness index <1.20	Increase. Richness index ≥1.20	Number of sites
All years	All	n/a	n/a	n/a	6
Above average	All	n/a	n/a	n/a	2
Average	All	n/a	n/a	n/a	1
Below average	All	n/a	n/a	n/a	3

Table 1:298. Cycle 3 - native perennial species richness Gascoyne1 sub-IBRA - c3a2 divided by c3a1.

Seasonal Quality	Species group	Decline. Richness index < 0.80	No change. 0.80 ≤ Richness index <1.20	Increase. Richness index ≥1.20	Number of sites
All years	All	n/a	n/a	n/a	2
Above average	All	n/a	n/a	n/a	0
Average	All	n/a	n/a	n/a	0
Below average	All	n/a	n/a	n/a	2

Table 1:299. Weighted average across all three cycles - native perennial species richness Gascoyne1 sub-IBRA.

Seasonal Quality	Species group	Decline. Richness index < 0.80	No change. 0.80 ≤ Richness index <1.20	Increase. Richness index ≥1.20	Number of sites	Cycles used
All years	All	n/a	n/a	n/a	n/a	n/a
Above average	All	n/a n/a	n/a n/a	n/a n/a	n/a n/a	n/a n/a
Average	All	n/a	n/a	n/a	n/a	n/a
Below average	All	n/a	n/a	n/a	n/a	n/a

Frequency of occurrence – native species

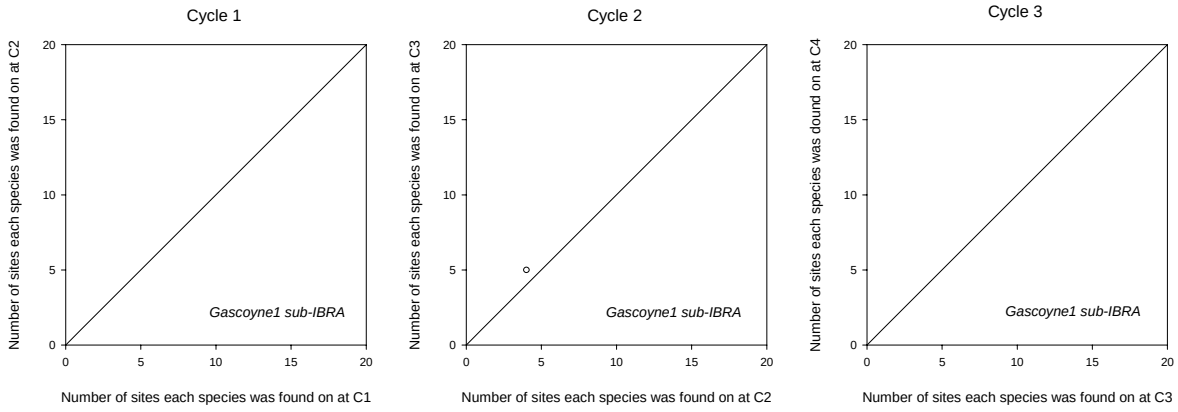
Table 1:300. Gascoyne1 sub-IBRA – species found on at least five sites at either the first or second assessment of each cycle and on at least one site at the first assessment date of each cycle.

	c1a1 & c1a2	c2a1 & c2a2	c3a1 & c3a2
Number of species	0	1	0
Average number of sites each species was found on	n/a	n/a	n/a
Average number of sites each species was found on	n/a	n/a	n/a
Occurrence ratio at least 1.0 – percentage of species	n/a	n/a	n/a
Occurrence ratio >1.10 – percentage of species	n/a	n/a	n/a
Occurrence ratio < 0.90 – percentage of species	n/a	n/a	n/a
Occurrence ratio < 0.50 – percentage of species	n/a	n/a	n/a
Average occurrence ratio +/- standard error of the mean	n/a	n/a	n/a

Table 1:301. Native species found on WARMS sites within the Gascoyne1 sub-IBRA. Data were filtered to include only those species found on at least five sites at any of the assessments, and on at least one site at the first assessment of each of the three sampling cycles. The table shows the number of sites each species was found on and the number of sites assessed at the first and second assessment of each cycle.

SPECIES_NAME	c1a1 & c1a2	c2a1 & c2a2	c3a1 & c3a2	ratio c1a2/ c1a1	ratio c2a2/ c2a1	ratio c3a1/ c3a2
Acacia victoriae	4 then 4 of 11	4 then 5 of 11		1.00	1.25	

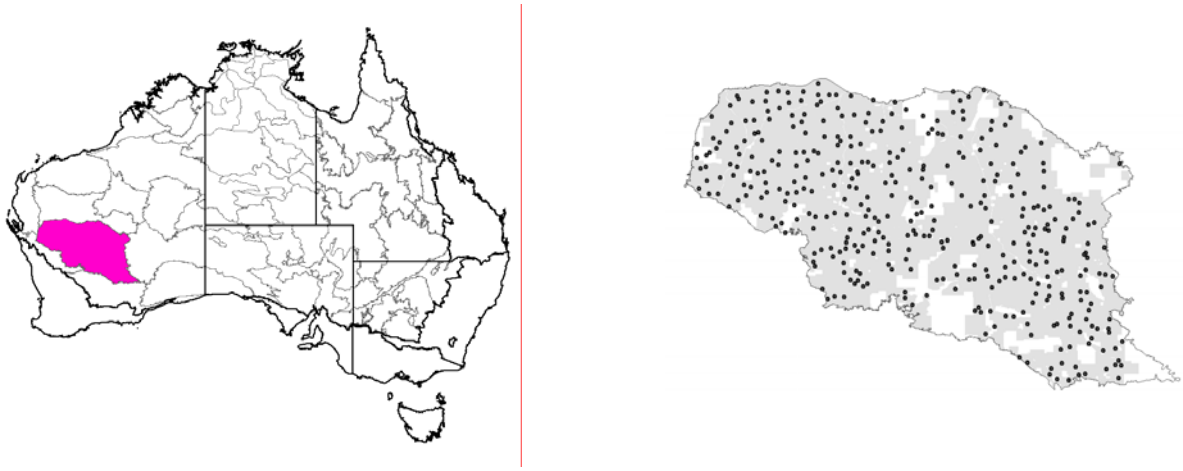
Figure 1:94. Frequency of occurrence for all native species found on at least five sites at either the first or second sampling, for each cycle – Gascoyne1 sub-IBRA. Bubble size represents number of sites at each x,y point.



Murchison IBRA

For shrubland sites, data from both Murchison sub-IBRAs were pooled and the complete Murchison IBRA is reported.

Figure 1:95. Location of Murchison IBRA (left) and WARMS sites in the IBRA (right). Greyed areas are pastoral tenure.



Site and seasonal summary

Table 1:302. Murchison IBRA – shrubland sites – total number of sites and dates assessed

Number of shrubland sites assessed	386
Number of shrubland sites in MUR1 (Eastern Murchison)	269
Number of shrubland sites in MUR2 (Western Murchison)	117
Date 1: first assessment (installation)	5/12/93 to 21/4/01
Date 2: second assessment	19/9/99 to 11/11/05
Above average seasonal quality – percentage of sites	41%
Average seasonal quality – percentage of sites	43%
Below average seasonal quality – percentage of sites	16%

Change in landscape function

Population growth rate (i.e. density)

Table 1:303. Murchison IBRA – shrubland sites – summary of population growth rate (i.e. density)

Average Population growth rate +/- standard error of the mean	1.18 +/- 0.03
PGR at least 1.0 – percentage of sites	62%
PGR <0.90 – percentage of sites	21%
PGR <0.50 – percentage of sites	3%

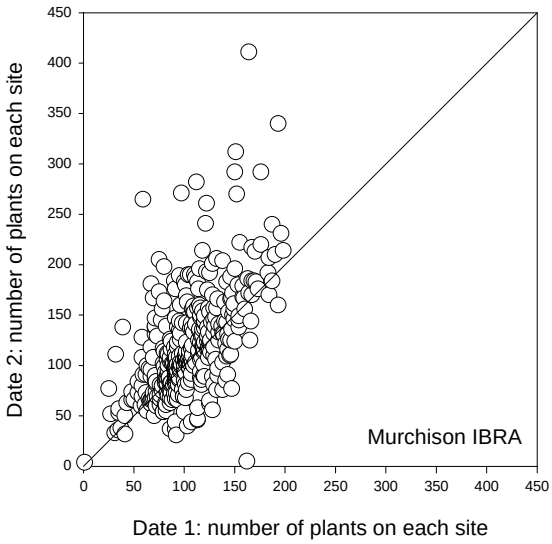


Table 1:304. Murchison IBRA – percentage of sites in each seasonal category showing change in shrub density (shrubland sites)

Seasonal Quality	Species group	Decline. Density < 95%	No change. Density between 95% and 105%	Increase. Density >=105%	Number of sites
All years	All	28%	19%	52%	386
Above average	All	14%	15%	71%	157
Average	All	30%	23%	47%	167
Below average	All	60%	19%	21%	62

Canopy area

Table 1:305. Murchison IBRA – summary of canopy area (shrubland sites)

Average change in cover +/- standard error of the mean	1.28 +/- 0.04
Cover: ratio Date 2 to Date 1 at least 1.0 – percentage of sites	68%
Cover: ratio Date 2 to Date 1 <0.90 – percentage of sites	22%
Cover: ratio Date 2 to Date 1 <0.50 – percentage of sites	3%

Average cover ratio Date 2 to Date 1 for above average seasonal quality	1.58
Average cover ratio Date 2 to Date 1 for average seasonal quality	1.15
Average cover ratio Date 2 to Date 1 for below average seasonal quality	0.85

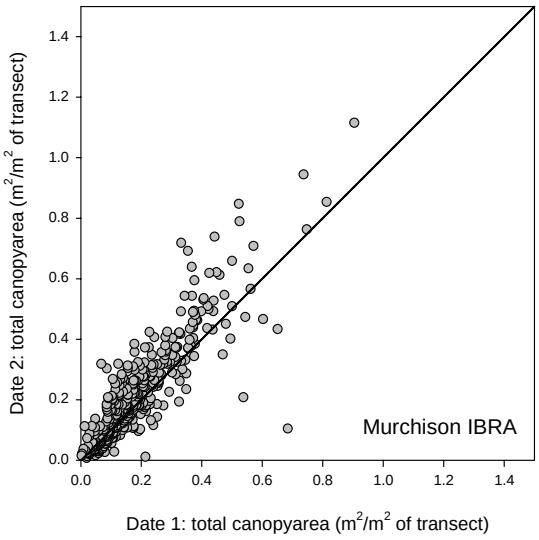


Table 1:306. Murchison IBRA – percentage of shrubland sites in each seasonal category showing change in canopy area of shrubs

Seasonal Quality	Species group	Decline. Total canopy area < 0.90	No change. 0.90>= total canopy area <1.10	Increase. total canopy area >=1.10	Number of sites
All years	All	22%	22%	56%	386
Above average	All	8%	11%	82%	157
Average	All	24%	28%	48%	167
Below average	All	52%	34%	15%	62

Canopy area but restricted to plants less than 1.5 m in height

Table 1:307 Murchison IBRA – summary of canopy area (shrubland sites), but restricted to plants less than 1.5 m in height

Average change in cover +/- standard error of the mean	1.48 +/- 0.05
Cover: ratio Date 2 to Date 1 at least 1.0 – percentage of sites	67%
Cover: ratio Date 2 to Date 1 <0.90 – percentage of sites	24%

Cover: ratio Date 2 to Date 1 <0.50 – percentage of sites	5%
Average cover ratio Date 2 to Date 1 for above average seasonal quality +/- standard error of the mean	1.97 +/- 0.09
Average cover ratio Date 2 to Date 1 for average seasonal quality +/- standard error of the mean	1.25 +/- 0.05
Average cover ratio Date 2 to Date 1 for below average seasonal quality +/- standard error of the mean	0.86 +/- 0.04

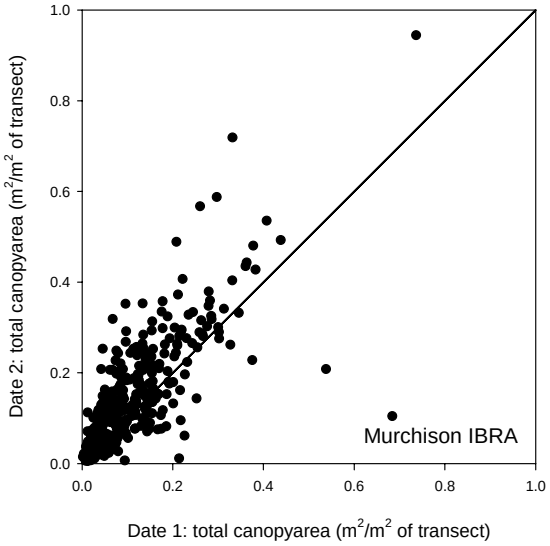


Table 1:308. Murchison IBRA – percentage of shrubland sites in each seasonal category showing change in canopy area of shrubs, but restricted to plants less than 1.5 m in height

Seasonal Quality	Species group	Decline. Total canopy area < 0.90	No change. 0.90 ≤ total canopy area < 1.10	Increase. total canopy area ≥ 1.10	Number of sites
All years	All	24%	16%	61%	386
Above average	All	8%	8%	84%	157
Average	All	25%	22%	53%	167
Below average	All	60%	18%	23%	62

Resource Capture Index

Table 1:309. Murchison IBRA – summary of resource capture index, shrubland sites.

Number of sites with useable data at both dates	297
Average change in Resource Capture Index +/- standard error of the mean	0.90 +/- 0.03

Cover: ratio Date 2 to Date 1 at least 1.0 – percentage of sites	32%
Cover: ratio Date 2 to Date 1 <0.90 – percentage of sites	47%
Cover: ratio Date 2 to Date 1 <0.50 – percentage of sites	21%
Average cover ratio Date 2 to Date 1 for above average seasonal quality	0.91
Average cover ratio Date 2 to Date 1 for average seasonal quality	0.92
Average cover ratio Date 2 to Date 1 for below average seasonal quality	0.84

Figure 1:96. Change in Resource Capture Index between Date 1 and Date 2 – Murchison IBRA.

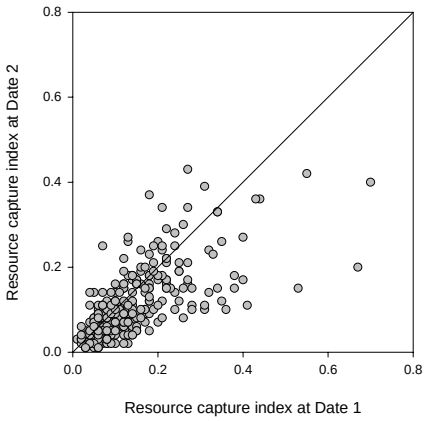


Table 1:310. Resource capture index – percentage of sites in each seasonal category showing change in the index – Murchison IBRA, shrubland sites

Seasonal Quality	Species group	Decline. RCI < 0.90	No change. 0.90 ≤ RCI <1.10	Increase. RCI ≥ 1.10	Number of sites
All years	All	59%	12%	29%	297
Above average	All	60%	9%	32%	94
Average	All	55%	15%	30%	141
Below average	All	68%	11%	21%	62

Proportional landscape function – stability, infiltration and nutrient cycling indices

Table 1:311. Summary - proportional landscape function indices – Murchison IBRA.

	Stability index	Infiltration index	Nutrient cycling index
Number of sites with useable data at both dates	299	299	299

Date 1 average +/- standard error of the mean	55.9 +/- 0.35	42.3 +/- 0.36	23.2 +/- 0.35
Date 2 average +/- standard error of the mean	56.1 +/- 0.38	42.5 +/- 0.37	19.3 +/- 0.37
Ratio of index: average +/- standard error of the mean	1.01 +/- 0.01	1.02 +/- 0.01	0.91 +/- 0.03
Ratio of index: Date 2 to Date 1 at least 1.0 – percentage of sites	49%	47%	32%
Ratio of index: : Date 2 to Date 1 <0.90 – percentage of sites	15%	22%	61%
Ratio of index: Date 2 to Date 1 <0.50 – percentage of sites	0%	0%	12%
Average of index ratio: Date 2 to Date 1 for above average seasonal quality	1.04 +/- 0.01	1.06 +/- 0.02	1.20 +/- 0.04
Average of index ratio: Date 2 to Date 1 for average seasonal quality	1.01 +/- 0.01	1.01 +/- 0.02	0.82 +/- 0.04
Average of index ratio: Date 2 to Date 1 for below average seasonal quality	0.97 +/- 0.01	0.95 +/- 0.01	0.67 +/ 0.02

Figure 1:97. Proportional landscape function – stability, infiltration and nutrient cycling indices at Date 1 and Date 2 – Murchison IBRA. The top panes show all data, the lower panes show expanded views over limited ranges.

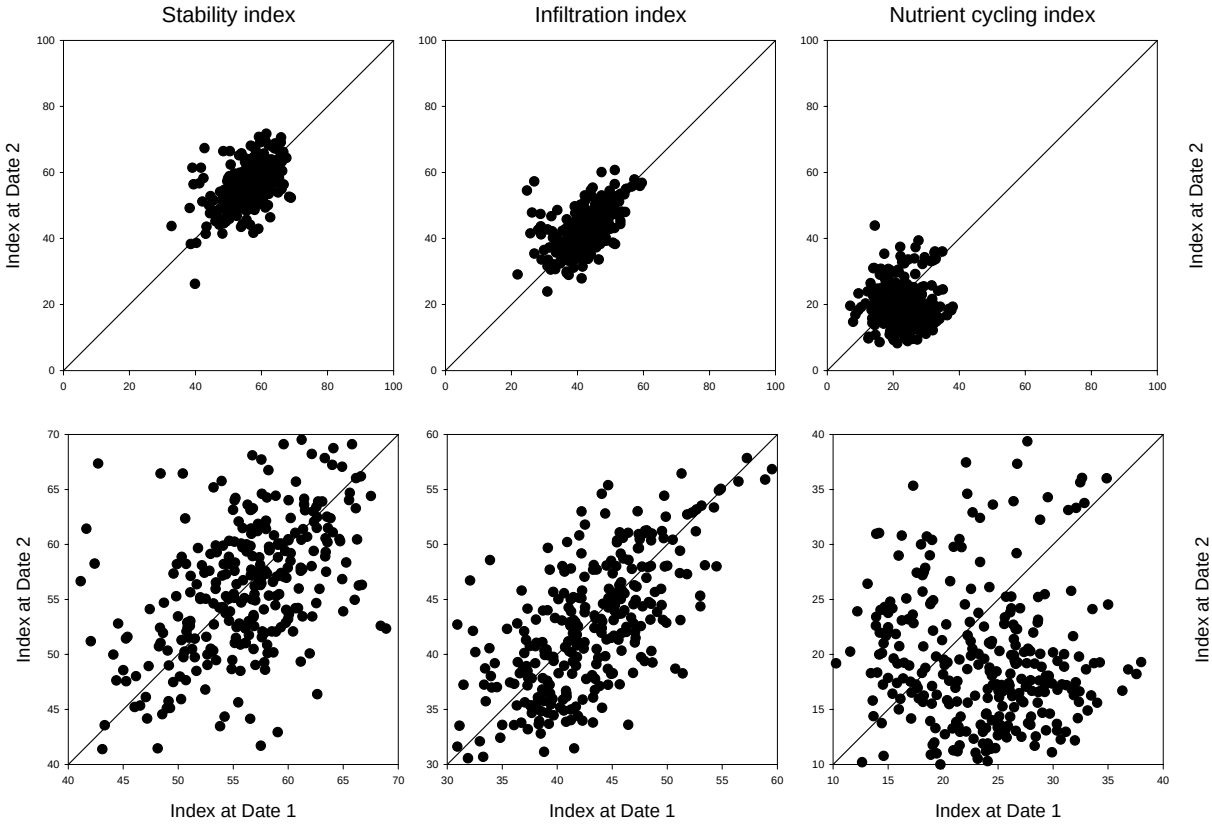


Table 1:312. Proportional landscape function – stability index – Murchison IBRA. Ratio of index at Date 2 to index at Date 1 (Ratio of Stability Index – RSI).

Seasonal Quality	Species group	Decline. RSI < 0.90	No change. 0.90>= RSI <1.10	Increase. RSI >=1.10	Number of sites

All years	All	15%	68%	17%	299
Above average	All	10%	66%	24%	96
Average	All	15%	68%	66%	142
Below average	All	20%	72%	8%	61

Table 1:313. Proportional landscape function – infiltration index – Murchison IBRA. Ratio of index at Date 2 to index at Date 1 (Ratio of Infiltration Index – RII).

Seasonal Quality	Species group	Decline. RII < 0.90	No change. 0.90>= RII <1.10	Increase. RII >=1.10	Number of sites
All years	All	22%	59%	20%	299
Above average	All	12%	58%	29%	96
Average	All	24%	58%	18%	142
Below average	All	31%	59%	10%	61

Table 1:314. Proportional landscape function – nutrient cycling index – Murchison IBRA. Ratio of index at Date 2 to index at Date 1 (Ratio of Nutrient Cycling Index – RNCI).

Seasonal Quality	Species group	Decline. RNCI < 0.90	No change. 0.90>= RNCI <1.10	Increase. RNCI >=1.10	Number of sites
All years	All	61%	13%	26%	299
Above average	All	31%	9%	59%	96
Average	All	70%	15%	15%	142
Below average	All	85%	13%	2%	61

Change in sustainable management of the pastoral estate – shrubland sites

Population growth rate (i.e. density) of Decreaser, Intermediate and Increaser species

Table 1:315. Summary of population growth rate of decreaser, intermediate and increaser species on shrubland sites – Murchison IBRA

PGR +/- standard error of the mean	1.39 +/- 0.08	1.23 +/- 0.05	1.41 +/- 0.07

PGR: Date 2 to Date 1 at least 1.0 – percentage of sites	64%	69%	84%
PGR: Date 2 to Date 1 <0.90 – percentage of sites	28%	19%	13%
PGR: Date 2 to Date 1 <0.50 – percentage of sites	7%	3%	2%
Average PGR Date 2 to Date 1 for above average seasonal quality	1.70	1.34	1.63
Average PGR Date 2 to Date 1 for average seasonal quality	1.29	1.22	1.34
Average PGR Date 2 to Date 1 for below average seasonal quality	0.86	0.97	1.18

Figure 1:98. Change in number of shrubs on each site by response category (shrubland sites), Murchison IBRA.

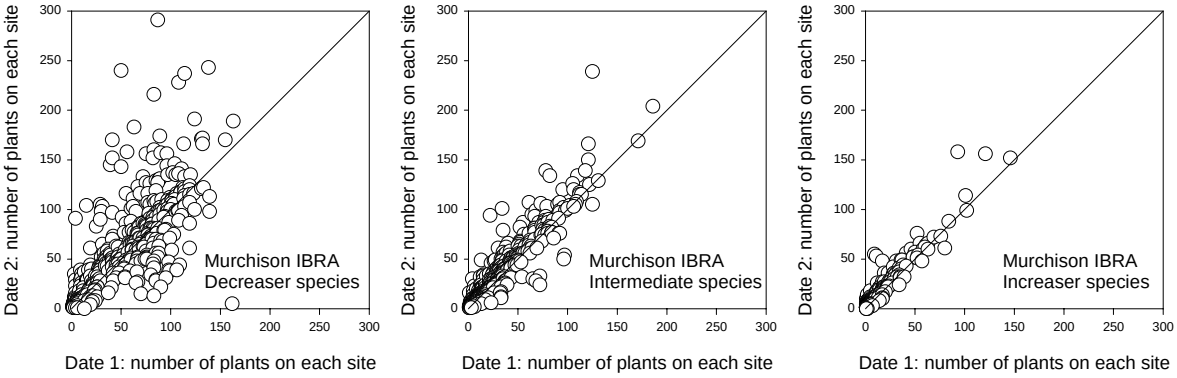


Table 1:316. Change in density between date 1 and date 2 of decreaser, intermediate and increaser shrub species – percentage of sites by seasonal category – Murchison IBRA.

Seasonal Quality	Species group	Decline. Density < 0.95	No change. 0.95 ≤ density < 1.05	Increase. Density ≥ 1.05	Number of sites
All years	Decreaser	32%	15%	54%	379
	Intermediate	25%	27%	49%	375
	Increaser	13%	35%	52%	225
Above average	Decreaser	17%	11%	73%	153
	Intermediate	16%	19%	65%	151
	Increaser	7%	36%	57%	74
Average	Decreaser	33%	20%	47%	165
	Intermediate	25%	31%	44%	166
	Increaser	12%	34%	54%	108
Below average	Decreaser	67%	10%	23%	61
	Intermediate	45%	34%	21%	58
	Increaser	28%	33%	40%	43

Canopy area of Decreaser, Intermediate and Increaser species but restricted to plants less than 1.5 m in height

Table 1:317. Murchison IBRA – summary of canopy area for decreaser, intermediate and increaser species but restricted to plants less than 1.5 m in height.

Average change in cover +/- standard error of the mean	1.84 +/- 0.16	2.55 +/- 0.60	2.99 +/- 0.38
Cover: ratio Date 2 to Date 1 at least 1.0 – percentage of sites	58%	75%	87%
Cover: ratio Date 2 to Date 1 <0.90 – percentage of sites	38%	18%	10%
Cover: ratio Date 2 to Date 1 <0.50 – percentage of sites	20%	6%	3%
Average cover ratio Date 2 to Date 1 for above average seasonal quality	2.85	3.94	4.61
Average cover ratio Date 2 to Date 1 for average seasonal quality	1.39	1.53	2.32
Average cover ratio Date 2 to Date 1 for below average seasonal quality	0.54	1.81	1.81

Figure 1:99. Canopy area by site – Decreaser, Intermediate and Increaser species but restricted to plants less than 1.5 m in height – Murchison IBRA. (

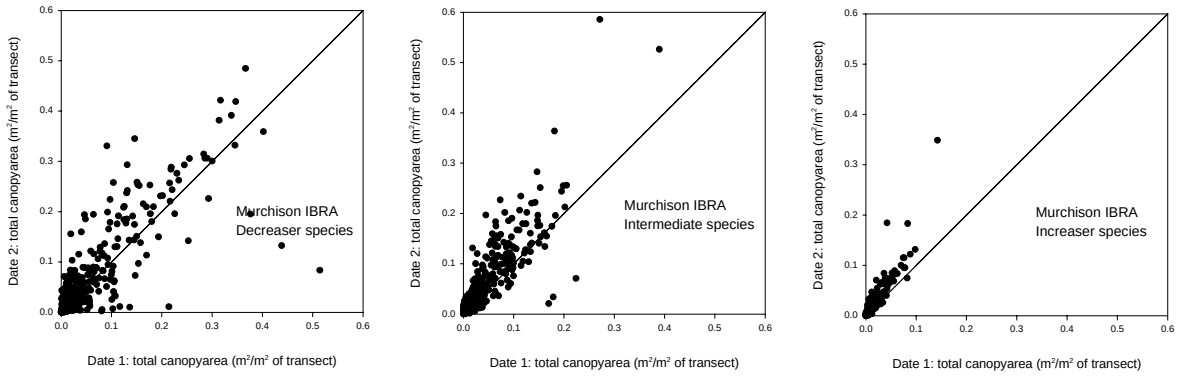


Table 1:318. Murchison IBRA – percentage of sites in each seasonal category showing change in canopy area for decreaser, intermediate and increaser species but restricted to plants less than 1.5 m in height.

Seasonal Quality	Species group	Decline. Total canopy area < 0.90	No change. 0.90 ≤ total canopy area < 1.10	Increase. total canopy area ≥ 1.10	Number of sites
All years	Decreaser	38%	8%	54%	378
	Intermediate	18%	15%	67%	375
	Increaser	9%	8%	83%	218
Above average	Decreaser	12%	6%	82%	153
	Intermediate	9%	9%	83%	152
	Increaser	4%	3%	93%	72
Average	Decreaser	46%	10%	44%	164
	Intermediate	20%	19%	61%	165
	Increaser	8%	10%	81%	106
Below	Decreaser	80%	10%	10%	61

average	Intermediate	38%	19%	43%	58
	Increaser	18%	13%	70%	40

Change in vegetation richness and occurrence

Native shrub species richness

Table 1:319. Murchison IBRA – summary of native shrub species richness

Number of sites assessed	386
Average number of species per site – Date 1	8.4 +/- 0.16
Average number of species per site – Date 2	8.8 +/- 0.17
Average ratio of species richness: Date 2 to Date 1 +/- standard error of the mean	1.08 +/- 0.01
Species richness: ratio Date 2 to Date 1 at least 1.0 – percentage of sites	80%
Species richness: ratio Date 2 to Date 1 <0.90 – percentage of sites	12%
Species richness: ratio Date 2 to Date 1 <0.50 – percentage of sites	0%

Figure 1:100. Change in shrub species richness on each site between Date 1 and Date 2 – Murchison IBRA. Bubble size represents number of sites at each x,y point.

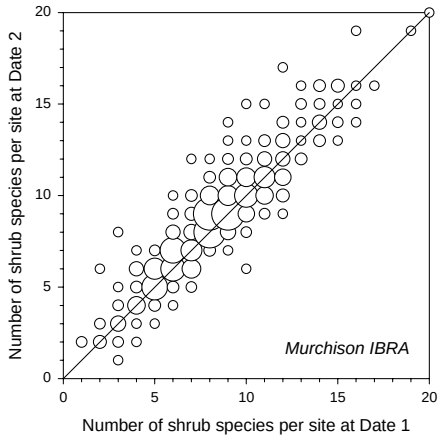


Table 1:320. Native species shrub richness Murchison IBRA - date 2 to divided by date 1.

Seasonal Quality	Species group	Decline. Richness index < 0.80	No change. 0.80 ≤ Richness index <1.20	Increase. Richness index ≥1.20	Number of sites
All years	All	3%	76%	21%	386

Above average	All	3%	67%	31%	157
Average	All	3%	83%	14%	167
Below average	All	5%	81%	15%	62

Frequency of occurrence

Table 1:321. Murchison IBRA – shrubland sites – species found on at least five sites at Date 1 or Date 2.

Number of species	88
Occurrence ratio Date 2 to Date 1 at least 1.0 – percentage of sites	83%
Occurrence ratio Date 2 to Date 1 >1.10 – percentage of species	30%
Occurrence ratio Date 2 to Date 1 < 0.90 – percentage of species	9%
Occurrence ratio Date 2 to Date 1 < 0.50 – percentage of species	0%
Average change in occurrence ratio	1.08

Table 1:322. Species with occurrence ratio greater than 1.1 or less than 0.90 and found on at least 10 sites at Date 1 or Date 2 – Murchison IBRA

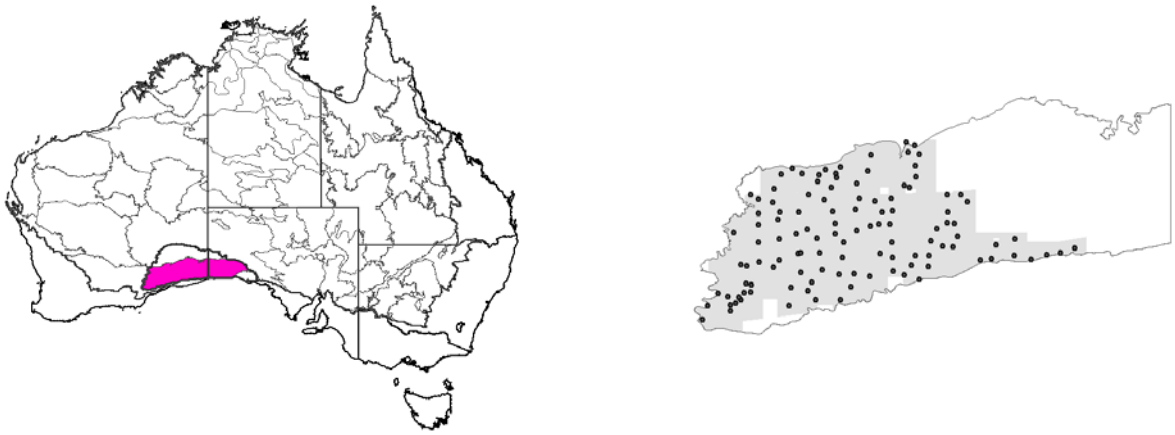
SPECIES_NAME	DESIR	TR_C	No_pop	No_pop	OR
Senna artemisioides	U	2	7	10	1.43
Senna artemisioides subsp. x coriacea	U	2	33	45	1.36
Solanum orbiculatum	U	1	18	24	1.33
Hakea preissii	U	3	36	48	1.33
Eremophila oldfieldii	D		10	13	1.30
Eremophila georgei	I	3	27	35	1.30
Acacia victoriae	U	2	15	19	1.27
Acacia linophylla	I	4	15	18	1.20
Eremophila longifolia	D	1	10	12	1.20
Eremophila platycalyx	I	3	26	31	1.19
Senna artemisioides subsp. x sturtii	U	3	47	55	1.17
Senna artemisioides subsp. x sturtii	U	2	36	42	1.17
Acacia burkittii	I		14	16	1.14
Acacia tetragonophylla	I	3	158	178	1.13
Spartothamnella teucriiflora	I	4	59	66	1.12
Maireana villosa	D	2	94	105	1.12
Senna glutinosa subsp. chatelainiana	D	1	26	29	1.12
Maireana platycarpa	D	4	18	20	1.11
Eremophila glabra	I	4	9	10	1.11
Maireana thesioides	D		18	16	0.89
Halosarcia species	I	3	25	21	0.84
Eremophila granitica	I	2	25	21	0.84

Figure 1:101. Frequency of occurrence for all species found on at least five sites in the Murchison IBRA.

Nullarbor2 sub-IBRA

For shrubland sites, only Nullarbor2 sub-IBRA (Central Band) is considered.

Figure 1:102. Location of Nullarbor2 sub-IBRA (left) and WARMS sites in the sub-IBRA (right). Greyed areas are pastoral tenure.



Site and seasonal summary

Table 1:323. Nullarbor IBRA – shrubland sites – total number of sites and dates assessed

Number of shrubland sites assessed in all sub-IBRAs	122
Number of shrubland sites in NUL1 (Northern Band)	6
Number of shrubland sites in NUL2 (Central Band)	**116**
Date 1: first assessment (installation) NUL2	18/09/96 to 12/11/99
Date 2: second assessment NUL2	14/11/02 to 30/11/04
Above average seasonal quality NUL2– percentage of sites	16%
Average seasonal quality NUL2 – percentage of sites	72%
Below average seasonal quality NUL2 – percentage of sites	12%

Change in landscape function

Population growth rate (i.e. density)

Table 1:324. Nullarbor2 sub-IBRA – shrubland sites – summary of population growth rate (i.e. density)

Average Population growth rate +/- standard error of the mean	1.20 +/- 0.04
PGR at least 1.0 – percentage of sites	79%

PGR <0.90 – percentage of sites	4%
PGR <0.50 – percentage of sites	1%

Figure 1:103. Change in number of plants on each site (population growth rate) between Date 1 and Date 2 – Nullarbor2 sub-IBRA.

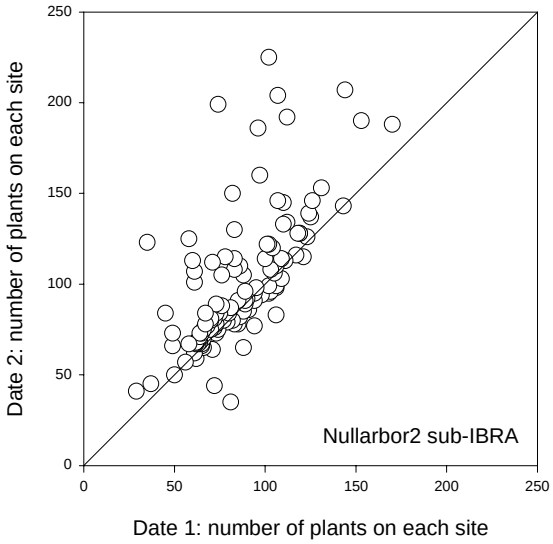


Table 1:325. Nullarbor2 sub-IBRA – percentage of sites in each seasonal category showing change in shrub density (shrubland sites)

Seasonal Quality	Species group	Decline. Density < 95%	No change. Density between 95% and 105%	Increase. Density >=105%	Number of sites
All years	All	12%	27%	61%	116
Above average	All	0%	32%	68%	19
Average	All	17%	28%	55%	83
Below average	All	0%	14%	86%	14

Canopy area

Table 1:326. Nullarbor2 sub-IBRA – summary of canopy area (shrubland sites)

Average change in cover +/- standard error of the mean	1.33 +/- 0.04
Cover: ratio Date 2 to Date 1 at least 1.0 – percentage of sites	83%
Cover: ratio Date 2 to Date 1 <0.90 – percentage of sites	9%
Cover: ratio Date 2 to Date 1 <0.50 – percentage of sites	1%
Average cover ratio Date 2 to Date 1 for above average seasonal quality	1.33

Average cover ratio Date 2 to Date 1 for average seasonal quality	1.35
Average cover ratio Date 2 to Date 1 for below average seasonal quality	1.21

Figure 1:104. Change in total canopy area between Date 1 and Date 2 – Nullarbor2 sub-IBRA.

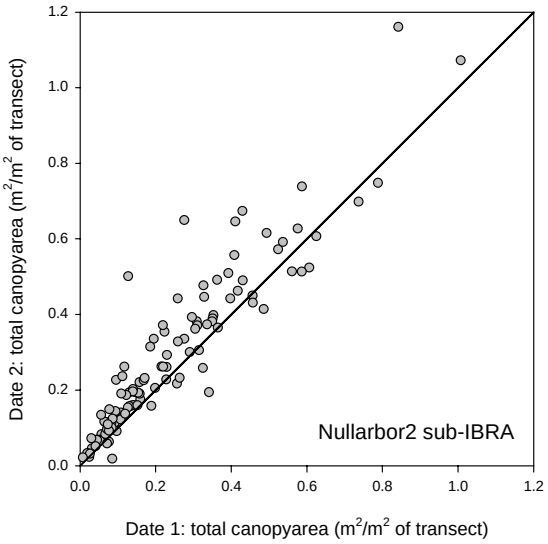


Table 1:327. Nullarbor2 sub-IBRA – percentage of shrubland sites in each seasonal category showing change in canopy area of shrubs

Seasonal Quality	Species group	Decline. Total canopy area <0.90	No change. ≤0.90 total canopy area <1.10	Increase. total canopy area ≥1.10	Number of sites
All years	All	9%	16%	75%	116
Above average	All	16%	5%	79%	19
Average	All	8%	16%	76%	83
Below average	All	7%	29%	64%	14

Canopy area but restricted to plants less than 1.5 m in height

Table 1:328 Nullarbor2 sub-IBRA – summary of canopy area (shrubland sites), but restricted to plants less than 1.5 m in height

Average change in cover +/- standard error of the mean	1.34 +/- 0.04
Cover: ratio Date 2 to Date 1 at least 1.0 – percentage of sites	83%

Cover: ratio Date 2 to Date 1 <0.90 – percentage of sites	9%
Cover: ratio Date 2 to Date 1 <0.50 – percentage of sites	1%
Average cover ratio Date 2 to Date 1 for above average seasonal quality +/- standard error of the mean	1.33 +/- 0.08
Average cover ratio Date 2 to Date 1 for average seasonal quality +/- standard error of the mean	1.36 +/- 0.06
Average cover ratio Date 2 to Date 1 for below average seasonal quality +/- standard error of the mean	1.30 +/- 0.12

Figure 1:105. Canopy area by site, but restricted to plants less than 1.5 m in height – Nullarbor2 sub-IBRA.

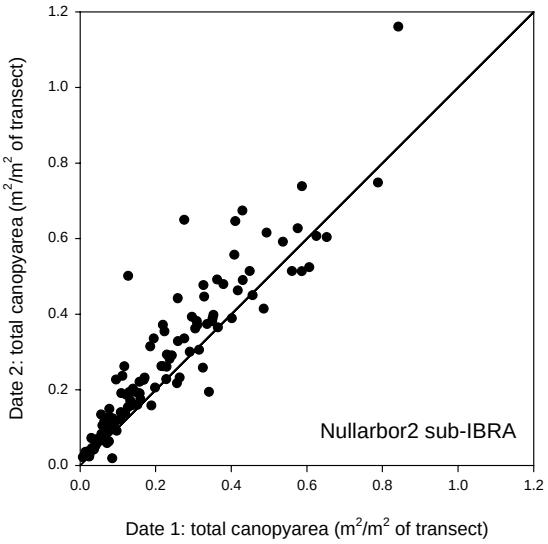


Table 1:329. Nullarbor2 sub-IBRA – percentage of shrubland sites in each seasonal category showing change in canopy area of shrubs, but restricted to plants less than 1.5 m in height

Seasonal Quality	Species group	Decline. Total canopy area <0.90	No change. 0.90>= total canopy area <1.10	Increase. total canopy area >=1.10	Number of sites
All years	All	9%	14%	77%	116
Above average	All	16%	5%	79%	19
Average	All	8%	13%	78%	83
Below average	All	7%	29%	64%	14

Resource Capture Index

Table 1:330. Nullarbor2 sub-IBRA – summary of resource capture index, shrubland sites.

Number of sites with useable data at both dates	116
Average change in Resource Capture Index +/- standard error of the mean	1.09 +/- 0.04
Cover: ratio Date 2 to Date 1 at least 1.0 – percentage of sites	73%
Cover: ratio Date 2 to Date 1 <0.90 – percentage of sites	23%
Cover: ratio Date 2 to Date 1 <0.50 – percentage of sites	6%
Average cover ratio Date 2 to Date 1 for above average seasonal quality	0.95
Average cover ratio Date 2 to Date 1 for average seasonal quality	1.10
Average cover ratio Date 2 to Date 1 for below average seasonal quality	1.28

Figure 1:106. Change in Resource Capture Index between Date 1 and Date 2 – Nullarbor2 sub-IBRA.

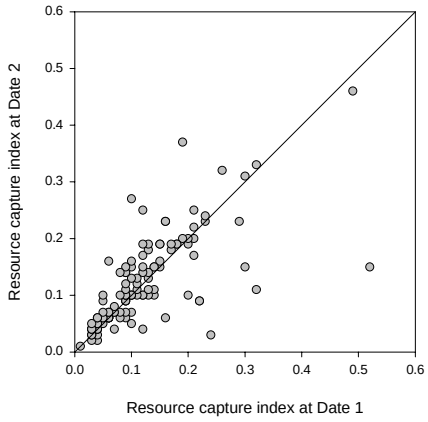


Table 1:331. Resource capture index – percentage of sites in each seasonal category showing change in the index – Nullarbor2 sub-IBRA, shrubland sites

Seasonal Quality	Species group	Decline. RCI < 0.90	No change. 0.90 ≤ RCI <1.10	Increase. RCI ≥ 1.10	Number of sites
All years	All	23%	36%	41%	116
Above average	All	32%	32%	37%	19
Average	All	23%	39%	39%	83
Below average	All	14%	29%	57%	14

Proportional landscape function - stability, infiltration and nutrient cycling indices

Table 1:332. Summary - proportional landscape function indices – Nullarbor2 sub-IBRA.

	Stability index	Infiltration index	Nutrient cycling index
Number of sites with useable data at both dates	116	116	116
Date 1 average +/- standard error of the mean	58.3 +/- 0.38	37.3 +/- 0.31	26.2 +/- 0.42
Date 2 average +/- standard error of the mean	59.0 +/- 0.63	39.1 +/- 0.43	27.6 +/- 0.43
Ratio of index: average +/- standard error of the mean	1.01 +/- 0.01	1.05 +/- 0.01	1.07 +/- 0.02
Ratio of index: Date 2 to Date 1 at least 1.0 – percentage of sites	59%	64%	56%
Ratio of index: : Date 2 to Date 1 <0.90 – percentage of sites	3%	8%	14%
Ratio of index: Date 2 to Date 1 <0.50 – percentage of sites	0%	0%	0%
Average of index ratio: Date 2 to Date 1 for above average seasonal quality	1.02 +/- 0.05	1.04 +/- 0.05	1.05 +/- 0.06
Average of index ratio: Date 2 to Date 1 for average seasonal quality	1.01 +/- 0.01	1.05 +/- 0.01	1.09 +/- 0.02
Average of index ratio: Date 2 to Date 1 for below average seasonal quality	1.02 +/- 0.02	1.07 +/- 0.04	0.99 +/ 0.05

Figure 1:107. Proportional landscape function - stability, infiltration and nutrient cycling indices at Date 1 and Date 2 – Nullarbor2 sub-IBRA. The top panes show all data, the lower panes show expanded views over limited ranges.

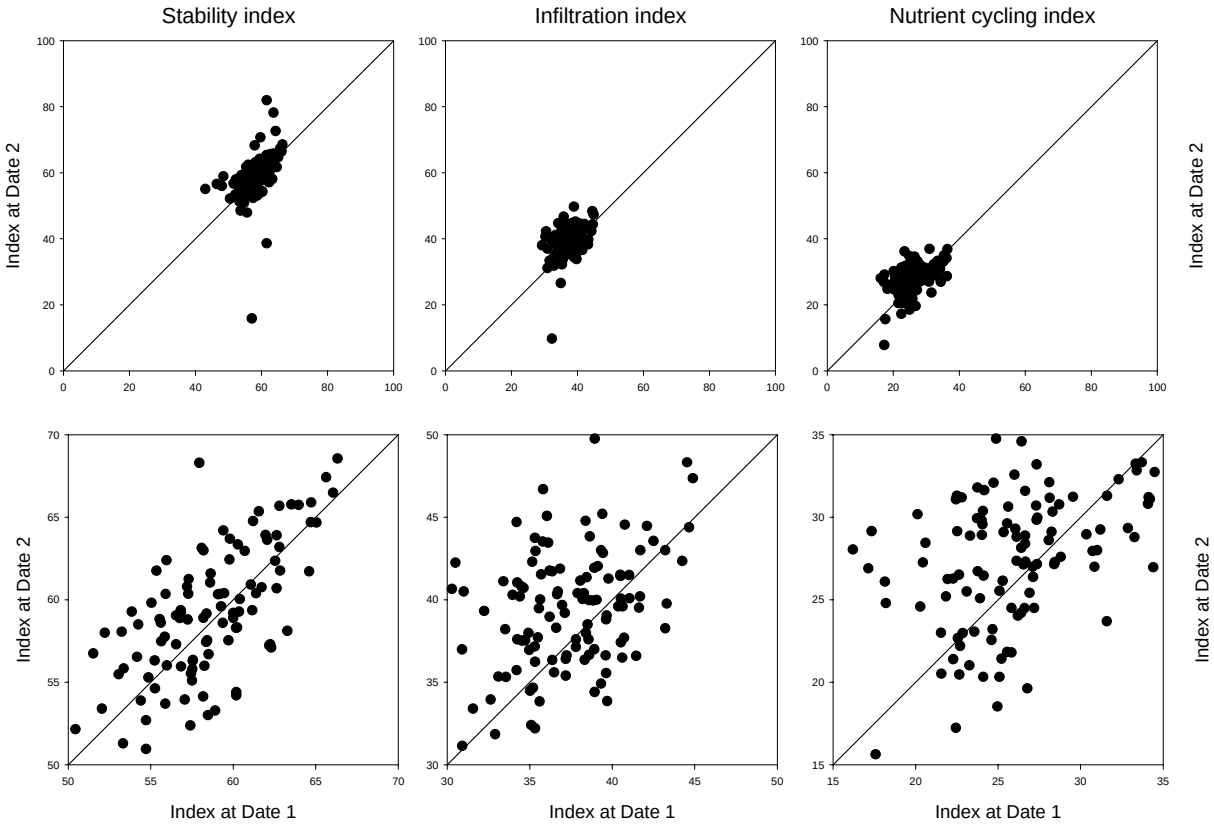


Table 1:333. Proportional landscape function - stability index – Nullarbor2 sub-IBRA. Ratio of index at Date 2 to index at Date 1 (Ratio of Stability Index – RSI).

Seasonal Quality	Species group	Decline. RSI < 0.90	No change. 0.90>= RSI <1.10	Increase. RSI >=1.10	Number of sites
All years	All	3%	85%	12%	116
Above average	All	11%	63%	26%	19
Average	All	1%	89%	10%	83
Below average	All	0%	93%	7%	14

Table 1:334. Proportional landscape function - infiltration index – Nullarbor2 sub-IBRA. Ratio of index at Date 2 to index at Date 1 (Ratio of Infiltration Index – RII).

Seasonal Quality	Species group	Decline. RII < 0.90	No change. 0.90>= RII <1.10	Increase. RII >=1.10	Number of sites
All years	All	8%	64%	28%	116
Above average	All	11%	58%	32%	19
Average	All	7%	65%	28%	83
Below average	All	7%	64%	29%	14

Table 1:335. Proportional landscape function – nutrient cycling index – Nullarbor2 sub-IBRA. Ratio of index at Date 2 to index at Date 1 (Ratio of Nutrient Cycling Index – RNCI).

Seasonal Quality	Species group	Decline. RNCI < 0.90	No change. 0.90>= RNCI <1.10	Increase. RNCI >=1.10	Number of sites
All years	All	14%	49%	37%	116
Above average	All	21%	42%	37%	19
Average	All	10%	53%	37%	83
Below average	All	29%	43%	29%	14

Change in sustainable management of the pastoral estate

Population growth rate (i.e. density) of Decreaser, Intermediate and Increaser species

Table 1:336. Summary of population growth rate of decreaser, intermediate and increaser species on shrubland sites – Nullarbor2 sub-IBRA

PGR +/- standard error of the mean	1.40 +/- 0.09	1.13 +/- 0.05	1.47 +/- 0.26
PGR: Date 2 to Date 1 at least 1.0 – percentage of sites	78%	90%	87%
PGR: Date 2 to Date 1 <0.90 – percentage of sites	8%	3%	9%
PGR: Date 2 to Date 1 <0.50 – percentage of sites	0%	2%	4%
Average PGR Date 2 to Date 1 for above average seasonal quality	1.64	1.08	1.87
Average PGR Date 2 to Date 1 for average seasonal quality	1.35	1.13	1.31
Average PGR Date 2 to Date 1 for below average seasonal quality	1.37	1.26	1.00

Figure 1:108. Change in number of shrubs on each site by response category (shrubland sites), Nullarbor2 sub-IBRA.

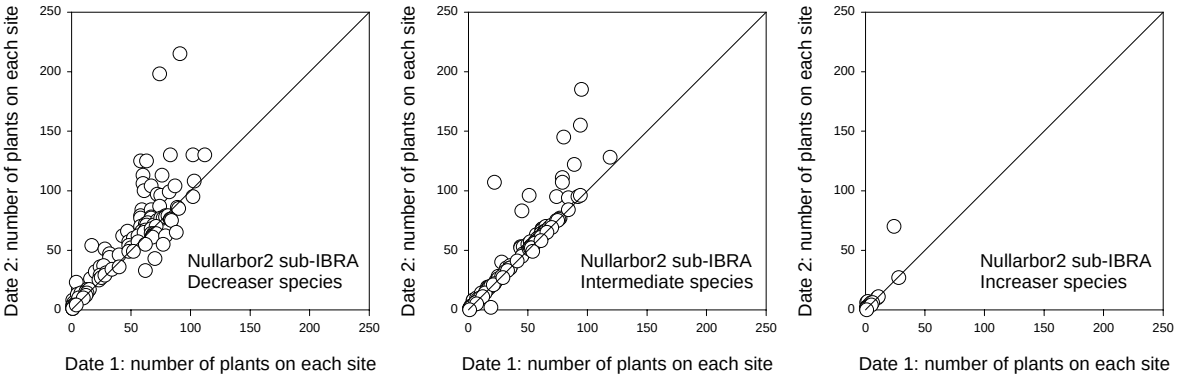


Table 1:337. Change in density between date 1 and date 2 of decreaser, intermediate and increaser shrub species – percentage of sites by seasonal category – Nullarbor2 sub-IBRA.

Seasonal Quality	Species group	Decline. Density < 0.95	No change. 0.95>= density <1.05	Increase. Density >=1.05	Number of sites
All years	Decreaser	17%	22%	61%	105
	Intermediate	6%	56%	38%	101
	Increaser	9%	61%	30%	23
Above average	Decreaser	5%	26%	68%	19
	Intermediate	0%	79%	21%	19
	Increaser	n/a	n/a	n/a	7
Average	Decreaser	22%	22%	55%	76
	Intermediate	6%	38%	29%	73
	Increaser	7%	67%	27%	15
Below average	Decreaser	0%	10%	90%	10
	Intermediate	n/a	n/a	n/a	9
	Increaser	n/a	n/a	n/a	1

Canopy area of Decreaser, Intermediate and Increaser species but restricted to plants less than 1.5 m in height

Table 1:338. Nullarbor2 sub-IBRA – summary of canopy area for decreaser, intermediate and increaser species but restricted to plants less than 1.5 m in height.

Average change in cover +/- standard error of the mean	2.26 +/- 0.41	1.42 +/- 0.04	12.3 +/- 4.88*
Cover: ratio Date 2 to Date 1 at least 1.0 – percentage of sites	74%	96%	100%
Cover: ratio Date 2 to Date 1 <0.90 – percentage of sites	17%	3%	0%
Cover: ratio Date 2 to Date 1 <0.50 – percentage of sites	3%	1%	0%
Average cover ratio Date 2 to Date 1 for above average seasonal quality	2.83	1.37	22.67*
Average cover ratio Date 2 to Date 1 for average seasonal quality	1.96	1.42	8.49
Average cover ratio Date 2 to Date 1 for below average seasonal quality	3.47	n/a	n/a

* This increase was largely attributable to an increase in the number of *Solanum orbiculatum* (1 to 6) on one site. With that site excluded, the average and standard error were 7.63 +/- 1.40.
** This increase was largely attributable to an increase in the number of *Solanum orbiculatum* (1 to 6) on one site. With that site excluded, the average was 4.17

Figure 1:109. Canopy area by site – Decreaser, Intermediate and Increaser species but restricted to plants less than 1.5 m in height – Nullarbor2 sub-IBRA. (

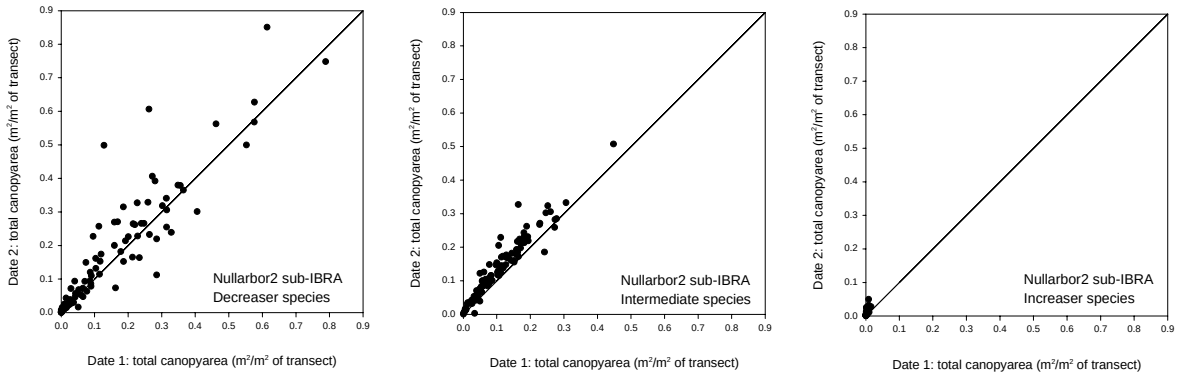


Table 1:339. Nullarbor2 sub-IBRA – percentage of sites in each seasonal category showing change in canopy area for decreaser, intermediate and increaser species but restricted to plants less than 1.5 m in height.

Seasonal Quality	Species group	Decline. Total canopy area	No change. 0.90>= total	Increase. total canopy area	Number of sites

		<0.90	canopy area <1.10	>=1.10	
All years	Decreaser	17%	23%	60%	105
	Intermediate	3%	8%	89%	100
	Increaser	0%	9%	91%	22
Above average	Decreaser	21%	0%	79%	19
	Intermediate	0%	16%	84%	19
	Increaser	n/a	n/a	n/a	6
Average	Decreaser	16%	28%	57%	76
	Intermediate	4%	6%	90%	72
	Increaser	0%	0%	100%	15
Below average	Decreaser	20%	30%	50%	10
	Intermediate	n/a	n/a	n/a	9
	Increaser	n/a	n/a	n/a	1

Change in vegetation richness and occurrence

Native shrub species richness

Table 1:340. Nullarbor2 sub-IBRA – summary of native shrub species richness

Number of sites assessed	116
Average number of species per site – Date 1	3.14 +/- 0.14
Average number of species per site – Date 2	3.5 +/- 0.16
Average ratio of species richness: Date 2 to Date 1 +/- standard error of the mean	1.13 +/- 0.02
Species richness: ratio Date 2 to Date 1 at least 1.0 – percentage of sites	96%
Species richness: ratio Date 2 to Date 1 <0.90 – percentage of sites	4%
Species richness: ratio Date 2 to Date 1 <0.50 – percentage of sites	0%

Figure 1:110. Change in shrub species richness on each site between Date 1 and Date 2 – Nullarbor2 sub-IBRA. Bubble size represents number of sites at each x,y point.

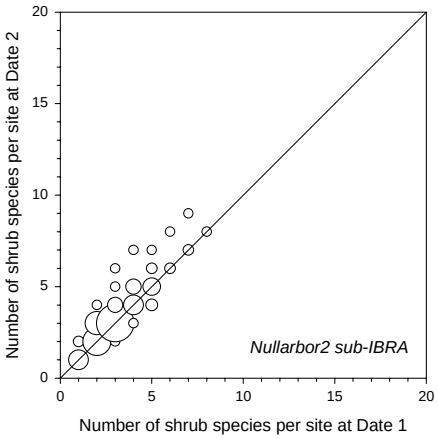


Table 1:341. Native species shrub richness Nullarbor2 sub-IBRA- date 2 to divided by date 1.

Seasonal Quality	Species group	Decline. Richness index < 0.80	No change. 0.80 ≤ Richness index <1.20	Increase. Richness index ≥1.20	Number of sites
All years	All	2%	67%	31%	116
Above average	All	0%	53%	47%	19
Average	All	2%	69%	29%	83
Below average	All	0%	79%	21%	14

Frequency of occurrence

Table 1:342. Nullarbor2 sub-IBRA – shrubland sites – species found on at least five sites at Date 1 or Date 2.

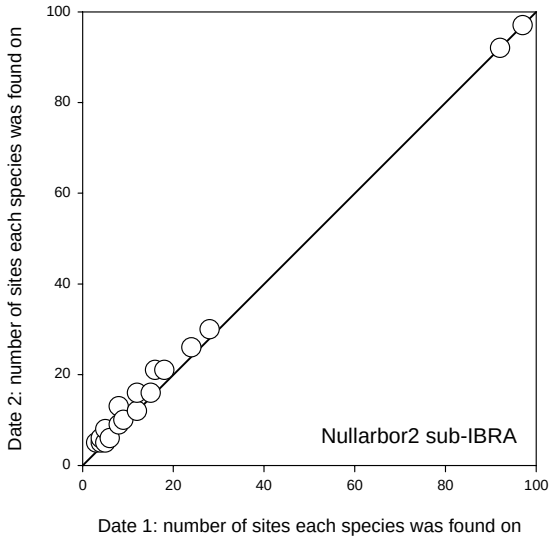
Number of species	18
Occurrence ratio Date 2 to Date 1 at least 1.0 – percentage of species	100%
Occurrence ratio Date 2 to Date 1 >1.10 – percentage of species	56%
Occurrence ratio Date 2 to Date 1 < 0.90 – percentage of species	0%
Occurrence ratio Date 2 to Date 1 < 0.50 – percentage of species	0%
Average change in occurrence ratio	1.22

Table 1:343. Species with occurrence ratio greater than 1.1 or less than 0.90 and found on at least 10 sites at Date 1 or Date 2 – Nullarbor2 sub-IBRA.

SPECIES_NAME	DESIR	TR_C	No_pop	No_pop	OR
Lawrencia squamata	I	4	8	13	1.63

Cratystylis conocephala	D	3	12	16	1.33
Solanum orbiculatum	U	1	16	21	1.31
Maireana georgei	D	2	18	21	1.17
Acacia papyrocarpa	I	1	9	10	1.11

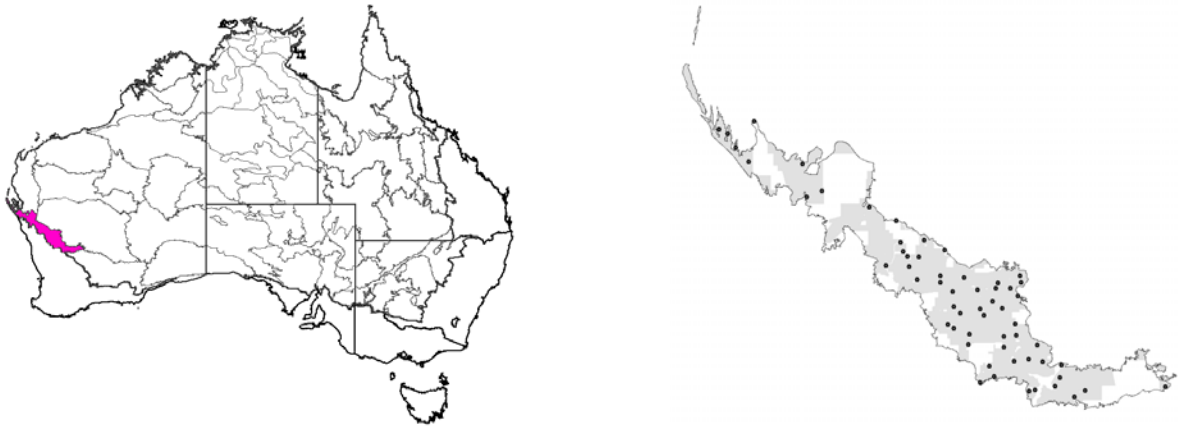
Figure 1:111. Frequency of occurrence for all species found on at least five sites in the Nullarbor2 sub-IBRA.



Yalgoo IBRA

For shrubland sites, data from both Yalgoo sub-IBRAs were pooled and the complete Yalgoo IBRA is reported.

Figure 1:112. Location of Yalgoo IBRA (left) and WARMS sites in the IBRA (right). Greyed areas are pastoral tenure.



Site and seasonal summary

Table 1:344. Yalgoo IBRA – shrubland sites – total number of sites and dates assessed

Number of shrubland sites assessed	60
Number of shrubland sites in YAL1 (Edel)	8
Number of shrubland sites in YAL2 (Tallering)	52
Date 1: first assessment (installation)	28/3/98 to 14/6/91
Date 2: second assessment	1/8/02 to 17/11/05
Above average seasonal quality – percentage of sites	0%
Average seasonal quality – percentage of sites	68%
Below average seasonal quality – percentage of sites	32%

Change in landscape function

Population growth rate (i.e. density)

Table 1:345. Yalgoo IBRA – shrubland sites – summary of population growth rate (i.e. density)

Average Population growth rate +/- standard error of the mean	0.91 +/- 0.03
PGR at least 1.0 – percentage of sites	32%
PGR <0.90 – percentage of sites	45%
PGR <0.50 – percentage of sites	5%

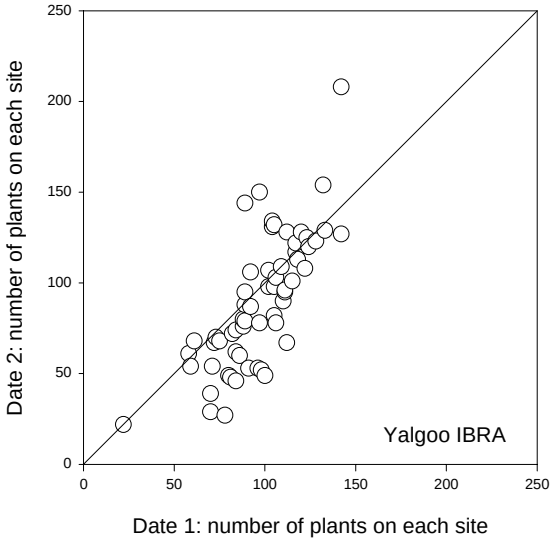


Table 1:346. Yalgoo IBRA – percentage of sites in each seasonal category showing change in shrub density (shrubland sites)

Seasonal Quality	Species group	Decline. Density < 95%	No change. Density between 95% and 105%	Increase. Density >=105%	Number of sites
All years	All	55%	23%	22%	60
Above average	All	n/a	n/a	n/a	0
Average	All	59%	27%	15%	41
Below average	All	47%	16%	37%	19

Canopy area

Table 1:347. Yalgoo IBRA – summary of canopy area (shrubland sites)

Average change in cover +/- standard error of the mean	0.93 +/- 0.04
Cover: ratio Date 2 to Date 1 at least 1.0 – percentage of sites	40%
Cover: ratio Date 2 to Date 1 <0.90 – percentage of sites	48%
Cover: ratio Date 2 to Date 1 <0.50 – percentage of sites	5%

Average cover ratio Date 2 to Date 1 for above average seasonal quality	n/a
Average cover ratio Date 2 to Date 1 for average seasonal quality	0.94
Average cover ratio Date 2 to Date 1 for below average seasonal quality	0.89

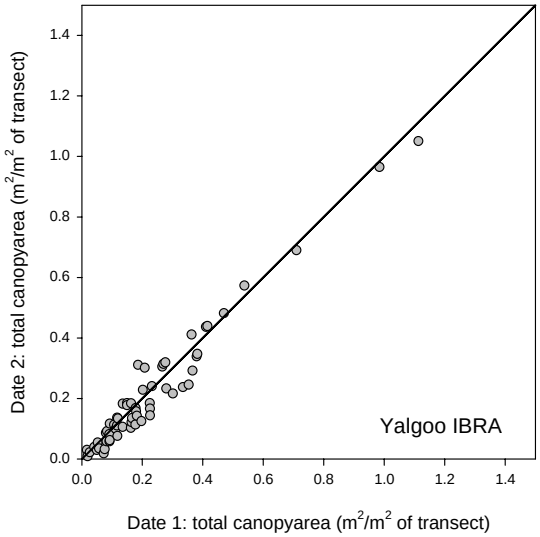


Table 1:348. Yalgoo IBRA – percentage of shrubland sites in each seasonal category showing change in canopy area of shrubs

Seasonal Quality	Species group	Decline. Total canopy area < 0.90	No change. 0.90>= total canopy area <1.10	Increase. total canopy area >=1.10	Number of sites
All years	All	48%	27%	25%	60
Above average	All	n/a	n/a	n/a	0
Average	All	46%	27%	27%	41
Below average	All	52%	26%	21%	19

Canopy area but restricted to plants less than 1.5 m in height

Table 1:349 Yalgoo IBRA – summary of canopy area (shrubland sites), but restricted to plants less than 1.5 m in height

Average change in cover +/- standard error of the mean	1.34 +/- 0.04
Cover: ratio Date 2 to Date 1 at least 1.0 – percentage of sites	38%
Cover: ratio Date 2 to Date 1 <0.90 – percentage of sites	53%

Cover: ratio Date 2 to Date 1 <0.50 – percentage of sites	18%
Average cover ratio Date 2 to Date 1 for above average seasonal quality +/- standard error of the mean	n/a
Average cover ratio Date 2 to Date 1 for average seasonal quality +/- standard error of the mean	0.89 +/- 0.07
Average cover ratio Date 2 to Date 1 for below average seasonal quality +/- standard error of the mean	0.87 +/- 0.10

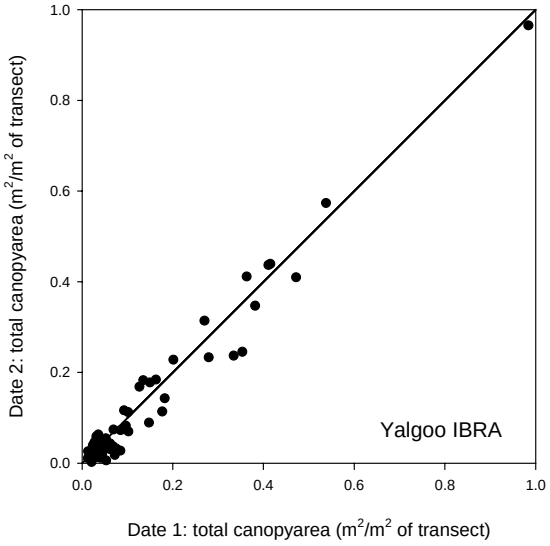


Table 1:350. Yalgoo IBRA – percentage of shrubland sites in each seasonal category showing change in canopy area of shrubs, but restricted to plants less than 1.5 m in height

Seasonal Quality	Species group	Decline. Total canopy area <0.90	No change. 0.90>= total canopy area <1.10	Increase. total canopy area >=1.10	Number of sites
All years	All	53%	20%	27%	60
Above average	All	n/a	n/a	n/a	0
Average	All	59%	15%	27%	41
Below average	All	42%	32%	26%	19

Resource Capture Index

Table 1:351. Yalgoo IBRA – summary of resource capture index, shrubland sites.

Number of sites with useable data at both dates	59
Average change in Resource Capture Index +/- standard error of the mean	1.00 +/- 0.05

Cover: ratio Date 2 to Date 1 at least 1.0 – percentage of sites	54%
Cover: ratio Date 2 to Date 1 <0.90 – percentage of sites	37%
Cover: ratio Date 2 to Date 1 <0.50 – percentage of sites	10%
Average cover ratio Date 2 to Date 1 for above average seasonal quality	n/a
Average cover ratio Date 2 to Date 1 for average seasonal quality	1.01
Average cover ratio Date 2 to Date 1 for below average seasonal quality	0.99

Figure 1:113. Change in Resource Capture Index between Date 1 and Date 2 – Yalgoo IBRA.

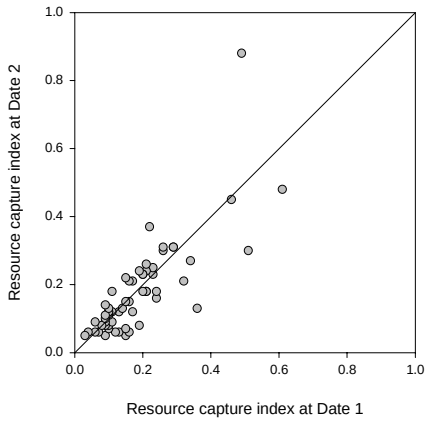


Table 1:352. Resource capture index – percentage of sites in each seasonal category showing change in the index – Yalgoo IBRA, shrubland sites

Seasonal Quality	Species group	Decline. RCI < 0.90	No change. 0.90 ≤ RCI <1.10	Increase. RCI ≥ 1.10	Number of sites
All years	All	39%	24%	37%	59
Above average	All	n/a	n/a	n/a	0
Average	All	41%	20%	39%	41
Below average	All	33%	33%	33%	18

Proportional landscape function - stability, infiltration and nutrient cycling indices

Table 1:353. Summary - proportional landscape function indices – Yalgoo IBRA.

	Stability index	Infiltration index	Nutrient cycling index
Number of sites with useable data at both dates	59	59	59

Date 1 average +/- standard error of the mean	56.9 +/- 0.85	42.5 +/- 0.61	26.0 +/- 0.63
Date 2 average +/- standard error of the mean	56.3 +/- 0.95	41.0 +/- 0.73	18.5 +/- 0.60
Ratio of index: average +/- standard error of the mean	0.99 +/- 0.01	0.97 +/- 0.01	0.73 +/- 0.03
Ratio of index: Date 2 to Date 1 at least 1.0 – percentage of sites	56%	37%	8%
Ratio of index: : Date 2 to Date 1 <0.90 – percentage of sites	14%	17%	86%
Ratio of index: Date 2 to Date 1 <0.50 – percentage of sites	2%	2%	7%
Average of index ratio: Date 2 to Date 1 for above average seasonal quality	n/a	n/a	n/a
Average of index ratio: Date 2 to Date 1 for average seasonal quality	0.98 +/- 0.02	0.96 +/- 0.02	0.71 +/- 0.03
Average of index ratio: Date 2 to Date 1 for below average seasonal quality	1.02 +/- 0.99	0.99 +/- 0.02	0.75 +/ 0.05

Figure 1:114. Proportional landscape function - stability, infiltration and nutrient cycling indices at Date 1 and Date 2 – Yalgoo IBRA. The top panes show all data, the lower panes show expanded views over limited ranges.

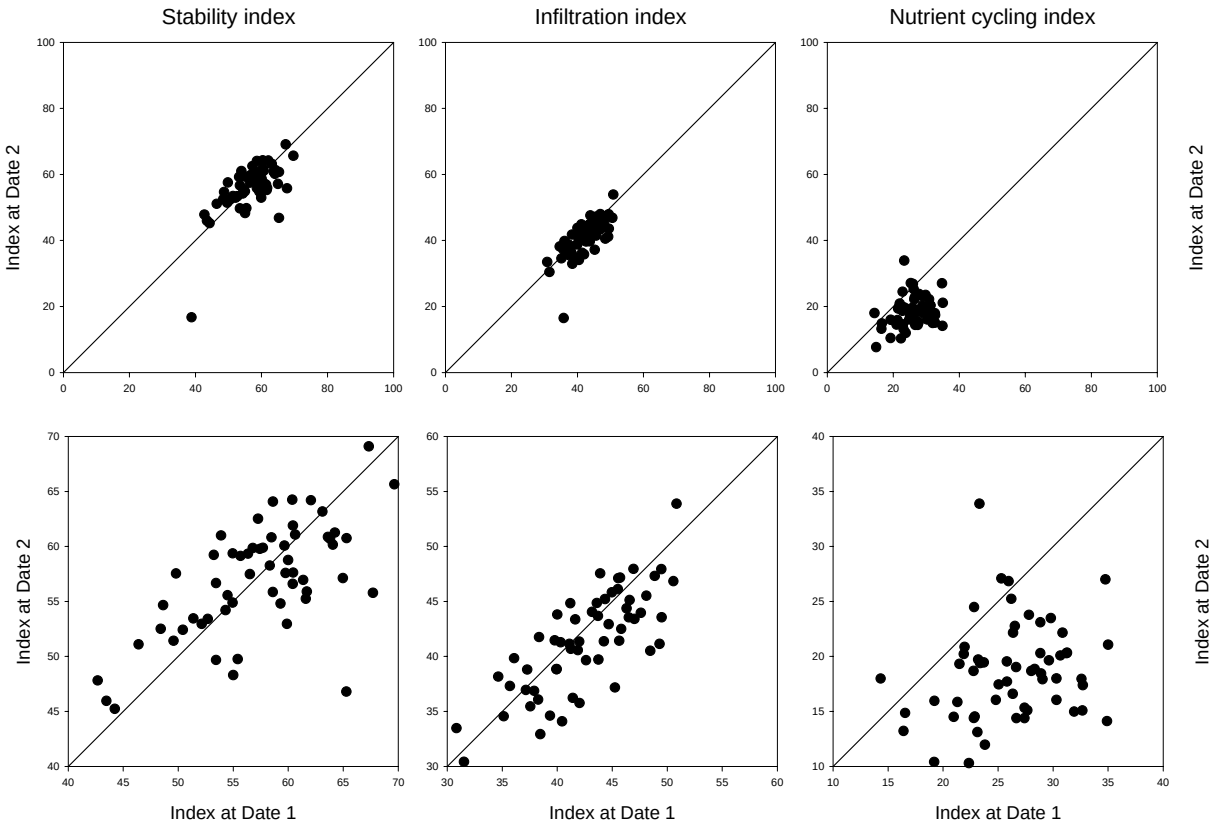


Table 1:354. Proportional landscape function - stability index – Yalgoo IBRA. Ratio of index at Date 2 to index at Date 1 (Ratio of Stability Index – RSI).

Seasonal Quality	Species group	Decline. RSI < 0.90	No change. 0.90>= RSI <1.10	Increase. RSI >=1.10	Number of sites

All years	All	14%	76%	10%	59
Above average	All	n/a	n/a	n/a	0
Average	All	15%	80%	5%	41
Below average	All	11%	67%	22%	18

Table 1:355. Proportional landscape function - infiltration index – Yalgoo-IBRA. Ratio of index at Date 2 to index at Date 1 (Ratio of Infiltration Index – RII).

Seasonal Quality	Species group	Decline. RII < 0.90	No change. 0.90>= RII <1.10	Increase. RII >=1.10	Number of sites
All years	All	17%	80%	3%	59
Above average	All	n/a	n/a	n/a	0
Average	All	20%	78%	2%	41
Below average	All	11%	83%	6%	18

Table 1:356. Proportional landscape function – nutrient cycling index – Yalgoo IBRA. Ratio of index at Date 2 to index at Date 1 (Ratio of Nutrient Cycling Index – RNCI).

Seasonal Quality	Species group	Decline. RNCI < 0.90	No change. 0.90>= RNCI <1.10	Increase. RNCI >=1.10	Number of sites
All years	All	86%	10%	3%	59
Above average	All	n/a	n/a	n/a	0
Average	All	90%	7%	2%	41
Below average	All	77%	17%	6%	18

Change in sustainable management of the pastoral estate – shrubland sites

Population growth rate (i.e. density) of Decreaser, Intermediate and Increaser species

Table 1:357. Summary of population growth rate of decreaser, intermediate and increaser species on shrubland sites – Yalgoo IBRA

PGR +/- standard error of the mean	0.91 +/- 0.31	1.09 +/- 0.61	1.04 +/- 0.53

PGR: Date 2 to Date 1 at least 1.0 – percentage of sites	25%	60%	78%
PGR: Date 2 to Date 1 <0.90 – percentage of sites	43%	23%	22%
PGR: Date 2 to Date 1 <0.50 – percentage of sites	7%	4%	9%
Average PGR Date 2 to Date 1 for above average seasonal quality	1.50	1.28	1.70
Average PGR Date 2 to Date 1 for average seasonal quality	0.91	1.01	1.05
Average PGR Date 2 to Date 1 for below average seasonal quality	0.91	1.26	n/a

Figure 1:115. Change in number of shrubs on each site by response category (shrubland sites), Yalgoo IBRA.

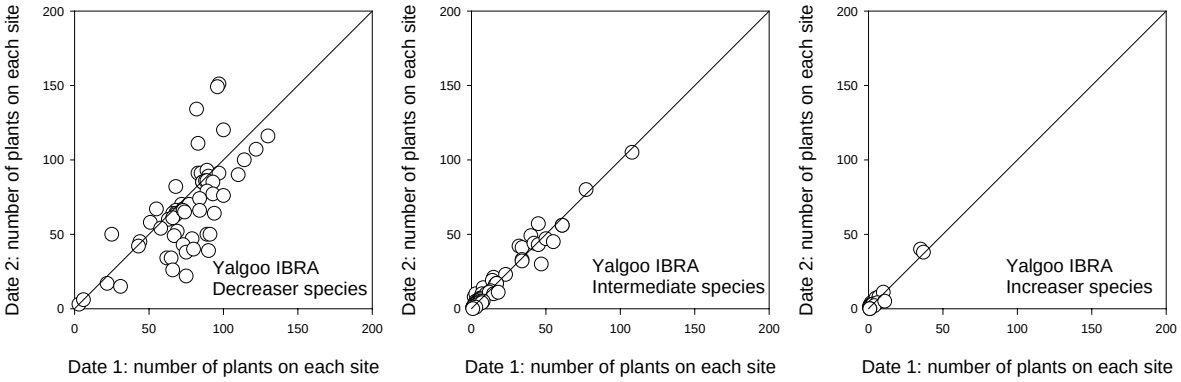


Table 1:358. Change in density between date 1 and date 2 of decreaser, intermediate and increaser shrub species – percentage of sites by seasonal category – Yalgoo IBRA.

Seasonal Quality	Species group	Decline. Density < 0.95	No change. 0.95>= density <1.05	Increase. Density >=1.05	Number of sites
All years	Decreaser	58%	23%	18%	60
	Intermediate	35%	37%	29%	52
	Increaser	22%	43%	35%	23
Above average	Decreaser	n/a	n/a	n/a	0
	Intermediate	n/a	n/a	n/a	0
	Increaser	n/a	n/a	n/a	0
Average	Decreaser	66%	22%	12%	41
	Intermediate	34%	43%	23%	35
	Increaser	24%	35%	41%	17
Below average	Decreaser	42%	26%	32%	19
	Intermediate	35%	24%	41%	17
	Increaser	n/a	n/a	n/a	6

Canopy area of Decreaser, Intermediate and Increaser species but restricted to plants less than 1.5 m in height

Table 1:359. Yalgoo IBRA – summary of canopy area for decreaser, intermediate and increaser species but restricted to plants less than 1.5 m in height.

Average change in cover +/- standard error of the mean	0.81 +/-0.43	1.43 +/- 0.91	2.2 +/- 4.0
Cover: ratio Date 2 to Date 1 at least 1.0 – percentage of sites	30%	63%	60%
Cover: ratio Date 2 to Date 1 <0.90 – percentage of sites	62%	29%	30%
Cover: ratio Date 2 to Date 1 <0.50 – percentage of sites	25%	4%	20%
Average cover ratio Date 2 to Date 1 for above average seasonal quality	n/a	n/a	n/a
Average cover ratio Date 2 to Date 1 for average seasonal quality	0.80	1.31	1.16
Average cover ratio Date 2 to Date 1 for below average seasonal quality	0.83	1.66	n/a

Figure 1:116. Canopy area by site – Decreaser, Intermediate and Increaser species but restricted to plants less than 1.5 m in height – Yalgoo IBRA.

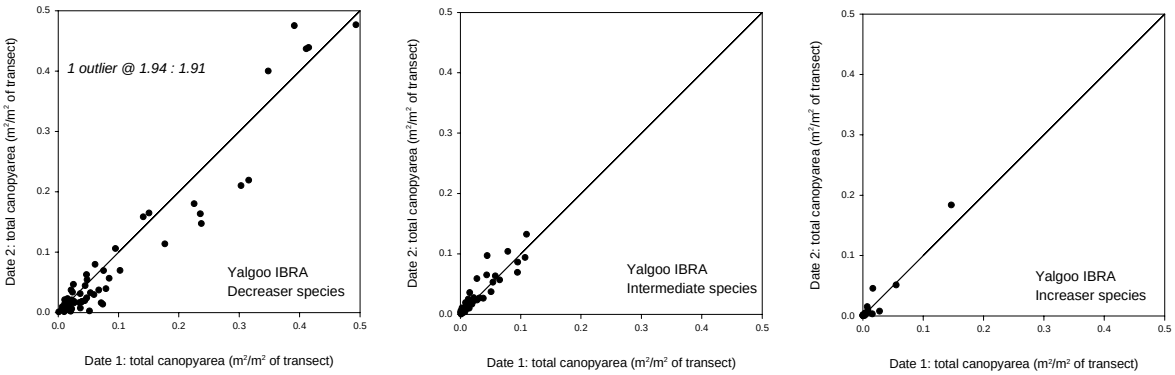


Table 1:360. Yalgoo IBRA – percentage of sites in each seasonal category showing change in canopy area for decreaser, intermediate and increaser species but restricted to plants less than 1.5 m in height.

Seasonal Quality	Species group	Decline. Total canopy area <0.90	No change. 0.90>= total canopy area <1.10	Increase. total canopy area >=1.10	Number of sites
All years	Decreaser	62%	13%	25%	60
	Intermediate	29%	12%	59%	49
	Increaser	30%	10%	60%	20
Above average	Decreaser	n/a	n/a	n/a	0
	Intermediate	n/a	n/a	n/a	0
	Increaser	n/a	n/a	n/a	0
Average	Decreaser	68%	7%	24%	41
	Intermediate	25%	16%	59%	32
	Increaser	33%	13%	53%	15
Below average	Decreaser	47%	26%	26%	19
	Intermediate	35%	6%	59%	17
	Increaser	n/a	n/a	n/a	5

Change in vegetation richness and occurrence

Native shrub species richness

Table 1:361. Yalgoo IBRA – summary of native shrub species richness

Number of sites assessed	60
Average number of species per site – Date 1	6.3 +/- 0.39
Average number of species per site – Date 2	6.3 +/- 0.41
Average ratio of species richness: Date 2 to Date 1 +/- standard error of the mean	1.01 +/- 0.03
Species richness: ratio Date 2 to Date 1 at least 1.0 – percentage of sites	72%
Species richness: ratio Date 2 to Date 1 <0.90 – percentage of sites	25%
Species richness: ratio Date 2 to Date 1 <0.50 – percentage of sites	0%

Figure 1:117. Change in shrub species richness on each site between Date 1 and Date 2 – Yalgoo IBRA. Bubble size represents number of sites at each x,y point.

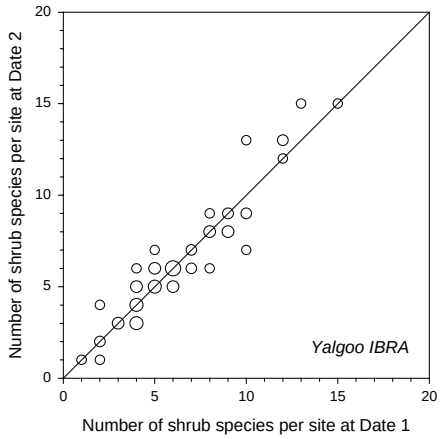


Table 1:362. Native species shrub richness Yalgoo IBRA- date 2 to divided by date 1.

Seasonal Quality	Species group	Decline. Richness index < 0.80	No change. 0.80 ≤ Richness index <1.20	Increase. Richness index ≥1.20	Number of sites
All years	All	12%	72%	17%	60
Above average	All	0%	0%	0%	0

Average	All	7%	76%	17%	41
Below average	All	21%	63%	16%	19

Frequency of occurrence

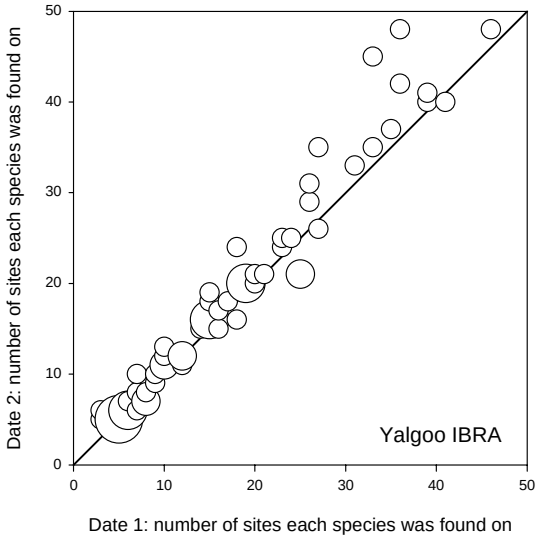
Table 1:363. Yalgoo IBRA – shrubland sites – species found on at least five sites at Date 1 or Date 2.

Number of species	32
Occurrence ratio Date 2 to Date 1 at least 1.0 – percentage of sites	75%
Occurrence ratio Date 2 to Date 1 >1.10 – percentage of species	19%
Occurrence ratio Date 2 to Date 1 < 0.90 – percentage of species	25%
Occurrence ratio Date 2 to Date 1 < 0.50 – percentage of species	0%
Average change in occurrence ratio	1.0

Table 1:364. Species with occurrence ratio greater than 1.1 or less than 0.90 and found on at least 10 sites at Date 1 or Date 2 – Yalgoo IBRA

SPECIES_NAME	DESIR	TR_C	No_pop	No_pop	OR
Ptilotus schwartzii	*D*	*4*	*12*	*15*	*1.25*
Solanum lasiophyllum	*I*	*2*	*16*	*19*	*1.19*
Maireana planifolia	*D*	*2*	*10*	*6*	*0.60*

Figure 1:118. Frequency of occurrence for all species found on at least five sites in the Yalgoo IBRA.



Species with at least one popn having at least 20 individuals at either date 1 or date 2	Species name	Common name	Species Code	Response category	No_popn _D1	No_popn _D2	Initial	Number of plants that died	Number of recruits	Final	Occurrence ratio	Rec Rate	Survivorship	Turnover Rate	Population Growth Rate	Species with at least one popn having at least 20 individuals at either date 1 or date 2
	Acacia acuminata	Jam	ACAACU	I	7	7	18	0	6	24	1.00	0.33	1.00	0.14	1.33	
ACAANA	Acacia anastema	Sand dune gidgee	ACAANA	I	7	7	43	0	35	78	1.00	0.81	1.00	0.29	1.81	ACAANA
	Acacia ancistrocarpa	Fitzroy wattle	ACAANC	I	1	2	3	1	2	4	2.00	0.67	0.67	0.43	1.33	
	Acacia andrewsii		ACAAND	I	1	1	9	1	0	8	1.00	0.00	0.89	0.06	0.89	
ACAANE	Acacia aneura	Mulga	ACAANE	I	320	340	2614	110	674	3178	1.06	0.26	0.96	0.14	1.22	ACAANE
	Acacia bivenosa	Coastal wattle	ACABIV	I	1	2	2	1	1	2	2.00	0.50	0.50	0.50	1.00	
	Acacia brachystachya	Turpentine mulga	ACABRA	I	2	2	4	0	4	8	1.00	1.00	1.00	0.33	2.00	
	Acacia burkittii	Burkitt's wattle, pinbush wattle	ACABUR	I	20	22	70	6	25	89	1.10	0.36	0.91	0.19	1.27	
	Acacia citrinoviridis	Golden wattle	ACACIT	I	11	14	16	0	10	26	1.27	0.63	1.00	0.24	1.63	
ACACOO	Acacia coolgardiensis	Sugar brother	ACACOO	I	2	2	16	0	5	21	1.00	0.31	1.00	0.14	1.31	ACACOO
	Acacia coriacea	Weeping acacia	ACACOR	I	2	2	2	0	0	2	1.00	0.00	1.00	0.00	1.00	
ACACRA	Acacia craspedocarpa	Hop mulga	ACACRA	I	26	27	112	3	11	120	1.04	0.10	0.97	0.06	1.07	ACACRA
ACACUS	Acacia cuspidifolia	Bohemia, wait-a-while	ACACUS	I	32	33	234	23	49	260	1.03	0.21	0.90	0.15	1.11	ACACUS
	Acacia cuthbertsonii	Snakewood type	ACACUT	I	3	3	17	2	14	29	1.00	0.82	0.88	0.35	1.71	
	Acacia demissa	Murchison willow	ACADEM		1	1	1	0	0	1	1.00	0.00	1.00	0.00	1.00	
	Acacia distans	Black mulga, gascoyne jam	ACADIS	I	2	2	5	0	0	5	1.00	0.00	1.00	0.00	1.00	
	Acacia drepanophylla	Hamelin wattle	ACADRE	I	1	1	6	0	0	6	1.00	0.00	1.00	0.00	1.00	
	Acacia eremaea	Snakewood	ACAERE	I	10	10	26	2	6	30	1.00	0.23	0.92	0.14	1.15	
	Acacia farnesiana	Camel bush, false mesquite	ACAFAR	U		9	0	0	30	30				1.00		
	Acacia grasbyi	Miniritchie	ACAGRA	I	36	38	83	6	16	93	1.06	0.19	0.93	0.13	1.12	
	Acacia hemignosta	Club leaf wattle	ACAHEM	I	2	2	6	0	1	7	1.00	0.17	1.00	0.08	1.17	
	Acacia jennerae	Gum wattle	ACAJEN	I	1	1	4	0	0	4	1.00	0.00	1.00	0.00	1.00	
	Acacia kempeana	Witchetty bush	ACAKEM	I	23	23	109	4	47	152	1.00	0.43	0.96	0.20	1.39	
	Acacia ligulata	Umbrella wattle	ACALIG	I	5	5	22	1	6	27	1.00	0.27	0.95	0.14	1.23	
ACALIN	Acacia linophylla	Bowgada or wanyu	ACALIN	I	42	46	257	14	58	301	1.10	0.23	0.95	0.13	1.17	ACALIN
	Acacia masliniana		ACAMAS		3	3	18	0	1	19	1.00	0.06	1.00	0.03	1.06	
	Acacia microcalyx		ACAMIC	I	1	1	1	0	0	1	1.00	0.00	1.00	0.00	1.00	
	Acacia murrayana	Fire or sand plain wattle, fire wattle	ACAMUR	I	4	4	9	0	2	11	1.00	0.22	1.00	0.10	1.22	
	Acacia oswaldii	Neliao or miljee	ACAOSW	I	1	1	8	0	2	10	1.00	0.25	1.00	0.11	1.25	
ACAPAP	Acacia papyrocarpa	Western myall	ACAPAP	I	14	16	164	6	296	454	1.14	1.80	0.96	0.49	2.77	ACAPAP
	Acacia pruinocarpa	Yalardy, gidgee	ACAPRU	I	33	35	66	14	25	77	1.06	0.38	0.79	0.27	1.17	
	Acacia pyrifolia	Kanji bush, ranji bush	ACAPYR	I	2	2	3	0	0	3	1.00	0.00	1.00	0.00	1.00	
	Acacia quadrimarginea	Murchison willow	ACAQUA	I	8	9	13	0	3	16	1.13	0.23	1.00	0.10	1.23	
ACARAM	Acacia ramulosa	Wanyu	ACARAM	I	87	86	538	11	88	615	0.99	0.16	0.98	0.09	1.14	ACARAM
	Acacia rhodophloia	Flat leafed miniritchie	ACARHO	I	4	4	18	1	3	20	1.00	0.17	0.94	0.11	1.11	
ACAROY	Acacia roycei	Needle myall	ACAROY	I	8	8	25	0	10	35	1.00	0.40	1.00	0.17	1.40	ACAROY
ACASCL	Acacia sclerosperma	Limestone wattle, silver bark wattle	ACASCL	I	28	36	103	7	99	195	1.29	0.96	0.93	0.36	1.89	ACASCL
	Acacia stowardii	Myall, water tree	ACASTO		2	2	5	0	0	5	1.00	0.00	1.00	0.00	1.00	
	Acacia subtessarogona	Spreading gidgee	ACASUB	I	8	9	35	0	8	43	1.13	0.23	1.00	0.10	1.23	
ACATET	Acacia tetragonophylla	Curara	ACATET	I	325	381	1199	51	515	1663	1.17	0.43	0.96	0.20	1.39	ACATET
	Acacia tumida	Pindan wattle (sickle leaf)	ACATUM	I	1	1	1	0	0	1	1.00	0.00	1.00	0.00	1.00	
ACAVIC	Acacia victoriae	Prickly wattle or bardi bush	ACAVIC	U	121	137	960	172	905	1693	1.13	0.94	0.82	0.41	1.76	ACAVIC
	Acacia wanyu		ACAWAN	I	2	4	11	0	7	18	2.00	0.64	1.00	0.24	1.64	
	Acacia wiseana	Kerosene bush	ACAWIS	I	7	7	12	1	1	12	1.00	0.08	0.92	0.08	1.00	
ACAXIP	Acacia xiphophylla	Snakewood	ACAXIP	I	41	41	194	4	49	239	1.00	0.25	0.98	0.12	1.23	ACAXIP
	Acanthocarpus preissii		ACNPRE	I	2	3	7	2	4	9	1.50	0.57	0.71	0.38	1.29	
	Alectryon oleifolius	Rosewood, mingah	ALEOLE	D	5	6	6	0	1	7	1.20	0.17	1.00	0.08	1.17	
	Alyogyne pinoniana	Sand plain hibiscus	ALGPIN	U	1	1	12	4	2	10	1.00	0.17	0.67	0.27	0.83	
	Angianthus tomentosus	Camel-grass	ANGTOM		1	1	1	0	0	1	1.00	0.00	1.00	0.00	1.00	
	Asclepiadaceae family		ASCLEP	D	1	1	7	0	1	8	1.00	0.14	1.00	0.07	1.14	
ATRAMN	Atriplex amnicola	River saltbush, swamp saltbush	ATRAMN	D	14	13	516	183	76	409	0.93	0.15	0.65	0.28	0.79	ATRAMN
ATRBUN	Atriplex bunburyana	Silver saltbush	ATRBUN	D	97	96	2695	700	1044	3039	0.99	0.39	0.74	0.30	1.13	ATRBUN
ATRNAN	Atriplex nana		ATRNAN		1	1	44	2	4	46	1.00	0.09	0.95	0.07	1.05	ATRNAN
ATRNUM	Atriplex nummularia	Old man saltbush	ATRNUM	D	50	51	253	20	68	301	1.02	0.27	0.92	0.16	1.19	ATRNUM
ATRSTI	Atriplex stipitata	Mallee saltbush	ATRSTI	U	6	6	149	58	34	125	1.00	0.23	0.61	0.34	0.84	ATRSTI
ATRVES	Atriplex vesicaria	Bladder saltbush	ATRVES	D	204	201	8907	1232	1956	9631	0.99	0.22	0.86	0.17	1.08	ATRVES
	Brachychiton gregorii	Kurrajong	BRYGRE	D	1	1	1	0	0	1	1.00	0.00	1.00	0.00	1.00	
BRALAT	Brachyscome latisquamea	Broad bracted daisy	BRALAT	D	1	3	6	0	31	37	3.00	5.17	1.00	0.72	6.17	BRALAT
	Bursaria occidentalis	Blackthorn	BUROCC	I	1	1	1	0	0	1	1.00	0.00	1.00	0.00	1.00	
	Bursaria spinosa	Australian blackthorn	BURSPI	I	2	2	3	1	0	2	1.00	0.00	0.67	0.20	0.67	
	Casuarina cristata	Black oak	CSUCRI	I	4	4	5	0	2	7	1.00	0.40	1.00	0.17	1.40	
	Corymbia aspera	Rough leaf range gum	CORASP	I	1	1	2	0	0	2	1.00	0.00	1.00	0.00	1.00	
CRACON	Cratystylis conocephala	False blue bush	CRACON	D	18	25	132	0	83	215	1.39	0.63	1.00	0.24	1.63	CRACON
CRASUB	Cratystylis subspinescens	Australian sage	CRASUB	D	66	67	937	45	89	981	1.02	0.09	0.95	0.07	1.05	CRASUB
	Cryptandra connata		CRYCON	I	4	4	11	2	16	25	1.00	1.45	0.82	0.50	2.27	

Species with at least one popn having at least 20 individuals at either date 1 or date 2	Species name	Common name	Species Code	Response category	No_popn_D1	No_popn_D2	Initial	Number of plants that died	Number of recruits	Final	Occurrence ratio	Rec Rate	Survivorship	Turnover Rate	Population Growth Rate	Species with at least one popn having at least 20 individuals at either date 1 or date 2
	Cryptandra leucophracta		CRYLEU		1	1	2	0	0	2	1.00	0.00	1.00	0.00	1.00	
	Dianella revoluta	Native lily	DIAREV	I	22	23	49	3	21	67	1.05	0.43	0.94	0.21	1.37	
	Dicrastylis linearifolia	Cabbage bush	DCRLIN		1	1	17	4	1	14	1.00	0.06	0.76	0.16	0.82	
DODINA	Dodonaea inaequifolia	Hopbush	DODINA		1	1	29	13	0	16	1.00	0.00	0.55	0.29	0.55	DODINA
	Dodonaea lobulata	Bead hop bush	DODLOB	I	4	7	6	1	18	23	1.75	3.00	0.83	0.66	3.83	
	Dodonaea rigida	Thread-leaf hopbush	DODRIG		2	3	2	0	1	3	1.50	0.50	1.00	0.20	1.50	
	Dodonaea viscosa	Sticky hopbush	DODVIS	I	2	2	3	1	5	7	1.00	1.67	0.67	0.60	2.33	
ERMBAT	Eremophila aff. battii		ERMBAT		1	1	75	4	35	106	1.00	0.47	0.95	0.22	1.41	ERMBAT
	Eremophila aff. clarkei		ERMACL		1	1	3	0	1	4	1.00	0.33	1.00	0.14	1.33	
ERMACO	Eremophila aff. compacta		ERMACO	D	25	24	473	43	123	553	0.96	0.26	0.91	0.16	1.17	ERMACO
	Eremophila aff. georgei		ERMAGE		1	1	13	1	2	14	1.00	0.15	0.92	0.11	1.08	
	Eremophila aff. gilesii	Charleville turkey bush	ERMAGI	U		1	0	0	2	2				1.00		
	Eremophila alternifolia		ERMALT		1	1	1	0	1	2	1.00	1.00	1.00	0.33	2.00	
ERMCLA	Eremophila clarkei	Turpentine bush	ERMCLA	I	21	23	225	31	34	228	1.10	0.15	0.86	0.14	1.01	ERMCLA
ERMCOM	Eremophila compacta	Compact poverty bush	ERMCOM	D	33	34	247	53	67	261	1.03	0.27	0.79	0.24	1.06	ERMCOM
ERMCRE	Eremophila crenulata	Waxy-leaf poverty bush	ERMCRE	U	14	14	175	29	39	185	1.00	0.22	0.83	0.19	1.06	ERMCRE
ERMCUN	Eremophila cuneifolia	Royal poverty bush	ERMCUN	U	70	74	845	64	360	1141	1.06	0.43	0.92	0.21	1.35	ERMCUN
	Eremophila decipiens		ERMDEC		5	6	21	2	7	26	1.20	0.33	0.90	0.19	1.24	
	Eremophila deserti		ERMDES		2	4	2	0	6	8	2.00	3.00	1.00	0.60	4.00	
ERMERI	Eremophila eriocalyx	Desert pride, slender poverty bush	ERMERI	D	3	3	54	3	8	59	1.00	0.15	0.94	0.10	1.09	ERMERI
ERMEXI	Eremophila exilifolia	Little turpentine, poverty bush	ERMEXI	I	2	2	51	6	7	52	1.00	0.14	0.88	0.13	1.02	ERMEXI
ERMFOL	Eremophila foliosissima		ERMFOL	I	4	4	61	24	40	77	1.00	0.66	0.61	0.46	1.26	ERMFOL
ERMFOR	Eremophila forrestii	Wilcox bush or felt bush	ERMFOR	I	237	240	3784	362	880	4302	1.01	0.23	0.90	0.15	1.14	ERMFOR
ERMFRA	Eremophila fraseri	Turpentine bush	ERMFRA	U	112	123	927	99	274	1102	1.10	0.30	0.89	0.18	1.19	ERMFRA
	Eremophila freelingii	Rock fuchsia bush, stony poverty bush	ERMFRE	U	21	22	93	20	48	121	1.05	0.52	0.78	0.32	1.30	
ERMGEO	Eremophila georgei	Fine-toothed poverty bush	ERMGEO	I	41	49	455	124	196	527	1.20	0.43	0.73	0.33	1.16	ERMGEO
ERMGIB	Eremophila gibsonii	Poverty bush	ERMGIB		1	1	22	3	2	21	1.00	0.09	0.86	0.12	0.95	ERMGIB
ERMGIL	Eremophila gilesii	Charleville turkey bush	ERMGIL	U	17	17	603	131	267	739	1.00	0.44	0.78	0.30	1.23	ERMGIL
ERMGLA	Eremophila glabra	Black fuchsia, tar bush	ERMGLA	I	16	19	73	3	16	86	1.19	0.22	0.96	0.12	1.18	ERMGLA
ERMGLN	Eremophila glandulifera	ermapu ermaco	ERMGLN		2	2	108	10	91	189	1.00	0.84	0.91	0.34	1.75	ERMGLN
ERMGRA	Eremophila granitica	Thin-leaved poverty bush, wanderrie poverty bush	ERMGRA	I	33	31	285	53	198	430	0.94	0.69	0.81	0.35	1.51	ERMGRA
ERMHOM	Eremophila homoplastica		ERMHOM		3	3	51	4	43	90	1.00	0.84	0.92	0.33	1.76	ERMHOM
ERMLAA	Eremophila laanii	Murchison river poverty bush	ERMLAA	D	5	4	38	22	6	22	0.80	0.16	0.42	0.47	0.58	ERMLAA
ERMLAC	Eremophila lachnocalyx	Woolly calyxed eremophila, woolly poverty	ERMLAC	I	3	4	38	16	5	27	1.33	0.13	0.58	0.32	0.71	ERMLAC
ERMLAN	Eremophila lanata		ERMLAN		1	1	47	10	16	53	1.00	0.34	0.79	0.26	1.13	ERMLAN
ERMLAE	Eremophila lanceolata		ERMLAE		33	38	325	92	210	443	1.15	0.65	0.72	0.39	1.36	ERMLAE
ERMLAT	Eremophila latrobei	Warty-leaf eremophila, warty fuchsia bush	ERMLAT	D	129	139	626	60	210	776	1.08	0.34	0.90	0.19	1.24	ERMLAT
ERMLIN	Eremophila linearis	Saline fuchsia bush, harlequin fuchsia	ERMLIN		4	6	30	1	14	43	1.50	0.47	0.97	0.21	1.43	ERMLIN
ERMLON	Eremophila longifolia	Long-leaved poverty bush	ERMLON	D	12	22	20	6	34	48	1.83	1.70	0.70	0.59	2.40	ERMLON
ERMMAY	Eremophila mackinlayi	Poverty bush	ERMMAY	I	2	2	128	34	132	226	1.00	1.03	0.73	0.47	1.77	ERMMAY
ERMMAC	Eremophila maculata	Native fuchsia \ travel bush	ERMMAC	I	29	30	302	44	69	327	1.03	0.23	0.85	0.18	1.08	ERMMAC
ERMMAI	Eremophila maitlandii	Sand plain or tall poverty bush	ERMMAI	I	11	11	206	17	61	250	1.00	0.30	0.92	0.17	1.21	ERMMAI
ERMMAL	Eremophila malacoides	Frontage poverty bush	ERMMAL	D	10	11	91	0	64	155	1.10	0.70	1.00	0.26	1.70	ERMMAL
ERMMAR	Eremophila margarethae	Narrow leaf grey or sandbank poverty bush	ERMMAR	U	56	59	1759	129	358	1988	1.05	0.20	0.93	0.13	1.13	ERMMAR
	Eremophila miniata	Kopi poverty bush	ERMMIN	I	6	5	18	4	2	16	0.83	0.11	0.78	0.18	0.89	
	Eremophila oldfieldii	Pixie bush, sub-Sp. angustifolia	ERMOLD	D	12	15	26	2	15	39	1.25	0.58	0.92	0.26	1.50	
	Eremophila oldfieldii subsp. angustifolia	Poverty bush	ERMOSA		2	2	4	1	9	12	1.00	2.25	0.75	0.63	3.00	
	Eremophila pantonii	Limestone poverty bush	ERMPAN		1	1	3	0	0	3	1.00	0.00	1.00	0.00	1.00	
ERMPAR	Eremophila parvifolia		ERMPAR		7	8	72	1	26	97	1.14	0.36	0.99	0.16	1.35	ERMPAR
ERMPLA	Eremophila platycalyx	Granite poverty bush	ERMPLA	I	44	53	207	17	73	263	1.20	0.35	0.92	0.19	1.27	ERMPLA
ERMPTE	Eremophila pterocarpa	Silver poverty bush	ERMPTE	I	18	18	94	2	4	96	1.00	0.04	0.98	0.03	1.02	ERMPTE
ERMPUN	Eremophila punicea		ERMPUN	U	15	14	325	34	82	373	0.93	0.25	0.90	0.17	1.15	ERMPUN
ERMSCO	Eremophila scoparia	Broom bush	ERMSCO	I	35	39	206	15	67	258	1.11	0.33	0.93	0.18	1.25	ERMSCO
	Eremophila serrulata	Green fuchsia bush	ERMSER	U		2	0	0	2	2				1.00		
ERMSPA	Eremophila spathulata	Grey poverty bush, spoon leaf eremophila	ERMSPA		18	17	135	8	35	162	0.94	0.26	0.94	0.14	1.20	ERMSPA
ERMSPE	Eremophila spectabilis	Sand plain poverty, showy eremophila	ERMSPE	I	23	24	638	92	236	782	1.04	0.37	0.86	0.23	1.23	ERMSPE
ERMSTR	Eremophila strongylophylla	Poverty bush	ERMSTR	D	1	1	38	5	2	35	1.00	0.05	0.87	0.10	0.92	ERMSTR
	Eremophila youngii	Hook leaf poverty bush	ERMYOU	I	1	3	2	0	6	8	3.00	3.00	1.00	0.60	4.00	
	Eucalyptus eudesmioides	Mallalie	EUCEUD	I	1	1	1	0	0	1	1.00	0.00	1.00	0.00	1.00	
	Eucalyptus loxophleba	York gum	EUCLOX	I	1	1	1	0	0	1	1.00	0.00	1.00	0.00	1.00	
	Eucalyptus salmonophloia	Salmon gum	EUCSAM		1	1	1	0	0	1	1.00	0.00	1.00	0.00	1.00	
	Eucalyptus salubris	Gimlet	EUCSAL			1	0	0	1	1				1.00		
	Eucalyptus striaticalyx	Kopi gum	EUCSTR		1	1	1	0	0	1	1.00	0.00	1.00	0.00	1.00	
	Eucalyptus terminalis	Inland bloodwood	EUCTER	I	1	1	2	0	0	2	1.00	0.00	1.00	0.00	1.00	
	Euryomyrtus maidenii		EURMAI		1	1	1	0	0	1	1.00	0.00	1.00	0.00	1.00	

Species with at least one popn having at least 20 individuals at either date 1 or date 2	Species name	Common name	Species Code	Response category	No_popn _D1	No_popn _D2	Initial	Number of plants that died	Number of recruits	Final	Occurrence ratio	Rec Rate	Survivorship	Turnover Rate	Population Growth Rate	Species with at least one popn having at least 20 individuals at either date 1 or date 2
	Exocarpos aphyllus	Broom bush, naked-lady	EXOAPH	I	13	13	14	1	7	20	1.00	0.50	0.93	0.24	1.43	
FRAPAU	Frankenia pauciflora	Sea heath	FRAPAU	D	3	3	190	8	22	204	1.00	0.12	0.96	0.08	1.07	FRAPAU
FRASPP	Frankenia species	Frankenia	FRASPP	D	149	159	4533	613	1333	5253	1.07	0.29	0.86	0.20	1.16	FRASPP
	Grevillea berryana	Sandy loam common	GRVBER	I	3	3	5	0	2	7	1.00	0.40	1.00	0.17	1.40	
	Grevillea brachystachya	Short spiked Grevillea	GRVBRA		5	5	7	0	0	7	1.00	0.00	1.00	0.00	1.00	
GRVDEF	Grevillea deflexa	Spiny grevillea,Ninghan Grevillea	GRVDEF	D	13	14	148	14	95	229	1.08	0.64	0.91	0.29	1.55	GRVDEF
	Grevillea eriostachya	Orange Grevillea, Flame Grevillea	GRVERI	I	2	2	6	0	4	10	1.00	0.67	1.00	0.25	1.67	
	Grevillea paradoxa	Bottlebrush Grevillea	GRVPAR		3	3	7	0	0	7	1.00	0.00	1.00	0.00	1.00	
	Grevillea stenobotrya	Rattle bush	GRVSTE	I	5	5	10	0	1	11	1.00	0.10	1.00	0.05	1.10	
	Grevillea striata	Beefwood	GRVSTR	I	15	19	42	7	25	60	1.27	0.60	0.83	0.31	1.43	
GUNQUA	Gunniopsis quadrifida	Pigface, sweet samphire or water bush	GUNQUA	D	29	33	263	145	312	430	1.14	1.19	0.45	0.66	1.63	GUNQUA
	Gymnema granitica		GYMGRA	D	1	1	3	0	0	3	1.00	0.00	1.00	0.00	1.00	
HAKPRE	Hakea preissii	Needle bush	HAKPRE	U	85	105	278	18	174	434	1.24	0.63	0.94	0.27	1.56	HAKPRE
	Hakea recurva subsp. arida	Common hakea, needle bush type	HAKRAR	U	2	2	2	0	0	2	1.00	0.00	1.00	0.00	1.00	
HAKSUB	Hakea suberea	Cork bark tree	HAKSUB	I	8	7	26	2	12	36	0.88	0.46	0.92	0.23	1.38	HAKSUB
HALDOL	Halosarcia doleiformis	Samphire	HALDOL		1	1	34	4	10	40	1.00	0.29	0.88	0.19	1.18	HALDOL
HALSPP	Halosarcia species	Samphire	HALSPP	I	61	56	860	163	271	968	0.92	0.32	0.81	0.24	1.13	HALSPP
	Hemichroa diandra		HMCDRA			1	0	0	2	2				1.00		
HEMTYS	Hemigenia tysonii		HEMTYS	I	2	2	40	35	0	5	1.00	0.00	0.13	0.78	0.13	HEMTYS
	Indigofera colutea		INDCOL		1	1	1	0	3	4	1.00	3.00	1.00	0.60	4.00	
INDMON	Indigofera monophylla		INDMON	I	5	9	46	11	35	70	1.80	0.76	0.76	0.40	1.52	INDMON
	Lamarchea hakeifolia	False paperbark	LAMHAK		2	2	10	0	0	10	1.00	0.00	1.00	0.00	1.00	
LAWHEL	Lawrencia helmsii	Dunna dunna	LAWHEL	I	1	1	20	1	5	24	1.00	0.25	0.95	0.14	1.20	LAWHEL
LAWSQU	Lawrencia squamata		LAWSQU	I	31	39	795	77	247	965	1.26	0.31	0.90	0.18	1.21	LAWSQU
	Lawrencia viridigrisea		LAWVIR		1	1	3	2	0	1	1.00	0.00	0.33	0.50	0.33	
LEPPLA	Lepidium platypetalum	peppercress	LEPPLA	D	2	2	48	15	13	46	1.00	0.27	0.69	0.30	0.96	LEPPLA
	Lepidium strongylophyllum		LEPSTR	D	1	1	1	0	1	2	1.00	1.00	1.00	0.33	2.00	
LYCAUS	Lycium australe	Water bush or Aust. Boxthorn	LYCAUS	D	54	57	423	16	249	656	1.06	0.59	0.96	0.25	1.55	LYCAUS
	Maireana amoena		MARAMO	D	7	6	32	7	15	40	0.86	0.47	0.78	0.31	1.25	
MARAPH	Maireana aphylla	Spiny bluebush	MARAPH	D	12	12	225	12	123	336	1.00	0.55	0.95	0.24	1.49	MARAPH
MARATK	Maireana atkinsiana	Bronze bluebush	MARATK	D	19	18	115	6	24	133	0.95	0.21	0.95	0.12	1.16	MARATK
MARBRE	Maireana brevifolia		MARBRE		1	1	1	0	20	21	1.00	20.00	1.00	0.91	21.00	MARBRE
MARCON	Maireana convexa	Mulga bluebush	MARCON	D	49	50	579	256	369	692	1.02	0.64	0.56	0.49	1.20	MARCON
	Maireana enchylaenoides	Bluebush	MARENC	I	1	1	3	0	0	3	1.00	0.00	1.00	0.00	1.00	
	Maireana erioclada		MARERC		6	6	13	0	0	13	1.00	0.00	1.00	0.00	1.00	
MARGEO	Maireana georgei	Golden bluebush, George's bluebush	MARGEO	D	185	202	2740	1084	2035	3691	1.09	0.74	0.60	0.48	1.35	MARGEO
MARGLO	Maireana glomerifolia	Ball-leaf bluebush	MARGLO	D	57	56	861	46	45	860	0.98	0.05	0.95	0.05	1.00	MARGLO
	Maireana lobiflora	Flannel flower bluebush	MARLOB		1	1	9	0	0	9	1.00	0.00	1.00	0.00	1.00	
MARMEL	Maireana melanocoma	Pussy bluebush	MARMEL	D	22	24	401	162	297	536	1.09	0.74	0.60	0.49	1.34	MARMEL
MARPEN	Maireana pentatropis	Erect bluebush	MARPEN	I	4	7	9	4	40	45	1.75	4.44	0.56	0.81	5.00	MARPEN
MARPLA	Maireana planifolia	Flat bluebush, flat-leaf bluebush	MARPLA	D	140	134	1236	551	483	1168	0.96	0.39	0.55	0.43	0.94	MARPLA
	Maireana planifolia x villosa		MARPXV		5	4	35	11	10	34	0.80	0.29	0.69	0.30	0.97	
MARPLT	Maireana platycarpa	Low bluebush, shy bluebush	MARPLT	D	54	52	1159	159	149	1149	0.96	0.13	0.86	0.13	0.99	MARPLT
MARPOL	Maireana polypterygia	Gascoyne bluebush	MARPOL	D	47	47	2246	92	500	2654	1.00	0.22	0.96	0.12	1.18	MARPOL
	Maireana prosthecochaeta		MARPRO		1	1	2	1	1	2	1.00	0.50	0.50	0.50	1.00	
MARPYR	Maireana pyramidata	Sago bush	MARPYR	I	163	164	3829	369	245	3705	1.01	0.06	0.90	0.08	0.97	MARPYR
MARSED	Maireana sedifolia	Pearl bluebush	MARSED	I	149	150	5953	40	128	6041	1.01	0.02	0.99	0.01	1.01	MARSED
MARSUE	Maireana suaedifolia	Lax bluebush	MARSUE	D	4	3	38	21	3	20	0.75	0.08	0.45	0.41	0.53	MARSUE
	Maireana thesioides	Climbing bluebush, lax bluebush	MARTHE	D	29	25	73	25	15	63	0.86	0.21	0.66	0.29	0.86	
	Maireana trichoptera	Downy bluebush	MARTRC	D	2		2	2	0	0		0.00	0.00	1.00	0.00	
	Maireana turbinata		MARTUB		5	5	27	5	4	26	1.00	0.15	0.81	0.17	0.96	
MARVIL	Maireana villosa	Bluebush	MARVIL	D	142	162	1236	608	645	1273	1.14	0.52	0.51	0.50	1.03	MARVIL
	Melaleuca cardiophylla	Tangling Melaleuca	MELCAR	I	1	1	3	0	0	3	1.00	0.00	1.00	0.00	1.00	
	Melaleuca uncinata	Broom honey myrtle	MELUNC	I	3	3	5	0	0	5	1.00	0.00	1.00	0.00	1.00	
	Mirbelia microphylla		MIRMIC	I	1	1	1	0	0	1	1.00	0.00	1.00	0.00	1.00	
	Mirbelia ramulosa		MIRRAM		3	3	23	0	7	30	1.00	0.30	1.00	0.13	1.30	
MIRSPI	Mirbelia spinosa		MIRSPI	I	12	12	103	20	31	114	1.00	0.30	0.81	0.24	1.11	MIRSPI
MUEFLO	Muehlenbeckia florulenta	Lignum / swamp bush	MUEFLO	D	3	2	22	2	81	101	0.67	3.68	0.91	0.67	4.59	MUEFLO
NITBIL	Nitraria billardierei	Nitre bush	NITBIL		14	14	88	1	10	97	1.00	0.11	0.99	0.06	1.10	NITBIL
	Olearia muelleri	Muellers daisy bush, muellers daisy	OLEMUE	I	12	10	57	5	13	65	0.83	0.23	0.91	0.15	1.14	
OLEPIM	Olearia pimeleoides	Pimelea daisy bush	OLEPIM		3	4	7	0	25	32	1.33	3.57	1.00	0.64	4.57	OLEPIM
PIMMIC	Pimelea microcephala	Mallee rice flower	PIMMIC	I	23	27	58	22	53	89	1.17	0.91	0.62	0.51	1.53	PIMMIC
PTOPHY	Pittosporum phylliraeoides	Desert willow, native willow	PTOPHY	I	3	2	28	27	1	2	0.67	0.04	0.04	0.93	0.07	PTOPHY
	Pityrodia paniculata		PITPAN		1	1	5	0	0	5	1.00	0.00	1.00	0.00	1.00	
	Psydrax attenuata		PSYATT		6	8	9	1	3	11	1.33	0.33	0.89	0.20	1.22	

Species with at least one popn having at least 20 individuals at either date 1 or date 2	Species name	Common name	Species Code	Response category	No_popn _D1	No_popn _D2	Initial	Number of plants that died	Number of recruits	Final	Occurrence ratio	Rec Rate	Survivorship	Turnover Rate	Population Growth Rate	Species with at least one popn having at least 20 individuals at either date 1 or date 2
	Psydrax latifolia	Native currant	PSYLAT	D	20	22	38	4	14	48	1.10	0.37	0.89	0.21	1.26	
PSYSUA	Psydrax suaveolens	Native currant	PSYSUA		31	39	90	9	47	128	1.26	0.52	0.90	0.26	1.42	PSYSUA
PTIBEA	Ptilotus beardii	Low mulla mulla	PTIBEA	D	3	3	101	1	1	101	1.00	0.01	0.99	0.01	1.00	PTIBEA
PTIDIV	Ptilotus divaricatus	Climbing mulla mulla	PTIDIV	D	21	22	84	19	55	120	1.05	0.65	0.77	0.36	1.43	PTIDIV
	Ptilotus exaltatus	Purple mulla mulla	PTIEXA	D	1		1	1	0	0		0.00	0.00	1.00	0.00	
PTIOBO	Ptilotus obovatus	Cotton bush	PTIOBO	D	575	606	17583	4690	9099	21992	1.05	0.52	0.73	0.35	1.25	PTIOBO
PTIPOL	Ptilotus polakii	Gascoyne mulla mulla	PTIPOL	I	45	46	1701	159	416	1958	1.02	0.24	0.91	0.16	1.15	PTIPOL
	Ptilotus rotundifolius	Royal mulla mulla	PTIROT	D	10	10	47	3	8	52	1.00	0.17	0.94	0.11	1.11	
PTISCH	Ptilotus schwartzii	Horse mulla mulla	PTISCH	D	117	125	2599	546	557	2610	1.07	0.21	0.79	0.21	1.00	PTISCH
RHADRU	Rhagodia drummondii	Low rhagodia	RHADRU		50	50	252	34	59	277	1.00	0.23	0.87	0.18	1.10	RHADRU
RHAERE	Rhagodia eremaea	Tall / climbing saltbush	RHAERE	D	300	337	1106	226	600	1480	1.12	0.54	0.80	0.32	1.34	RHAERE
	Santalum acuminatum	Quandong, sweet quandong (rough fruit)	SANACU	D	4	7	8	2	5	11	1.75	0.63	0.75	0.37	1.38	
	Santalum lanceolatum	Bitter quandong, plumbush, plumwood (smooth fruit)	SANLAN	D	1	1	7	0	0	7	1.00	0.00	1.00	0.00	1.00	
	Santalum spicatum	Sandalwood	SANSPI	D	3	5	4	0	2	6	1.67	0.50	1.00	0.20	1.50	
	Sauropus crassifolius		SAUCRA		1	1	1	0	0	1	1.00	0.00	1.00	0.00	1.00	
SCVSPI	Scaevola spinescens	Currant bush, maroon bush	SCVSPI	D	114	116	606	30	215	791	1.02	0.35	0.95	0.18	1.31	SCVSPI
	Scaevola tomentosa	Ragged leafed scaevola, ragged leaf fan flower	SCVTOM	D	8	7	19	2	0	17	0.88	0.00	0.89	0.06	0.89	
SCLMED	Sclerolaena medicaginoides		SCLMED	D	4	4	97	2	7	102	1.00	0.07	0.98	0.05	1.05	SCLMED
	Senna aff.phyllodinea		SNNAPH		2	3	4	0	1	5	1.50	0.25	1.00	0.11	1.25	
SNNART	Senna artemisioides	Silver cassia	SNNART	U	17	24	98	14	154	238	1.41	1.57	0.86	0.50	2.43	SNNART
SNNHEL	Senna artemisioides subsp. helmsii	Crinkle-leaf cassia, crinkled cassia	SNNHEL	U	199	206	1500	419	801	1882	1.04	0.53	0.72	0.36	1.25	SNNHEL
SNNOLI	Senna artemisioides subsp. oligophylla	Blood bush	SNNOLI	I	67	76	989	404	544	1129	1.13	0.55	0.59	0.45	1.14	SNNOLI
SNNSAR	Senna artemisioides subsp. x artemisioides		SNNSAR	U	25	24	58	7	33	84	0.96	0.57	0.88	0.28	1.45	SNNSAR
SNNASS	Senna artemisioides subsp. x coriacea	Desert cassia	SNNASS	U	59	78	205	33	179	351	1.32	0.87	0.84	0.38	1.71	SNNASS
SNNASX	Senna artemisioides subsp. x sturtii	Variable cassia	SNNASX	U	136	149	1019	268	546	1297	1.10	0.54	0.74	0.35	1.27	SNNASX
SNNSTU	Senna artemisioides subsp. x sturtii	Variable cassia	SNNSTU	U	84	96	375	116	169	428	1.14	0.45	0.69	0.35	1.14	SNNSTU
	Senna glutinosa	Sticky cassia	SNNGLU			1	0	0	2	2				1.00		
	Senna glutinosa subsp. charlesiana	Tall cassia	SNNCHR		1	1	1	0	0	1	1.00	0.00	1.00	0.00	1.00	
SNNCHA	Senna glutinosa subsp. chatelainiana		SNNCHA	D	51	60	101	14	81	168	1.18	0.80	0.86	0.35	1.66	SNNCHA
SNNPRU	Senna glutinosa subsp. pruinosa	Silver cassia, white cassia	SNNPRU	I	20	26	105	37	62	130	1.30	0.59	0.65	0.42	1.24	SNNPRU
SNNLUE	Senna glutinosa subsp. x luerssenii	White cassia	SNNLUE	I	12	13	62	25	62	99	1.08	1.00	0.60	0.54	1.60	SNNLUE
SNNHAM	Senna hamersleyensis	Creeping cassia	SNNHAM	D	18	19	221	30	77	268	1.06	0.35	0.86	0.22	1.21	SNNHAM
SIDCAL	Sida calyxhymenia	Tall sida	SIDCAL	D	97	87	440	121	99	418	0.90	0.23	0.73	0.26	0.95	SIDCAL
	Sida spodochroma	Creeping sida, dwarf sida	SIDSPO	D	1		3	3	0	0		0.00	0.00	1.00	0.00	
	Solanum esuriale	Quena	SOLESU	U	5	2	13	11	1	3	0.40	0.08	0.15	0.75	0.23	
SOLLAS	Solanum lasiophyllum	Flannel bush	SOLLAS	I	504	537	3912	1739	2859	5032	1.07	0.73	0.56	0.51	1.29	SOLLAS
SOLORB	Solanum orbiculatum	Tomato bush	SOLORB	U	64	81	200	42	160	318	1.27	0.80	0.79	0.39	1.59	SOLORB
	Solanum sturtianum	Thargomindah nightshade	SOLSTU	I	1	1	1	0	3	4	1.00	3.00	1.00	0.60	4.00	
	Spartothamnella puberula		SPAPUB		1	1	9	1	0	8	1.00	0.00	0.89	0.06	0.89	
SPATEU	Spartothamnella teucriiflora	Broom bush	SPATEU	I	79	87	307	23	172	456	1.10	0.56	0.93	0.26	1.49	SPATEU
STYSPA	Stylobasium spathulatum	Pebble bush	STYSPA	I	22	22	133	45	31	119	1.00	0.23	0.66	0.30	0.89	STYSPA
	Thryptomene decussata		THRDEC	I	2	2	18	1	0	17	1.00	0.00	0.94	0.03	0.94	
	Thryptomene maisonneuvei		THRMAI		1	1	17	2	0	15	1.00	0.00	0.88	0.06	0.88	
	Trianthema triquetra	Red spinach weed	TIATRI		1	1	7	0	8	15	1.00	1.14	1.00	0.36	2.14	
	Tribulus platypterus	Corkwood, corky bark caltrop	TRBPLA	D	2	2	3	2	4	5	1.00	1.33	0.33	0.75	1.67	
						TOTAL	**98,090**	**18,149**	**36,288**	**116,229**				**AVERAGE**	1.41	

Appendix 3

Determination of seasonal quality categories for WARMS monitoring sites used in ACRIS

Background

Monthly SILO gridded rainfall was used as the input data set (see http://www.bom.gov.au/silo/). Rainfall data were extracted for the 0.05 degree grid cell (~5-km by ~5-km) corresponding with the location of each relevant monitoring site.

A single seasonal quality category was assigned to each monitoring site over the period between site assessments. There were three seasonal quality categories – above average, average and below average.

The method detailed below was used in Western Australia to assign a single category to each Western Australian Rangeland Monitoring System (WARMS) site for ACRIS reporting in 2007.

Winter is defined as April to September. Summer is defined as October to March.

For sites assessed in a given year (say 2005), the seasonal quality category of the preceding year (i.e. 2004) is used.

Procedure for shrubland sites – winter rainfall dominated

For WARMS shrubland sites, winter rainfall is considered more important than summer rainfall for determining site dynamics. For each summer/winter pair making up a year, summer rainfall is considered to precede winter rainfall.

Summary

Individual tercile categories for summer and winter rainfall are used to derive a combined score for each year. The combined scores for each year over the interval between site assessments are aggregated to produce a single score for each site over the interval. Tercile categories are derived from this aggregate score to provide seasonal quality categories of above average, average or below average.

Procedure

The following details the procedure used to produce the seasonal quality categories.

Examples in this section will be based on a monitoring site being assessed in 2000 and 2005. That is, with a five year interval between assessments. The seasonal quality score from the five year period ending in 2004 is assigned to this site. The seasonal quality score is made up of;
first year – summer 1999 (99/00), winter 2000
second year – summer 2000 (00/01), winter 2001
third year – summer 2001 (01/02), winter 2002

fourth year – summer 2002 (02/03), winter 2003
fifth year – summer 2003 (03/04) , winter 2004

Wherever terciles are calculated, the following conventions are used.

- tercile 3 is the lowest and tercile 1 is the highest
- the threshold for the third tercile is calculated as PERCENTILE(array,1/3) in Excel
- the threshold for the second tercile is calculated as PERCENTILE(array,2/3) in Excel
- for allocating values to terciles, tercile 3 is <1/3 and tercile 1 is >2/3. This means that, on average, more values will end up in tercile 2 (the middle tercile) than either tercile 3 or 1 as values that = 1/3 or = 2/3 will go into tercile 2. This decision was made to deal with situations where a number of years have the same value, which is equal to the threshold value for that tercile. This does not often happen with rainfall data but does happen with data from scores, especially the aggregated scores, where the number of years of data (~100) is greater than the number of intervals in the range, 40 (i.e. 45 – 5).

Tercile 3 is below average
Tercile 2 is average
Tercile 1 is above average

1. Provide details for each monitoring site, including; name & number, location, year it was last assessed and year it was previously assessed. The interval between assessments (in years) is calculated as the difference between these two years. While the interval used as an example throughout this section is 5 years, it could just as easily be a different number of years and is calculated for each site separately.

2. Produce total summer rainfall for each year by adding the rainfall from October through to the following March. So that summer 2003 is made up of rainfall from October 2003 to March 2004.

3. Calculate tercile cut-offs (mm rainfall) for summer rain.

4. Produce total winter rainfall for each year by adding the rainfall from April to September for that year.

5. Calculate tercile cut-offs (mm rainfall) for winter rain.

6. For each year, a summer tercile value is calculated. So that for 2003, a summer tercile is calculated from October 2003 to March 2004 rainfall.

7. For each year, a winter tercile value is calculated**.**

8. A combined score for each year is determined by using the combination of summer and winter terciles (see Table 3.1)
   The combined score for 2004 uses summer of 03/04 (Oct to Mar) and winter of 2004 (Apr to Sep).
   The combined score ranges from 1 (for a summer tercile 3 followed by a winter tercile 3) to 9 (for a summer tercile 1 followed by a winter tercile 1).

9. An aggregate score is produced by summing the combined score from each year, over the number of years in the interval, say 5 years, 2000 to 2005. The range of scores is therefore from 5 (i.e. 5 x 1) to 45 (i.e. 5 x 9).

10. Calculate tercile cut offs for this aggregate score.

11. Allocate a tercile to the aggregate score for each year**.**

12. The seasonal category for a particular site for a particular year of assessment is taken as the tercile from the aggregate score for the year before the year of assessment. So, for a site assessed in 2005, the tercile category from 2004 is used to determine the seasonal quality category.
    Remember that the tercile category for a given year, say 2004, is actually a tercile category over a number of years (say 5), ending in the year 2004. That is, it can be considered as the years 2000-2004**.**

Table 3.1. Shrubland sites - matrix used to derive a combined score for each year based on winter and summer rainfall.

	Winter tercile 1	Winter tercile 2	Winter tercile 3
Summer tercile 1	9	7	3
Summer tercile 2	8	5	2
Summer tercile 3	6	4	1

Procedure for grassland sites – summer rainfall dominated

For WARMS grassland sites, summer rainfall is considered more important than winter rainfall for determining site dynamics. For each winter/summer pair making up a year, winter rainfall is considered to precede summer rainfall.

Summary

Individual tercile categories for winter and summer rainfall are used to derive a combined score for each year. The combined scores for each year over the interval between site reassessments are aggregated to produce a single score for each site over the interval. Tercile categories are derived from this aggregate score to provide seasonal quality categories of above average, average or below average.

Procedure

The following details the procedure used to produce the seasonal quality categories.

Examples in this section will be based on a monitoring site being assessed in 2002 and 2005. That is, with a three year interval between assessments. The seasonal quality score from the three year period ending in 2004 is assigned to this site. The seasonal quality score is made up of;
first year – winter 2002, summer2002 (02/03)
second year – winter 2003, summer 2003 (03/04)
third year – winter 2004, summer 2004 (04/05)

Wherever terciles are calculated, the following conventions are used.

- tercile 3 is the lowest and tercile 1 is the highest

- the threshold for the third tercile is calculated as PERCENTILE(array,1/3) in Excel
- the threshold for the second tercile is calculated as PERCENTILE(array,2/3) in Excel
- for allocating values to terciles, tercile 3 is <1/3 and tercile 1 is >2/3. This means that, on average, more values will end up in tercile 2 (the middle tercile) than either tercile 3 or 1 as values that = 1/3 or = 2/3 will go into tercile 2. This decision was made to deal with situations where a number of years have the same value, which is equal to the threshold value for that tercile. This does not often happen with rainfall data but does happen with data from scores, especially the aggregated scores, where the number of years of data (~100) is greater than the number of intervals in the range, 24 (i.e. 27-3).

Tercile 3 is below average
Tercile 2 is average
Tercile 1 is above average

1. Provide details for each monitoring site, including; name & number, location, year it was last assessed and year it was previously assessed. The interval between assessments (in years) is calculated as the difference between these two years. While the interval used as an example throughout this section is 3 years, it could just as easily be a different number of years and is calculated for each site separately.

2. Produce total summer rainfall for each year by adding the rainfall from October through to the following March. So that summer 2003 is made up of rainfall from October 2003 to March 2004.

3. Calculate tercile cut-offs (mm rainfall) for summer rain.

4. Produce total winter rainfall for each year by adding the rainfall from April to September for that year.

5. Calculate tercile cut-offs (mm rainfall) for winter rain.

6. For each year, a summer tercile value is calculated. So that for 2003, a summer tercile is calculated from October 2003 to March 2004 rainfall.

7. For each year, a winter tercile value is**.**

8. A combined score for each year is determined by using the combination of summer and winter terciles (Table 3.2)
   The combined score for 2004 uses winter of 2004 (Apr to Sep) and the summer of 04/05 (Oct to Mar).
   The combined score ranges from 1 (for a winter tercile 3 followed by a summer tercile 3) to 9 (for a winter tercile 1 followed by a summer tercile 1).

9. An aggregate score is produced by summing the combined score from each year, over the number of years in the interval, say 3 years, 2002 to 2005. The range of scores is therefore from 3 (i.e. 3 x 1) to 27 (i.e. 3 x 9).

10. Calculate tercile cut offs for this aggregate.

11. Allocate a tercile to the aggregate score for each**.**

12. The seasonal category for a particular site for a particular year of assessment is taken as the tercile from the aggregate score for the year before the year of assessment. So, for a site assessed in 2005, the tercile category from 2004 is used to determine the seasonal quality category.
    Remember that the tercile category for a given year, say 2004, is actually a tercile category over a number of years (say 3), ending in the year 2004. That is, it can be considered as the years 2002-2004**.**

Table 3.2. Grassland sites - matrix used to derive a combined score for each year based on winter and summer rainfall.

	Winter tercile 1	Winter tercile 2	Winter tercile 3
Summer tercile 1	9	8	6
Summer tercile 2	7	5	4
Summer tercile 3	3	2	1

Appendix 4: GIS Analysis of Distance from Water

Percentage Area Analysed

Table 4.1. Percentage of sub IBRA area analysed in reporting distance from water.

Table 8 reports the area of each sub IBRA within the WA rangelands boundary, the area analysed (i.e. within pastoral leasehold land) and the percent of the sub IBRA analysed.

Sub-IBRA No	Sub-IBRA name	Sub-IBRA code	IBRA No	IBRA name	IBRA code	Area analysed (km^2)	Area within WA (km^2)	Percent of sub-IBRA analysed
Kimberley pastoral region								
77	Pentecost	CK1	55	Central Kimberley	CK	36,521	43,972	83.1
78	Hart	CK2	55	Central Kimberley	CK	21,944	23,246	94.4
79	Mount Eliza	CK3	55	Central Kimberley	CK	6,531	9,536	68.5
110	Fitzroy Trough	DL1	58	Dampierland	DL	30,931	34,238	90.3
111	Pindanland	DL2	58	Dampierland	DL	30,593	49,218	62.2
260	Mitchell	NK1	66	Northern Kimberley	NK	16,329	58,978	27.7
261	Berkeley	NK2	66	Northern Kimberley	NK	5,843	24,412	23.9
272	Ord Victoria Plains P1	OVP1	51	Ord Victoria Plain	OVP	16,216	21,643	74.9
273	South Kimberley Interzone	OVP2	51	Ord Victoria Plain	OVP	32,548	33,336	97.6
324	Tanami P1	TAN1	49	Tanami	TAN	18,619	30,161	61.7
335	Victoria Bonaparte P1	VB1	52	Victoria Bonaparte	VB	12,152	18,734	64.9
Pilbara pastoral region								
277	Chichester	PIL1	68	Pilbara	PIL	56,183	83,740	67.1
278	Fortescue	PIL2	68	Pilbara	PIL	16,520	19,514	84.7
279	Hamersley	PIL3	68	Pilbara	PIL	26,601	56,347	47.2
280	Roebourne	PIL4	68	Pilbara	PIL	13,907	18,460	75.3
Southern shrublands								
64	Cape Range	CAR1	54	Carnarvon	CAR	18,236	23,676	77

Sub-IBRA No	Sub-IBRA name	Sub-IBRA code	IBRA No	IBRA name	IBRA code	Area analysed (km^2)	Area within WA (km^2)	Percent of sub-IBRA analysed
65	Wooramel	CAR2	54	Carnarvon	CAR	51,163	60,070	85.2
80	Mardabilla	COO1	56	Coolgardie	COO	1,938	18,430	10.5
81	Southern Cross	COO2	56	Coolgardie	COO	5,669	60,104	9.4
82	Eastern Goldfield	COO3	56	Coolgardie	COO	19,197	50,581	38
149	Ashburton	GAS1	53	Gascoyne	GAS	30,140	36,870	81.8
150	Carnegie	GAS2	53	Gascoyne	GAS	27,118	47,186	57.5
151	Augustus	GAS3	53	Gascoyne	GAS	73,898	96,695	76.4
188	Hampton	HAM	34	Hampton	HAM	3,976	10,414	38.2
231	Eastern Murchison	MUR1	65	Murchison	MUR	165,438	211,350	78.3
232	Western Murchison	MUR2	65	Murchison	MUR	63,509	69,855	90.9
266	Northern band, Carlisle	NUL1	33	Nullarbor	NUL	2,787	50,651	5.5
267	Central band, Nullarbor Plain	NUL2	33	Nullarbor	NUL	46,010	86,709	53.1
161	Edel	YAL1	71	Yalgoo	YAL	8,401	15,588	53.9
406	Tallering	YAL2	71	Yalgoo	YAL	26,279	34,986	75.1
“Non-pastoral” desert								
93	Mann-Musgrave Block	CR1	28	Central Ranges	CR	0	47,015	0
157	Lateritic Plain	GD1	59	Gibson Desert	GD	0	127,148	0
158	Dune Field	GD2	59	Gibson Desert	GD	0	29,141	0
164	McLarty	GSD1	60	Great Sandy Desert	GSD	13,044	123,167	10.6
165	Mackay	GSD2	60	Great Sandy Desert	GSD	304	172,228	0.2
182	Shield	GVD1	32	Great Victoria Desert	GVD	8,656	47,418	18.3
183	Central	GVD2	32	Great Victoria Desert	GVD	2,260	125,908	1.8
184	Eastern, Maralinga	GVD3	32	Great Victoria Desert	GVD	0	38,837	0
194	Rudall	LSD1	63	Little Sandy Desert	LSD	0	9,912	0
195	Trainor	LSD2	63	Little Sandy Desert	LSD	1,746	100,985	1.7

Distance from Water

Table 4.2. Percentage of sub IBRA area within different distance classes from permanent and semi-permanent sources of stock water

Table 9 reports the percentage of pastoral leasehold land per sub-IBRA in each distance from water class. These figures only include land which is pastoral leasehold and within Western Australia. The "analysed %" column gives the percentage of the sub IBRA used in the analysis (i.e. percent of the sub IBRA within the WA pastoral rangelands).

IBRA No	IBRA code	IBRA name	Sub IBRA No	Sub IBRA code	Sub-IBRA name	0 to ≤ 3 km	> 3 to ≤ 6 km	> 6 to ≤ 8 km	> 8 km	Analysed %
Kimberley pastoral region										
55	CK	Central Kimberley	77	CK1	Pentecost	5.5	14.1	8.5	71.9	83.1
55	CK	Central Kimberley	78	CK2	Hart	19.9	37	13.4	29.7	94.4
55	CK	Central Kimberley	79	CK3	Mount Eliza	12.6	26.5	13.2	47.7	68.5
58	DL	Dampierland	110	DL1	Fitzroy Trough	29.4	44.9	12.8	12.9	90.3
58	DL	Dampierland	111	DL2	Pindanland	24.2	35.3	13.6	26.9	62.2
66	NK	Northern Kimberley	260	NK1	Mitchell	3.5	8.1	6.1	82.3	27.7
66	NK	Northern Kimberley	261	NK2	Berkeley	1	2.3	2.2	94.6	23.9
51	OVP	Ord Victoria Plain	272	OVP1	Ord-Victoria Plains P1	13.3	26.7	13.1	46.9	74.9
51	OVP	Ord Victoria Plain	273	OVP2	South Kimberley Interzone	17.5	39.6	15.8	27.1	97.6
49	TAN	Tanami	324	TAN1	Tanami P1	3	10	7.7	79.3	61.7
52	VB	Vic Bonaparte	335	VB1	Victoria Bonaparte P1	9.5	22.6	13.3	54.6	64.9
Pilbara pastoral region										
68	PIL	Pilbara	277	PIL1	Chichester	32	33.9	10.7	23.4	67.1
68	PIL	Pilbara	278	PIL2	Fortescue	31.9	46.4	12.8	8.9	84.7
68	PIL	Pilbara	279	PIL3	Hamersley	25	39.9	12.4	22.7	47.2
68	PIL	Pilbara	280	PIL4	Roebourne	59.2	36.6	3.7	0.6	75.3
Southern shrublands										
54	CAR	Carnarvon	64	CAR1	Cape Range	33.4	46.5	10.2	10	77

IBRA No	IBRA code	IBRA name	Sub IBRA No	Sub IBRA code	Sub-IBRA name	0 to ≤ 3 km	> 3 to ≤ 6 km	> 6 to ≤ 8 km	> 8 km	Analysed %
54	CAR	Carnarvon	65	CAR2	Wooramel	36.1	48.8	8.8	6.3	85.2
56	COO	Coolgardie	80	COO1	Mardabilla	12.9	27.9	16.8	42.4	10.5
56	COO	Coolgardie	81	COO2	Southern Cross	11.3	25	18.8	44.9	9.4
56	COO	Coolgardie	82	COO3	Eastern Goldfield	37	31.4	7.8	23.8	38
53	GAS	Gascoyne	149	GAS1	Ashburton	26.3	43	12.2	18.4	81.8
53	GAS	Gascoyne	150	GAS2	Carnegie	12.8	29.3	15.9	42.1	57.5
53	GAS	Gascoyne	151	GAS3	Augustus	32.5	50	10.3	7.2	76.4
34	HAM	Hampton	188	HAM	Hampton	13.1	29.4	12.9	44.6	38.2
65	MUR	Murchison	231	MUR1	Eastern Murchison	38.3	42.9	7.7	11.1	78.3
65	MUR	Murchison	232	MUR2	Western Murchison	48.6	48.6	2.6	0.3	90.9
33	NUL	Nullarbor	266	NUL1	Northern band Carlisle	11.9	34.1	18	36.1	5.5
33	NUL	Nullarbor	267	NUL2	Central band Nullabor Plain	10.2	25.8	14.7	49.3	53.1
71	YAL	Yalgoo	161	YAL1	Edel	27.6	39.7	13.8	19	53.9
71	YAL	Yalgoo	406	YAL2	Tallering	51	42	3	4.1	75.1
“Non pastoral” desert										
28	CR	Central Ranges	93	CR1	Mann-Musgrave Block	n/a	n/a	n/a	n/a	0
59	GD	Gibson Desert	157	GD1	Lateritic Plain	n/a	n/a	n/a	n/a	0
59	GD	Gibson Desert	158	GD2	Dune Field	n/a	n/a	n/a	n/a	0
60	GSD	Great Sandy Desert	164	GSD1	McLarty	4.7	13.9	11.3	70.2	10.6
60	GSD	Great Sandy Desert	165	GSD2	Mackay	11.7	27.4	15.9	45.1	0.2
32	GVD	Great Victoria Desert	182	GVD1	Shield	12.9	24.4	9.2	53.5	18.3
32	GVD	Great Victoria Desert	183	GVD2	Central	0	1.2	2.1	96.7	1.8
32	GVD	Great Victoria Desert	184	GVD3	Eastern Maralinga	n/a	n/a	n/a	n/a	0
63	LSD	Little Sandy Desert	194	LSD1	Rudall	n/a	n/a	n/a	n/a	0
63	LSD	Little Sandy Desert	195	LSD2	Trainor	8.7	29.8	18.2	43.4	1.7