Offset Assessment
Lot 310 and Lot 300 Neames Road
Mogumber

Prepared for: **Strategen-JBS&G**

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EXECUTIVE SUMMARY

This report has been prepared by Del Botanics on behalf of Strategen-JBS&G to review the remnant Banksia woodland vegetation on Lot 310 and Lot 300 Neames Road, Mogumber and compare to the data previously recorded from Lot 10 & 12 Rowley Rd, Mandogolup. This report is the result of a spring botanical survey of the flora and vegetation within the Banksia woodland areas of the site only. Broad vegetation type and condition mapping was also undertaken across the whole survey area. The location of the survey area is shown on **Figure 1 & 2.**

The recent Flora and Vegetation Assessment undertaken in the area described above identified a number of flora species. The vegetation condition varies across the site ranging from "Completely Degraded" to "Excellent".

Five vegetation communities were recorded at a local level during the survey. No species of Threatened (T), or Priority Flora pursuant to the *Biodiversity Conservation Act* 2016 were located during the time of the survey. One Threatened Ecological Community (TEC) was recorded during the survey.

The Floristic Community Type (FCT) determined the two sites currently consist of Banksia woodlands, the impact site in Mandogalup is confirmed as FCT 28 and the offset site in Mogumber has been identified as SCP S09, which is described as *Banksia attenuata* woodlands over dense low shrublands. The species composition/floristics between the Mandogalup and Mogumber sites are statistically distinct with very little similarity.

STATEMENT OF LIMITATIONS

This environmental report has been prepared in accordance with the scope of services set out in the original quotation. In preparing the report, Del Botanics has relied on data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations, most of which are referred to in the report. Del Botanics has not verified the accuracy or completeness of the data to the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report are based in whole or in part on the data, those conclusions are contingent upon the accuracy and completeness of the data. Del Botanics will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, unavailable, misrepresented or otherwise not fully disclosed.

In accordance with the scope of services, Del Botanics has relied on the data and have conducted environmental field monitoring in the preparation of the report. The nature and extent of monitoring conducted is described in the report. Within the limitations imposed by the scope of services, the monitoring and preparation of this report have been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care. No other warranty, express or implied, is made.

The report has been prepared for the benefit of the Client and for no other party. Del Botanics assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report. Other parties should not rely upon the report or the accuracy or completeness of any conclusions, and should make their own enquiries and obtain independent advice in relation to such matters.

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1. INTRODUCTION

1.1 BACKGROUND

This report has been prepared by Del Botanics on behalf of Strategen-JBS&G to survey remnant Banksia woodland vegetation on Lot 310 and Lot 300 Neames Road, Mogumber and compare to data collected from Lot 10 & 12 Rowley Rd, Mandogolup. A botanical survey of the flora species and vegetation was undertaken on 24th November 2019. The site is approximately 912 ha in size and is situated 127 kilometres north, north east of the Perth central area, in the Shire of Gingin. The site location is shown on **Figure 1 & 2**.

1.2 PURPOSE OF THIS REPORT

This report was prepared primarily to document the Banksia woodland vegetation that occurs within the area described above and to compare this site to Lots 10 & 12 Rowley Rd, Mandogolup to assess the suitability of this site as an Offset.

In summary this report provides:

- A spring botanical survey of the Banksia woodland of the site;
- A broad assessment of vegetation communities and condition;
- Observations of suitability of Black Cockatoo habitat within the site; and
- A statistical comparison of data from both sites described above.

2. EXISTING ENVIRONMENT

2.1 SOILS AND GEOLOGY

The site occurs on the Swan Coastal Plain – Dandaragan Plateau subregion (SWA1). The plateau is bordered by the Derby and Dandaragan Faults. It exists of Cretaceous marine sediments mantled by sands and laterites. The site is characterised by Banksia low woodland, Jarrah - Marri woodland, Marri woodland, and by scrub-heaths on laterite pavement and on gravelly sandplains.

The Dandaragan Plateau represents a wedge shaped raised section of the sedimentary rocks of the Swan Coastal Plain. This plateau lies between the Darling Scarp to the east and the Gingin Scarp to the west, and rises from 130m above sea level in the south near Bullsbrook to 230m above sea level in the north near Moore River. The plateau is generally sand and laterite plain that overlies flat-lying cretaceous rocks.

2.2 CLIMATE

The Survey Area is located on the Swan Coastal Plain, in a region with a Mediterranean climate of cool, wet winters and warm to hot, dry summers.

The nearest weather station with a complete set of data to the site is located in Walebing (approximately 40km north east of the Survey Area). The long term average annual rainfall in Walebing is 475.4mm. Rain is frequent and heaviest through the winter months. The average maximum temperature is 24.9^{o}c, the average minimum temperature is 10.8 ^{o}c.

In the 12 months prior to this survey (November 2018 – October 2019) Walebing weather station recorded 259.8mm of rain, 215.6mm lower than the long term average annual rainfall.

3. FLORA AND VEGETATION

The survey area lies in the Drummond Botanical Subdistrict within the Southwest Botanical Province as described by Beard (1990). Four vegetation types mapped by Beard cover the Survey Area. These are a part of the Dandaragan Plateau, 949 - Low Banksia woodland; 1015 – Mosaic of mixed scrub/heath/shrublands and Dryandra thickets; 1017 - medium open Jarrah and Marri woodland over a low woodland of *Banksia* species and 37 – Shrublands and Teatree thicket.

The Dandaragan Plateau is largely covered by open forest of Jarrah, Marri, Tuart, Blackbutt and Flooded Gum with some Wandoo in the north near to the Moore River. The secondary storey of vegetation consists of varieties of *Banksia*, Prickly Bark and Sheoak. Towards the north-eastern part of the plateau, the Eucalyptus forests largely disappear, except in the low lying valleys adjacent to the Moore River.

Two vegetation complexes are mapped as occurring within the Survey Area:

3.1.1 Cullula Complex

This vegetation is described as a mixture of low open forest of *Banksia* species - *Eucalyptus todtiana* (Pricklybark) and open woodland of *Corymbia calophylla* (Marri) with second storey of *Eucalyptus todtiana* (Pricklybark) – *Banksia attenuata (*Candlestick Banksia*)* - *Banksia menziesii* (Firewood Banksia) - *Banksia ilicifolia* (Holly-leaved Banksia) (Heddle *et al*, 1980).

3.1.2 Mogumber Complex North

This vegetation is described as an open to closed heath of *Banksia* species and *Allocasuarina humilis* (Dwarf Sheoak) (Heddle *et al*, 1980).

3.2 VEGETATION METHODS

A botanical survey was undertaken on the 24th November 2019. The site was surveyed to map broad vegetation communities and record vegetation condition. A detailed survey was undertaken in the Banksia woodland areas of the site only. This vegetation type was recorded with five 10 metre by 10 metre quadrats. Data was recorded to statistically determine the vegetation community and its condition. Each quadrat recorded flora species, heights, percentage cover and percentage dead and alive. Quadrats were not assembled permanently; quadrat data is available in **Appendix B.**

Although a targeted search for conservation significant flora including Threatened (T) and Priority Flora (P) was not undertaken, flora was sampled opportunistically during the survey as the site was traversed and during quadrat sampling.

The survey methodology was undertaken in accordance with EPA Position Statement No.3: *Terrestrial Biological Surveys as an Element of Biodiversity Protection* and Technical Guidance – *Flora and Vegetation Surveys for Environmental Impact Assessment* (Environmental Protection Authority, 2016).

All plant specimens collected during the field survey were dried, pressed and then sorted in accordance with the requirements of the Western Australian State Herbarium. Identification of specimens occurred through comparison with named material and through the use of taxonomic keys.

The use of standard data collection forms ensured the data was collected in a systematic and consistent manner. At each quadrat the following information was recorded:

- Vegetation condition;
- Vegetation community;
- Flora species;
- Local disturbances;
- Topography;
- Soils; and
- Age since fire.

The vegetation communities occurring across the rest of the site were described broadly. Aerial photography was used to extrapolate and map plant communities in combination with running notes made during the course of the survey.

3.3 DECLARED RARE AND PRIORITY FLORA

Species of Flora acquire "Threatened" "Presumed Extinct" or "Priority" conservation status where populations are restricted geographically or threatened by local processes. The Department of Biodiversity, Conservation and Attractions (DBCA) recognise these threats and subsequently applies regulations towards population protection and species conservation. The DBCA enforces regulations under the *Biodiversity Conservation* (BC) *Act* 2016 to conserve Threatened species and protect significant populations. Priority Flora species are potentially rare or threatened and are classified in order of threat. Threatened and Priority Flora category definitions are listed in **Table 1**.

Table 1: Definition of Rare and Priority Flora Species *Biodiversity Conservation Act* 2016.

Conservation Code	Category
T	Threatened species Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the Biodiversity Conservation Act 2016 (BC Act). Threatened flora is that subset of 'Rare Flora' listed under schedules 1 to 3 of the Wildlife Conservation (Rare Flora) Notice 2018 for Threatened Flora. The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below. **CR Critically endangered species** Threatened species considered to be "facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for critically endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for critically endangered flora. **EN Endangered species** Threatened species considered to be "facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for endangered flora. **VU Vulnerable species** Threatened species considered to be "facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for vulnerable fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for vulnerable flora.
X	**Extinct species** Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild. EX Extinct species Species where "there is no reasonable doubt that the last member of the species has died", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act). Published as presumed extinct under schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for extinct fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for extinct flora. **EW** Extinct in the wild species Species that "is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act). Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.
P1	**Priority 1: Poorly-known species** Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
P2	**Priority 2: Poorly-known species** Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey

P3	**Priority 3: Poorly-known species** Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
P4	**Priority 4: Rare**, **Near Threatened and other species in need of monitoring** (a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

A search of the Department of Biodiversity, Conservation and Attractions (DBCA) NatureMap database identified 21 Threatened (T), five Priority 1 (P1), 11 Priority 2 (P2), 40 Priority 3 (P3) and 26 Priority 4 (P4) species, likely to occur within a 20km radius of the Survey Area. These species are listed in **Table 2** below.

Determination of the likelihood of these species to occur was only considered in the Banksia woodland vegetation within the Survey Area and was based purely on available habitat information for each species.

Table 2: NatureMap listed species

Species Name	Conservation Code		Likely to occur onsite	Survey undertaken in flowering time
	BC Act	EPBC Act		
Acacia splendens	T	En	No	No
Andersonia gracilis	T	En	No	Yes
Banksia fuscobractea	T	En	Yes	No
Banksia mimica	T	En	Yes	No
Banksia serratuloides subsp. *serratuloides*	T	Vn	No	No
Conospermum densiflorum subsp. *unicephalatum*	T	En	No	Yes
Conostylis wonganensis	T	En	No	No
Darwinia acerosa	T	En	Yes	Yes
Darwinia carnea	T	En	No	No
Eleocharis keigheryi	T	Vu	No	Yes
Eremophila glabra subsp. *chlorella*	T	En	No	Yes
Eucalyptus pruiniramis	T	En	No	No
Glyceria drummondii	T	En	No	No
Goodenia arthrotricha	T	En	No	Yes
Grevillea bracteosa subsp. *bracteosa*	T	CE	Yes	No
Grevillea sp. Gillingarra	T	CE	unknown	unknown
Lepidosperma rostratum	T	En	No	unknown
Spirogardnera rubescens	T	En	No	Yes
Stylidium semaphorum	T	CE	No	No
Thomasia sp. Green Hill	T	En	No	No
Trithuria occidentalis	T	En	No	No
Baeckea sp. Youndegin Hill	P1	-	No	No
Drosera orbiculata	P1	-	No	No
Stylidium vinosum	P1	-	unknown	unknown
Synaphea panhesya	P1	-	No	No
Tetratheca plumosa	P1	-	unknown	unknown
Acacia browniana var *glaucescens*	P2	-	No	No
Calectasia elegans	P2	-	unknown	unknown
Dampiera spicigera	P2	-	Yes	Yes
Desmocladus myriocladus	P2	-	Yes	Yes
Goodenia xanthotricha	P2	-	Yes	Yes
Hibbertia glomerata subsp. *ginginensis*	P2	-	Yes	No
Lepyrodia curvescens	P2	-	No	Yes
Stylidium glabrifolium	P2	-	No	Yes
Synaphea sparsiflora	P2	-	No	No
Tetraria sp. Chandala	P2	-	unknown	unknown
Tetratheca hirsuta subsp. *boonanarring*	P2	-	unknown	unknown
Banksia dallanneyi subsp. *pollosta*	P3	-	Yes	No
Lasiopetalum venustum	P3	-	unknown	unknown
Acacia anarthros	P3	-	No	No
Acacia cummingiana	P3	-	Yes	No
Acacia drummondii subsp. affinis	P3	-	No	No
Acacia latipes subsp. *latipes*	P3		Yes	No
Acacia oncinophylla subsp. *oncinophylla*	P3	-	No	No
Acacia pulchella var *reflexa acuminate bracteole variant*	P3	-	Yes	No
Acacia ridleyana	P3	-	Yes	No
Allocasuarina grevilleoides	P3	-	No	unknown
Allocasuarina ramosissima	P3	-	No	unknown
Banksia kippistiana var. paenepeccata	P3	-	No	Yes
Banksia pteridifolia subsp. *vernalis*	P3	-	Yes	No
Beaufortia eriocephala	P3	-	No	Yes
Chamaescilla corymbosa var. corymbosa	P3	-	Yes	Yes

Chamelaucium sp. Wongan Hills	P3	-	unknown	unknown
Comesperma rhadinocarpum	P3	-	Yes	Yes
Conospermum scaposum	P3	-	Yes	Yes
Desmocladus biformis	P3	-	Yes	No
Dielsiodoxa leucantha subsp. *leucantha*	P3	-	unknown	unknown
Dillwynia dillwynioides	P3	-	No	Yes
Eucalyptus macrocarpa x pyriformis	P3	-	Yes	No
Grevillea florida	P3	-	Yes	No
Guichenotia impudica	P3	-	No	No
Guichenotia tuberculata	P3	-	No	No
Haemodorum loratum	P3	-	Yes	Yes
Isopogon drummondii	P3	-	unknown	No
Lasiopetalum caroliae	P3	-	unknown	No
Leucopogon allittii	P3	-	No	No
Melaleuca sclerophylla	P3	-	No	No
Persoonia rudis	P3	-	Yes	Yes
Petrophile biternata	P3	-	Yes	No
Petrophile plumosa	P3	-	No	Yes
Schoenus benthamii	P3	-	No	Yes
Schoenus capillifolius	P3	-	No	Yes
Stylidium nonscandens	P3	-	Yes	Yes
Stylidium sacculatum	P3	-	Yes	Yes
Styphelia filifolia	P3	-	unknown	unknown
Verticordia huegelii var. *tridens*	P3	-	No	Yes
Verticordia muelleriana subsp. *muelleriana*	P3	-	Yes	Yes
Acacia alata var *platyptera*	P4	-	No	No
Anigozanthos humilis subsp. *chrysanthus*	P4	-	Yes	No
Asterolasia grandiflora	P4	-	No	No
Banksia chamaephyton	P4	-	Yes	Yes
Boronia tenuis	P4	-	No	Yes
Caladenia speciosa	P4	-	Yes	No
Calothamnus pachystachyus	P4	-	No	No
Conostylis pauciflora subsp. *euryrhipis*	P4	-	Yes	No
Eucalyptus macrocarpa subsp. *elachantha*	P4	-	No	Yes
Grevillea drummondii	P4	-	No	No
Grevillea saccata	P4	-	No	Yes
Hibbertia miniata	P4	-	No	Yes
Hydrocotyle lemnoides	P4	-	No	No
Hypolaena robusta	P4	-	Yes	No
Lepidobolus densus	P4	-	No	unknown
Ornduffia submersa	P4	-	No	unknown
Persoonia sulcata	P4	-	No	Yes
Regelia megacephala	P4	-	No	Yes
Schoenus griffinianus	P4	-	Yes	No
Schoenus natans	P4	-	No	No
Stylidium longitubum	P4	-	No	Yes
Synaphea grandis	P4	-	No	Yes
Thelymitra apiculata	P4	-	Yes	No
Thysanotus glaucus	P4	-	unknown	unknown
Verticordia lindleyi subsp. *lindleyi*	P4	-	No	Yes
Verticordia paludosa	P4	-	No	No

3.3.1 Environment Protection and Biodiversity Conservation Act (1999) – Species level significance

The *Environment Protection and Biodiversity Conservation* (EPBC) *Act*, 1999, promotes the conservation of biodiversity by providing strong protection for plants at a species level. Section 178 and 179 provides the lists and categories of threatened species under the Act and is presented in **Table 3** below.

Table 3: Categories of Threatened Species (EPBC Act, Section 179, 1999)

1	**Extinct (E)** A native species is eligible to be included in the extinct category at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
2	**Extinct in the Wild (EW)** A native species is eligible to be included in the **extinct in the wild** category at a particular time if, at that time:(a) it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or (b) it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
3	**Critically Endangered (CE)** A native species is eligible to be included in the critically endangered category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
4	**Endangered (En)** A native species is eligible to be included in the endangered category at a particular time if, at that time: (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
5	**Vulnerable (V)** A native species is eligible to be included in the vulnerable category at a particular time if, at that time: (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria..
6	**Conservation Dependant** A native species is eligible to be included in the conservation dependent category at a particular time if, at that time: (a) the species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or (b) the following subparagraphs are satisfied: (i) the species is a species of fish; (ii) the species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised; (iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory; (iv) cessation of the plan of management would adversely affect the conservation status of the species.

A search using the Department Environment and Energy (DEE) Protected Matters Tool was undertaken within a 5km radius of the site. The search result noted eighteen flora species of significance likely to occur in the area. Sixteen flora species have been listed as Endangered; two species are listed as Vulnerable. These species are listed in **Table 4** below.

Table 4: Protected Matters listed flora species

Species Name	Conservation Code	Likely to occur onsite	Survey undertaken in flowering time
Andersonia gracilis	Endangered	No	Yes
Banksia mimica	Endangered	Yes	No
Banksia serratuloides subsp. *serratuloides*	Vulnerable	No	No
Conospermum densiflorum subsp. *unicephalatum*	Endangered	No	Yes
Darwinia carnea	Endangered	No	Yes
Diplolaena andrewsii	Endangered	No	No
Eleocharis keigheryi	Vulnerable	No	Yes
Eremophila glabra subsp. *chlorella*	Endangered	No	Yes
Eremophila scaberula	Endangered	No	No
Eucalyptus absita	Endangered	No	No
Eucalyptus leprophloia	Endangered	No	No
Eucalyptus x balanites	Endangered	No	No
Grevillea curviloba subsp. incurva	Endangered	No	No
Hemiandra gardneri	Endangered	Yes	No
Melaleuca sciotostyla	Endangered	No	No
Spirogardnera rubescens	Endangered	No	Yes
Thelymitra dedmaniarum	Endangered	No	Yes
Thelymitra stellata	Endangered	Yes	Yes

3.4 THREATENED ECOLOGICAL COMMUNITIES

In Western Australia Threatened Ecological Communities (TEC's) are assessed through a procedure coordinated by the DBCA and are assigned to one of the categories outlined below in **Table 5**. While they are not afforded direct statutory protection at a State level (unlike Threatened Flora under the *Biodiversity Conservation Act* 2016) their significance is acknowledged through other State environmental approval processes (i.e. Environmental Impact Assessment pursuant to Part IV of the *Environmental Protection Act* 1986). Scheduled TEC's are afforded statutory protection at a Federal level pursuant to the EPBC Act. The department has been identifying and listing threatened ecological communities since 1994 through the non-statutory process.

The Minister for Environment previously listed ecological communities as threatened through a non-statutory process if the community was presumed to be totally destroyed or at risk of becoming totally destroyed. The *Biodiversity Conservation* (BC) *Act*, 2016 provides for the statutory listing of threatened ecological communities (TECs) by the Minister. The new legislation also describes statutory processes for preparing recovery plans for TECs, the registration of their critical habitat, and penalties for unauthorised modification of TECs.

The department has been identifying and listing TECs since 1994 through the non-statutory process. The WA Minister for Environment has endorsed 69 ecological communities as threatened in the following categories:

- 20 critically endangered

- 17 endangered
- 28 vulnerable
- 4 presumed totally destroyed.

25 of these are listed under the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999*. As at January 2019, an additional 393 ecological communities (community types and sub-types) with insufficient information available to be considered a TEC, or which are rare but not currently threatened, have been placed on the Priority list and referred to as priority ecological communities (PECs)**.**

Table 5: Categories of DBCA's Threatened Ecological Communities

PD	**Presumably Totally Destroyed** An ecological community that has been adequately searched for but for which no representative occurrences have been located.
CE	**Critically Endangered** An ecological community that has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future.
E	**Endangered** An ecological community that has been adequately surveyed and is not critically endangered but is facing a very high risk of total destruction in the near future.
V	**Vulnerable** An ecological community that has been adequately surveyed and is not critically endangered or endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future.

The EPBC Act provides for the strong protection of TEC's, which are listed under section 181 of the Act and are described as 'Critically Endangered', 'Endangered' or 'Vulnerable' under section 182. Schedules of protected TECs maintained pursuant to the EPBC Act are based on the same Floristic Community Type's (FCT's) as adopted by DBCA, however not all TEC's listed by the DBCA are scheduled under the EPBC Act.

A Department Environment and Energy (DEE) Protected Matters Report indicated there are two known Threatened Ecological Communities (TEC's) likely to occur within a 5km radius of the area, these are listed in **Table 6** below. During the site assessment one TEC, the Endangered *Banksia woodlands of the Swan Coastal Plain ecological community* has been identified as occurring onsite. The dominant species, the condition of the vegetation and the size of the area currently fit the criteria of this area being classified as Banksia woodlands of the Swan Coastal Plain ecological community. This is discussed further in **Section 3.5**. The location of this TEC is shown in the vegetation community mapping displayed as **Figure 3**.

Table 6: Protected Matters listed Threatened Ecological Communities

Species Name	Conservation Code		Likely to occur on site
	BC Act	EPBC Act	
Banksia woodlands of the Swan Coastal Plain ecological community	Endangered	Endangered	Yes
Clay pans of the Swan Coastal Plain	Critically Endangered	Critically Endangered	No

3.5 BANKSIA WOODLAND CRITERIA

The determination of the presence of the Endangered Banksia woodlands of the Swan Coastal Plain ecological community occurring within the site meets the following criteria:

3.5.1 Location and physical environment

The Banksia woodlands ecological community primarily occurs in the Swan Coastal Plain IBRA bioregion, which this site is situated within.

3.5.2 Soils and landform

The Banksia woodlands ecological community typically occurs on well drained, low nutrient soils on sandplain landforms, particularly deep Bassendean and Spearwood sands and occasionally on Quindalup sands. The site is characterised by well drained sandy soils.

3.5.3 Structure and Composition

The structure of the ecological community is low woodland to forest with these features:

- A distinctive upper sclerophyllous layer of low trees (occasionally large shrubs more than 2 m tall), typically dominated or co dominated by one or more of these diagnostic *Banksia* species;
    - *Banksia attenuata* (Candlestick Banksia)
    - *Banksia menziesii* (Firewood Banksia)
    - *Banksia prionotes* (Acorn Banksia); and/or
    - *Banksia ilicifolia* (Holly-leaved Banksia)

The areas of the survey area mapped as Banksia woodland are dominated by *Banksia attenuata* (Candlestick Banksia), and commonly includes *Banksia menziesii* (Firewood Banksia), *Banksia prionotes* (Acorn Banksia) and occasionally includes *Banksia ilicifolia* (Holly-leaved Banksia).

- Emergent trees of medium or tall (>10 m) height *Eucalyptus* or *Allocasuarina* species may sometimes be present above the *Banksia* canopy. During the survey emergent *Eucalyptus todtiana* (Pricklybark) was recorded.
- A often highly species-rich understorey that consists of:

- a layer of sclerophyllous shrubs of various heights; and,
- a herbaceous ground layer of cord rushes, sedges and perennial and ephemeral forbs, that sometimes includes grasses. The development of a ground layer may vary depending on the density of the shrub layer and disturbance history.

Key species of this community type recorded in the sclerophyllous shrub layer include; *Adenanthos cygnorum* (Woolly Bush), *Allocasuarina humilis* (Dwarf Sheoak), *Bossiaea eriocarpa* (Common Brown Pea), *Conostephium pendulum* (Pearl Flower), *Daviesia* spp., *Eremaea pauciflora*, *Gompholobium tomentosum* (Hairy Yellow Pea), *Jacksonia* spp., *Petrophile linearis* (Pixie Mops) and *Stirlingia latifolia* (Blueboy).

Key species of this community type recorded in the herbaceous ground layer include; *Amphipogon turbinatus* (Tufted Beard Grass), *Lyginia barbata* (Southern Rush), *Lyginia imberbis*, *Mesomelaena pseudostygia* (Semaphore Sedge), *Patersonia occidentalis* (Purple Flag) and *Xanthosia huegelii* (Heath Xanthosia).

3.5.4 Condition

To be considered as part of the ecological community for EPBC Act referral, assessment and compliance purposes, a patch should meet at least the Good Condition category and a minimum patch size. The Banksia woodland recorded on this site meets the size and condition criteria as it is greater than 2ha and is in Very Good to Excellent vegetation condition.

3.5.5 Summary of threats

The main ongoing threats to the Banksia dominated woodlands ecological community are:
The greatest threat is clearing and fragmentation. This includes:

- clearing for urban developments, especially in the Perth metropolitan region but also in the urban centres of Bunbury and Busselton;
- associated urban degradation/disturbance such as rubbish dumping, uncontrolled vehicle access, wildflower and seed harvesting;
- clearing for agriculture and horticulture (mainly in the past); and
- mining for basic raw materials (e.g. road/building materials), mineral sands and silica sands, that involve vegetation clearing and hydrological impacts.

- Dieback diseases (especially those caused by *Phytophthora* species).
- Invasive species.
- Fire regime change (particularly increased fire frequency; prescribed burning during late autumn to late spring when plants are in active growth, flowering and seed development and animals are active).

- Hydrological degradation (groundwater abstraction, eutrophication, soil acidification).
- Climate change (increasing temperatures, declining rainfall, changing rainfall timing).
- Grazing (including overabundance of kangaroos particularly in peri-urban reserves).
- Decline in pollinating and seed dispersing fauna.

3.6 FLORISTIC COMMUNITY TYPES

A key aim of this survey was to gather data which could be compared to that of the previously mentioned Mandogalup site. The floristic community type of the Mandogalup site is FCT 28 (Strategen, 2017). This community is described as *Banksia attenuata* woodlands, *Corymbia calophylla* - *B. attenuata* woodlands or *Eucalyptus marginata* - *B. attenuata* woodlands. It has been recorded from between Thompson's Lake and as far north as Seabird. Species richness averages 55.2 species per plot and average weed frequency is high at 8 species per plot (Strategen, 2017).

FCT 28 is not listed as a TEC under the *Biodiversity Conservation Act 2016* (BC Act) or as a PEC by DBCA, but forms part of the Banksia woodlands of the Swan Coastal Plain ecological community, listed as Endangered under the EPBC Act (Strategen, 2017).

3.6.1 Comparison methodology

The data from the Mandogalup site was compared to the data collected during this survey statistically. Data analysis was carried out for flora quadrat data utilising PATN™ software (Belbin 1995). It involved multivariate cluster analysis of species presence/absence. The data was used to statistically determine the similarity of the species composition and diversity of the two sites.

3.7 BLACK COCKATOO HABITAT ASSESSMENT METHODOLOGY

An informal assessment of the value of the Survey Area as Black Cockatoo Habitat was undertaken. No potential breeding trees were specifically recorded during this assessment. Observations and running notes were made during the survey. The site was opportunistically surveyed for signs of foraging and roosting.

4. VEGETATION ASSESSMENT RESULTS

A total of 56 taxa, comprising of 21 families and 44 genera were recorded on site. A list of these species has been provided in **Appendix A**. Species representation was greatest among the Proteaceae (13 species) and Myrtaceae (8 species) families.

4.1 INTRODUCED SPECIES

Five introduced flora species were recorded on the site. Four of these species were from the Asteraceae family. Introduced species represent 8.9% of the total number of flora species recorded on site.

4.2 THREATENED AND PRIORITY FLORA

No species of Threatened (T) or Priority Flora were recorded during the survey; No other flora, pursuant to subsection 2 of section 23F of the *Wildlife Conservation Act* 1950 and listed by the Department of Biodiversity, Conservation and Attractions (DBCA) were located during the time of the survey. The botanical survey was undertaken in spring to coincide with the majority of the flowering times of the threatened species.

4.3 EPBC LISTED SPECIES AND THREATENED ECOLOGICAL COMMUNITIES

One TEC *Banksia woodlands of the Swan Coastal Plain ecological community* has been identified as occurring onsite. The dominant species, the condition of the vegetation and the size of the area currently fit the criteria of this area being classified as Banksia woodlands of the Swan Coastal Plain ecological community. The location of this community is mapped as Banksia woodland in **Figure 3**.

4.4 LOCAL VEGETATION COMMUNITIES

Only the Banksia woodland areas were sampled in detail as part of this survey. Other vegetation types were observed and broadly mapped according to dominant species observed. All vegetation communities are shown in **Figure 3.**

Vegetation structure classes were used to determine the Banksia woodland vegetation community recorded. Definitions of the vegetation structure classes are shown in **Table 7** below. They are the ones defined and used in Bush Forever (2000, Volume 2, Table 11 and p. 493) to describe vegetation in Bush Forever sites.

Table 7: Vegetation Structure Classes

Life Form/ Height Class	Canopy Cover (percentage)			
	100% - 70%	**70% - 30%**	**30% - 10%**	**10% - 2%**
Trees 10-30m Trees < 10m	Closed Forest Low Closed Forest	Open Forest Low Open Forest	Woodland Low Woodland	Open Woodland Low Open Woodland
Shrub Mallee	Closed Shrub Mallee	Shrub Mallee	Open Shrub Mallee	Very Open Shrub Mallee
Shrubs > 2m Shrubs 1-2m Shrubs <1m	Closed Tall Scrub Closed Heath Closed Low Heath	Tall Open Scrub Open Heath Open Low Heath	Tall Shrubland Shrubland Low Shrubland	Tall Open Shrubland Open Shrubland Low Open Shrubland
Grasses	Closed Grassland	Grassland	Open Grassland	Very Open Grassland
Herbs	Closed Herbland	Herbland	Open Herbland	Very Open Herbland
Sedges	Closed Sedgeland	Sedgeland	Open Sedgeland	Very Open Sedgeland

Five vegetation communities were recorded at a local level during the survey; these have been described below in **Table 8.** Vegetation communities, condition and quadrat locations are shown on **Figure 3 and 4.**

Table 8: Local Vegetation Communities Recorded at Neames Rd Mogumber, November 2019

Community Descriptions
Vegetation Community 1 – Banksia woodland
Low woodland of *Banksia attenuata* and *Banksia menziesii* over shrubland of *Adenanthos cygnorum*, *Eremaea pauciflora, Beaufortia elegans* and *Verticordia densiflora* over sedgeland of *Desmocladus asper* and *Lyginea imberbis*
Vegetation Community 2 - Wetland
Wetland vegetation including *Melaleuca* spp. and *Regelia* sp.
Vegetation Community 3 – *Eucalyptus todtiana* woodland
Very open woodland of *Eucalyptus todtiana* over mixed shrubland
Vegetation Community 4 – *Banksia prionotes* woodland
Dense stands of *Banksia prionotes* with very little understorey

Vegetation Community 5 – Open Heath
Open heath dominated by *Regelia* spp

4.5 VEGETATION CONDITION

Many bushland remnants have been historically and/or subject to ongoing degradation and are especially susceptible to disturbances arising as a result of indirect impacts from surrounding developments and human activity. Degradation is caused by a wide range of factors, including isolation and edge effects, weed invasion, plant diseases, changes in fire frequency and behaviour, landscape fragmentation, increased predation on native fauna by feral animals, resulting in a decrease in species richness and general modification of ecological function. These issues can affect the biodiversity rating and ecological viability of areas of remnant vegetation and should be assessed in line with conservation values.

The vegetation condition was rated according to the Vegetation Condition Scale commonly used in the Perth Metropolitan Region (Government of WA 2000). The definitions are described in **Table 9** below.

Table 9: Vegetation Condition Scale (Technical Guidance Statement, 2016)

Vegetation Condition	Definition
Pristine (1)	Pristine or nearly so, no obvious signs of disturbance.
Excellent (2)	Vegetation structure intact, disturbance affecting individual species and weeds are nonaggressive species.
Very Good (3)	Vegetation structure altered, obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing
Good (4)	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Degraded (5)	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely Degraded (6)	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

The vegetation condition of the Survey Area ranged varied from "Completely Degraded" to "Excellent" with the majority of the site recorded as being in Excellent condition. Vegetation condition mapping is provided on **Figure 4.**

4.6 FLORISTIC COMMUNITY TYPES

Data analysis was carried out for flora quadrat data utilising PATN™ software (Belbin 1995). It involved multivariate cluster analysis of species presence/absence data. Data was first prepared for analysis including the grouping of some taxa to minimise or exclude ambiguity. For example, removing infra-specific epithets and using only the specific epithet, and removing all species identified to genus only. Replicates of data were also produced that excluded weeds, annuals and singletons (Focused Vision, 2019). Dendrograms are provided in **Appendix C.**

An association matrix of Bray-Curtis dissimilarity coefficients was generated from the presence and absence site by species matrix using the software. The resultant Bray-Curtis matrices were analysed for similarity (from dissimilarity) and the dendrograms were analysed to identify clusters, where statistically significant similarities in species composition exist. Comparisons were made in the analysis in accordance with the scenarios listed below:

- Between the sites including weeds and annuals;
- Between the sites excluding weeds and annuals;
- Between both sites and the consolidated Gibson *et. al* (1994) and Keighery (2012) floristic datasets, including weeds, annuals and singletons (species recorded only once at each site); and
- Between both sites and the consolidated Gibson *et. al* (1994) and Keighery (2012) floristic datasets, excluding weeds, annuals and singletons.

The results show that the species composition/floristics between the Mandogalup and Mogumber sites are statistically distinct and very little similarity is evident. The greatest similarity is between Quadrat 1 at Mogumber and site RR04 at Mandogalup, with 28% similarity. The similarity of Quadrat 4 with other sites in the same location at Mogumber is also low (Focused Vision, 2019). The species richness comparison between the two sites is shown below in **Table 10**

Table 10: Species Richness comparison between Mogumber and Mandogalup

Area/FCT	Number of Quadrats	**Species richness/quadrat**		
		All recorded species (annuals, perennials and species excluded from PATN analysis)	Native sp. (including annuals and perennials but removed species excluded from PATN analysis)	Native sp. (including perennials only and removed species excluded from PATN analysis)
Mogumber	5	24.8	21.4	21.4
Mandogalup	4	41.75	32.5	30.5

FCT 28	38	55.21	45.47	38.74
FCT S09	34	39.53	38.79	38.68

Quadrat data from the Mandogalup ('RR') and Mogumber ('Quadrat #') sites were analysed against data for Banksia woodland sites from regional datasets from Gibson *et. al* (1994) and Keighery (2012) studies, which have aimed to define floristic community types (FCTs) across the Swan Coastal Plain. Following an initial analysis, which resulted in clusters close to sites for FCTs S09, 28 and 23c, further analyses were then carried out with site data from only those FCTs (Focused Vision, 2019).

The analysis has determined the following key results:

- The species composition/floristics between the Mandogalup and Mogumber sites are statistically distinct with very little similarity.
- The Mandogalup sites show closest affinity to regional data from sites characterised as FCT 28
- The Mogumber sites show closest affinity to regional data from sites characterised as SCP S09.
- Species richness across all sites was relatively low and this may be the reason for relatively poor cohesion in the dendrograms.

The Mandogalup site is confirmed as FCT 28, which is not listed as a TEC under the *Biodiversity Conservation Act 2016* or as a PEC by DBCA, but forms part of the Banksia woodlands of the Swan Coastal Plain, listed as Endangered under the EPBC Act (Strategen, 2017). FCT 28 is described as Spearwood *Banksia attenuata* or *Banksia attenuata* - Eucalyptus woodlands.

The Mogumber site is confirmed as SCP S09 which is not listed as a TEC under the *Biodiversity Conservation Act 2016* or as a PEC by DBCA, but forms part of the Banksia woodlands of the Swan Coastal Plain, ecological community listed as Endangered under the EPBC Act. SCP S09 is described as *Banksia attenuata* woodlands over dense low shrublands.

4.7 BLACK COCKATOO HABITAT ASSESSMENT

During the informal assessment of the value of the Survey Area as Black Cockatoo Habitat, no signs of roosting were recorded. Although 360 ha of the site was mapped as Banksia woodland in very good to excellent condition, which is known to be key forage habitat for Black Cockatoo species, particularly Carnaby's Cockatoo, no signs of foraging were recorded during the survey. No sightings of Black Cockatoos were made during the survey.

5. CONCLUSIONS AND RECOMMENDATIONS

The recent Flora and Vegetation Assessment of the Banksia woodland components of Lot 310 and Lot 300 Neames Road, Mogumber, identified a number of flora species. The vegetation condition varies across the site ranging from "Completely Degraded" to "Excellent".

Five vegetation types were recorded at a local level during the survey. No species of Threatened (T), or Priority Flora pursuant to The *Biodiversity and Conservation Act* 2016 were located during the time of the survey. One Threatened Ecological Community (TEC) was located during the survey, approximately 360 ha of the Endangered *Banksia woodlands of the Swan Coastal Plain ecological community* was recorded within the Survey Area.

This vegetation type was statistically compared to the quadrat data for FCT 28 which was recorded in the Mandogalup Survey Area. SCP S09 was inferred for the Mogumber site. The data from each site was also compared to determine species similarity of the two sites; the sites have a low similarity index, with the highest similarity index being 28%.

The Survey Area includes 360 ha of Black Cockatoo forage habitat. No evidence of foraging was recorded during the survey.

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FIGURES

FIGURE 1: LOCATION MAP

FIGURE 2: PROJECT AREA

FIGURE 3: VEGETATION COMMUNITIES

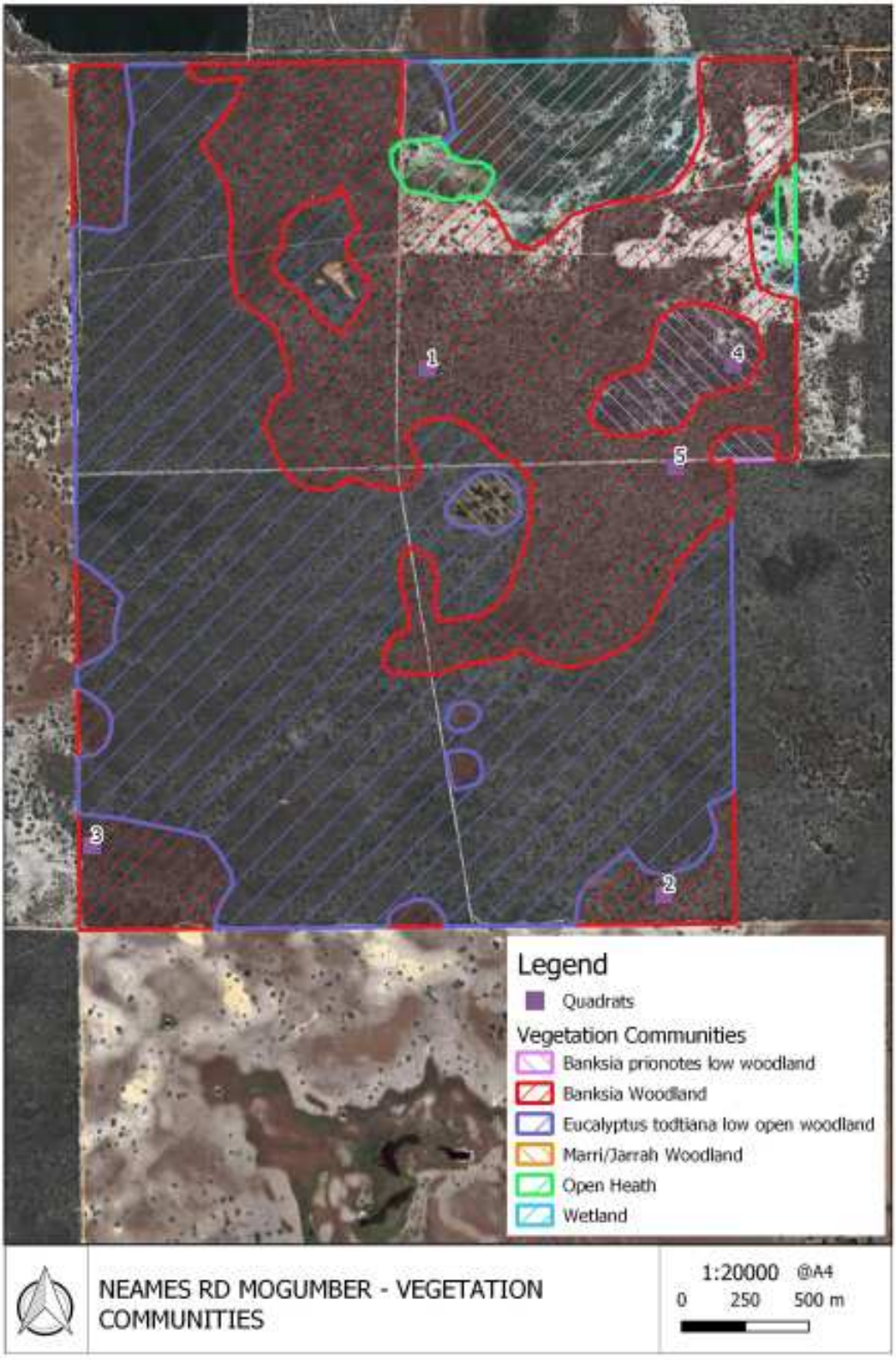
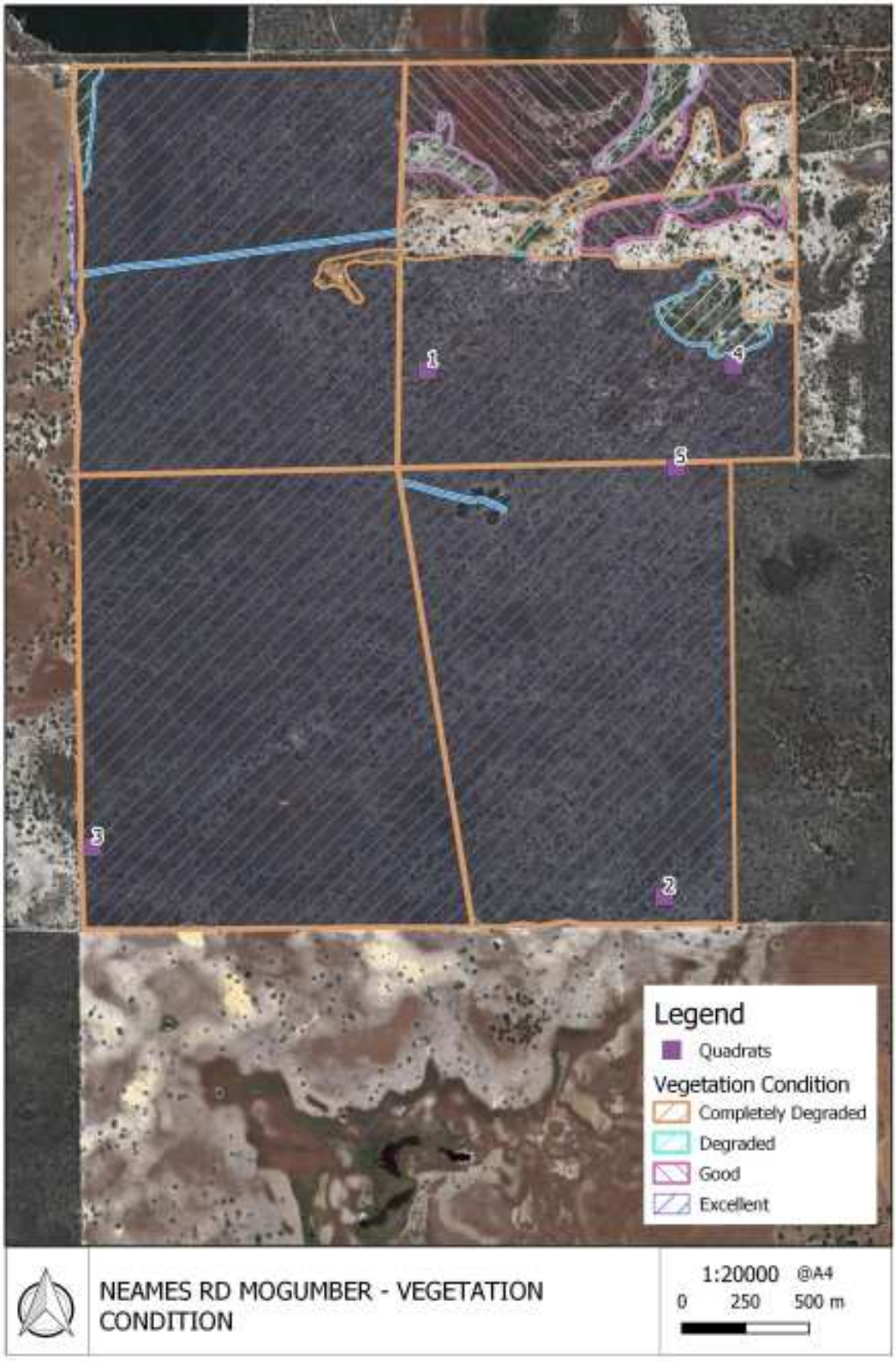


FIGURE 4: VEGETATION CONDITION



PHOTOGRAPHIC PLATES

Plate 1: Banksia woodland

Plate 2: *Eucalyptus todtiana* woodland

APPENDIX A
VASCULAR PLANT SPECIES RECORDED

APPENDIX A: VASCULAR PLANT SPECIES RECORDED AT NEAMES RD, MOGUMBER, NOVEMBER 2019

(* denotes weed species)

FAMILY	SPECIES
Anarthriaceae	*Lyginia barbata*
	Lyginia imberbis
Apiaceae	*Xanthosia heugelii*
Asparagaceae	*Lomandra* sp.
Asteraceae	**Hypochaeris glabra*
	Siloxerus sp.
	**Ursinia anthemoides*
Cyperaceae	*Caustis dioica*
	Mesmolaena pseudostygia
	Schoenus pedicellatus
Dilleniaceae	*Hibbertia acerosa*
	Hibbertia subvaginata
Ericaceae	*Conostephium pendulum*
	Andersonia sp.
Fabaceae	*Bossiaea eriocarpa*
	Daviesia decurrens
	Daviesia nudiflora
	Jacksonia floribunda
Haemodoraceae	*Conostylis aculeata*
	Phlebocarya filifolia
Iridaceae	**Gladiolus caryophyllaceus*
	Patersonia occidentalis
Lamiaceae	*Hemiandra incana*
Lauraceae	*Cassytha pomiformis*
Loranthaceae	*Nuytsia floribunda*
Myrtaceae	*Beaufortia elegans*
	Calytrix flavescens
	Calytrix variabilis
	Eremaea pauciflora
	Eucalyptus todtiana
	Leptospermum erubescens
	Myrtaceae sp
	Verticordia densiflora
	Verticordia nitens
Poaceae	**Aira caryophyllea*
	Amphipogon turbinatus
	Austrostipa sp.
	**Erharta longiflora*
Proteacea	*Adenanthos cygnorum*
	Banksia attenuata

	Banksia dallaneyi subsp. *dallaneyi* var *dallaneyi*
	Banksia echinata
	Banksia ilicifolia
	Banksia menziessii
	Banksia prionotes
	Conospermum stoechadis
	Hakea preissii
	Lambertia sp
	Petrophile linearis
	Petrophile macrostachya
	Stirlingia latifolia
	Synaphea sp.
Restionaceae	*Desmocladus asper*
	Lepidobolus chaetocephalus
Rutaceae	*Boronia* sp.
Stylidiaceae	*Stylidium repens*
	Stylidium sp.
Thymelaeaceae	*Pimelea* sp.
Xanthorrhoeaceae	*Xanthorrhoea acanthostachya*

APPENDIX B
QUADRAT DATA

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FIELD SHEET – FLORA AND VEGETATION SURVEY

Job Code: Neames Rd, Mogumber	**Date:** 24/11/2019	**Site:** Q1
GPS Datum: 50 404217 6562003	**Topography:** upper slope	**Litter cover:** 10 % twigs, 10 % leaves 20% logs
Age since fire: >10 yrs	**Disturbance:** Hi Med **Lo**	**Soils:** White/grey sand
Vegetation Description: Low open forest of *Banksia attenuata* over *Leptospermum erubescens* shrubland over *Eremaea pauciflora* low shrubland over a very open sedgeland of *Desmocladus asper*.		
Vegetation Condition: Excellent		
Observations: no weeds, limited disturbance, no deaths		

Coll No.	Taxon	Ht (cm)	% Alive	% Dead	% Cover
	Banksia attenuata	650	99	1	35
	Banksia menziessii	450	100	0	5
	Leptospermum erubescens	120	100	0	14
DBM1	*Verticordia densiflora*	40	100	0	1
	Calytrix flavescens	50	100	0	1
	Eremaea pauciflora	60	100	0	13
	Jacksonia floribunda	250	100	0	2
	Stirlingia latifolia	80	100	0	1
	Cassytha pomiformis	T	100	0	5
DBM2	*Petrophile macrostachya*	100	99	1	5
DBM3	*Beaufortia elegans*	60	100	0	5
	Desmocladus asper	10	100	0	3
	Lyginea imberbis	60	100	0	0.1
	Bossiaea eriocarpa	30	100	0	0.1
	Daviesia nudiflora	30	100	0	0.1
	Synaphea sp.	30	100	0	0.5

	Lomandra sp.	30	100	0	0.2
	Petrophile linearis	15	100	0	0.1
	Boronia sp.	10	100	0	0.1
DBM4	*Schoenus pedicellatus*	50	100	0	2
	Hibbertia subvaginata	30	100	0	0.5
	Patersonia occidentalis	40	100	0	1
	Conostephium pendulum	35	100	0	0.5
	Mesmolaena pseudostygia	50	100	0	0.5
	Stylidium sp.	5	100	0	0.01
	Stylidium repens	10	100	0	0.2
	Adenanthos cygnorum	10	100	0	0.1
OPP	*Eucalyptus todtiana*				
	Calytrix variabilis				

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FIELD SHEET – FLORA AND VEGETATION SURVEY

Job Code: Neames Rd, Mogumber	**Date:** 24/11/2019	**Site:** Q2
GPS Datum: 50 405148 6559934	**Topography:** lower slope	**Litter cover:** 5% twigs, 5% leaves 5% logs
Age since fire: >10 yrs	**Disturbance:** Hi Med **Lo**	**Soils:** White/grey sand
Vegetation Description: Low woodland of *Banksia attenuata* over *Eremaea pauciflora* shrubland over a very open sedgeland of *Lyginea imberbis*.		
Vegetation Condition: Excellent		
Observations: no weeds, sparse Banksia		

Coll No.	Taxon	Ht (cm)	% Alive	% Dead	% Cover
	Banksia attenuata	600	100	0	10
	Banksia menziessii	500	100	0	3
DBM3	*Beaufortia elegans*	40	100	0	6
	Mesomelaena pseudostygia	50	100	0	4
	Eremaea pauciflora	140	100	0	12
	Cassytha pomiformis	T	100	0	1
	Lyginea imberbis	60	100	0	6
	Patersonia occidentalis	60	100	0	1
	Verticordia nitens	120	100	0	0.5
	Daviesia nudiflora	160	100	0	2
DBM1	*Verticordia densiflora*	50	99.5	0.5	1
	Xanthorrhoea acanthostachya	100	100	0	3
DBM5	Myrtaceae sp	130	100	0	0.5
	Amphipogon turbinatus	30	100	0	0.01
	Bossiaea eriocarpa	120	100	0	4
DBM6	*Conospermum stoechadis*	110	100	0	0.5

DBM7	*Banksia echinata*	12	100	0	0.1
	Stirlingia latifolia	40	100	0	1
DBM8	*Banksia dallaneyi* subsp. *dallaneyi* var *dallaneyi*	15	100	0	0.3
	Caustis dioica	60	100	0	3.5
	Xanthosia heugelii	10	100	0	1.5
	Conostephium pendulum	40	100	0	0.5
	Petrophile linearis	30	100	0	0.5
	Lyginea imberbis	20	100	0	0.4
	Adenanthos cygnorum	10	100	0	0.1
	Stylidium repens	5	100	0	0.01
	Jacksonia floribunda	10	100	0	0.2
OPP	*Eucalyptus todtiana*				
OPP	*Leptospermum erubescens*				
OPP	*Nuytsia floribunda*				

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FIELD SHEET – FLORA AND VEGETATION SURVEY

Job Code: Neames Rd, Mogumber	**Date:** 24/11/2019	**Site:** Q3
GPS Datum: 50 402899 6560128	**Topography:** upper slope	**Litter cover:** 20% twigs, 30% leaves 10% logs
Age since fire: >10 yrs	**Disturbance:** Hi Med **Lo**	**Soils:** White/grey sand
Vegetation Description: Low woodland of *Banksia attenuata* over open heath of *Adenanthos cygnorum* over low open shrubland of *Beaufortia elegans* over low open shrubland of *Petrophile macrostachya*.		
Vegetation Condition: Excellent		
Observations: no weeds, dense vegetation		

Coll No.	Taxon	Ht (cm)	% Alive	% Dead	% Cover
	Banksia attenuata	600	100	0	20
	Banksia menziessii	400	100	0	7
	Adenanthos cygnorum	160	100	0	40
DBM1	*Verticordia densiflora*	40	100	0	0.5
DBM9	*Lambertia sp*	150	100	0	5
DBM3	*Beaufortia elegans*	100	100	0	7
DBM4	*Schoenus pedicellatus*	50	100	0	3
	Hibbertia acerosa	20	100	0	1.5
	Stirlingia latifolia	40	100	0	1
	Desmocladus asper	15	100	0	1
	Synaphea sp.	60	100	0	0.5
	Cassytha pomiformis	T	100	0	0.5
	Xanthorrhoea acanthostachya	130	100	0	3
	Bossiaea eriocarpa	70	100	0	1.5
	Amphipogon turbinatus	60	100	0	0.01
DBM7	*Banksia echinata*	40	100	0	0.1
	Caustis dioica	25	100	0	0.2
	Lyginea barbata	60	100	0	1

	Patersonia occidentalis	60	100	0	1
	Austrostipa sp.	60	100	0	0.01
	Conostephium pendulum	40	100	0	0.5
	Pimelea sp.	20	100	0	0.1
DBM10	*Lepidobolus chaetocephalus*	80	100	0	0.1
DBM11	*Phlebocarya filifolia*	25	100	0	0.5
	Jacksonia floribunda	12	100	0	0.2
	Petrophile linearis	15	100	0	0.2
DBM2	*Petrophile macrostachya*	60	100	0	4
	Stylidium sp.	15	100	0	2
	Daviesia decurrens	20	100	0	0.5
	Daviesia nudiflora	110	100	0	1.5
DBM12	*Andersonia sp*	60	100	0	1
DBM13	*Siloxerus sp*	6	100	0	0.3
	Stylidium repens	5	100	0	0.01
	Eremaea pauciflora	130	100	0	2.5
	Hemiandra incana	20	100	0	0.1
OPP	*Banksia ilicifolia*				
OPP	*Hakea preissii*				

Del Botanics

FIELD SHEET – FLORA AND VEGETATION SURVEY

Job Code: Neames Rd, Mogumber	**Date:** 24/11/2019	**Site:** Q4
GPS Datum: 50 405418 6562021	**Topography:** lower slope	**Litter cover:** 40% twigs, 60% leaves 10% logs
Age since fire: >10 yrs	**Disturbance: Hi** Med Lo	**Soils:** White/grey sand
Vegetation Description: Low open forest of *Banksia attenuata* over shrubland of *Calytrix variabilis* over low open shrubland of *Conostephium pendulum* over very open grassland of **Aira caryophyllea*.		
Vegetation Condition: Good - Degraded		
Observations: Contains weed species & bare areas, less diversity		

Coll No.	Taxon	Ht (cm)	% Alive	% Dead	% Cover
	Banksia attenuata	400	100	0	50
	Banksia menziessii	500	100	0	10
	Banksia prionotes	600	100	0	20
	Calytrix variabilis	150	100	0	25
	**Ursinia anthemoides*	15	20	80	5
	Conostephium pendulum	50	100	0	7
	Jacksonia floribunda	200	100	0	5
	* *Aira caryophyllea*	15	0	100	3
OPP	*Eremaea pauciflora*				
	**Hypochaeris glabra*	8	100	0	0.5
DBM3	*Beaufortia elegans*	100	100	0	0.7
	**Erharta longiflora*	50	100	0	0.01
	* *Gladiolus caryophyllaceus*	10	100	0	0.01
OPP	*Stirlingia latifolia*				

Del Botanics

FIELD SHEET – FLORA AND VEGETATION SURVEY

Job Code: Neames Rd, Mogumber	**Date:** 24/11/2019	**Site:** Q5
GPS Datum: 50 405192 6561619	**Topography:** mid slope	**Litter cover:** 10% twigs, 20% leaves 10% logs
Age since fire: >10 yrs	**Disturbance:** Hi Med **Lo**	**Soils:** White/grey sand
Vegetation Description: Low woodland of *Banksia menziessii* over shrubland of *Beaufortia elegans* over low open shrubland of *Verticordia densiflora*.		
Vegetation Condition: Very Good		
Observations: no weeds		

Coll No.	Taxon	Ht (cm)	% Alive	% Dead	% Cover
	Banksia menziessii	650	100	0	20
	Banksia attenuata	500	100	0	7
	Eremaea pauciflora	100	100	0	6
	Stirlingia latifolia	100	100	0	8
DBM3	*Beaufortia elegans*	120	100	0	10
DBM1	*Verticordia densiflora*	50	100	0	3
	Bossiaea eriocarpa	60	100	0	1
	Adenanthos cygnorum	150	100	0	6
	Cassytha pomiformis	T	100	0	0.1
	Desmocladus asper	7	100	0	1
	Amphipogon turbinatus	40	100	0	0.05
	Patersonia occidentalis	60	100	0	1
	Lyginea imberbis	50	100	0	0.2
	Petrophile linearis	20	100	0	0.2
	Conospermum stoechadis	120	100	0	0.5
	Conostephium pendulum	35	100	0	0.5

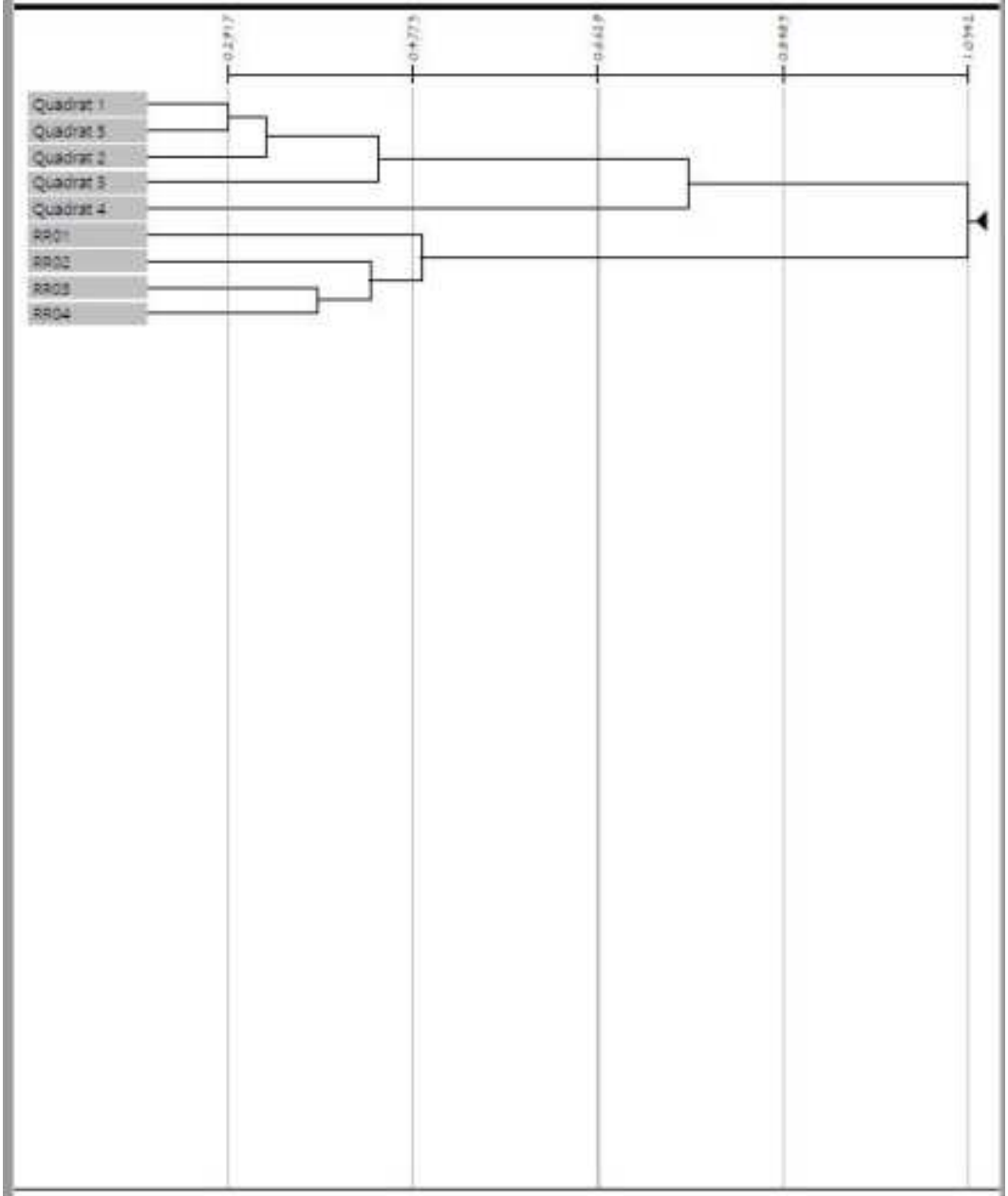
DBM12	*Andersonia sp.*	40	100	0	0.5
	Calytrix flavescens	20	100	0	0.2
DBM9	*Lambertia sp*	50	100	0	0.25
DBM4	*Schoenus pedicellatus*	50	100	0	0.1
	Conostylis aculeata	60	100	0	0.5
	Stylidium repens	3	100	0	0.2

APPENDIX C
DENDROGRAMS FOR MOGUMBER AND MANDOGALUP

Fusion Type: Flexible UPGMA Beta = -0.10

On Association: Bray & Curtis (Columns) Created on: 15:45:26, December 05, 2019

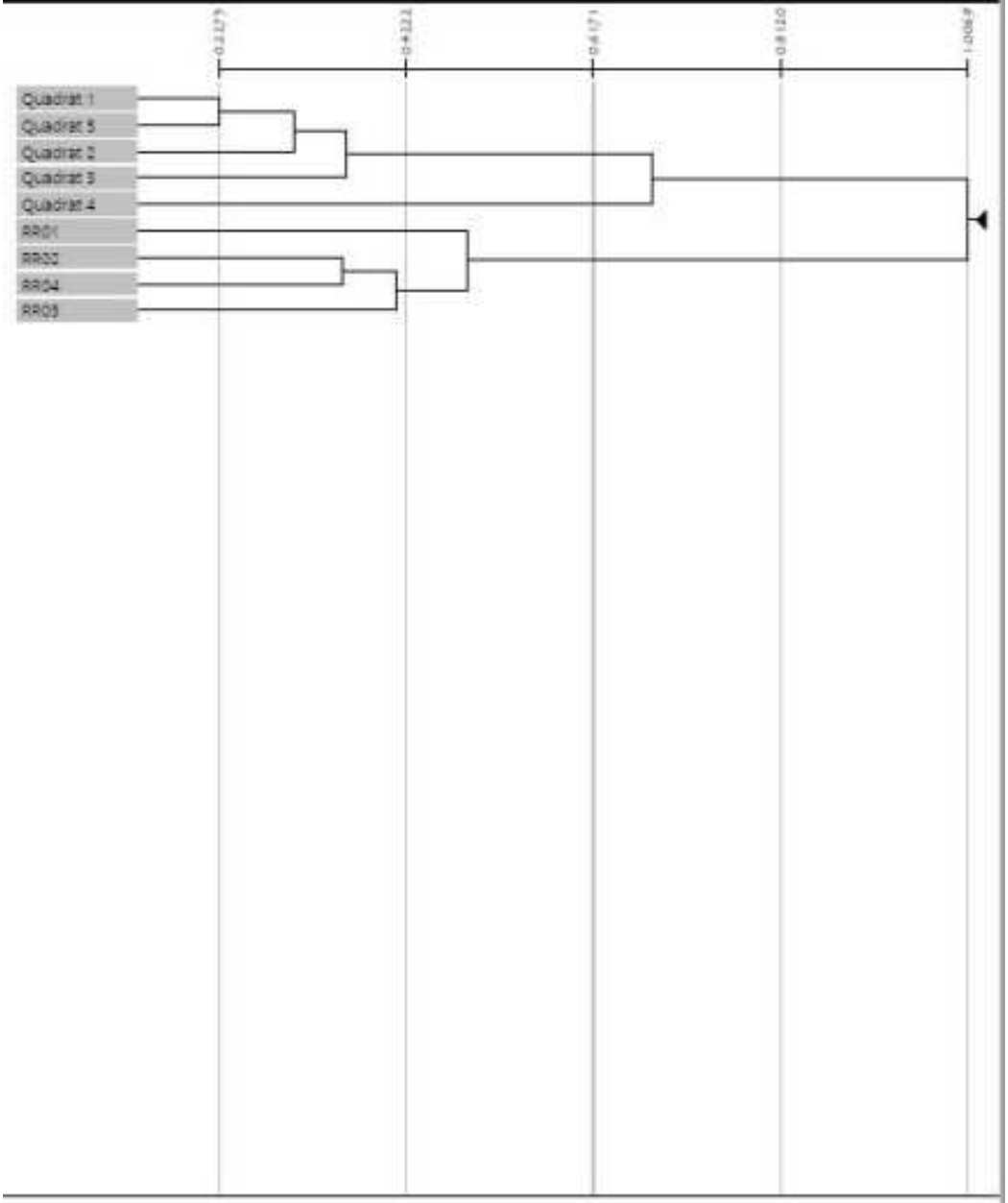
Column Fusion Dendrogram



Fusion Type: Flexible UPGMA Beta = -0.10

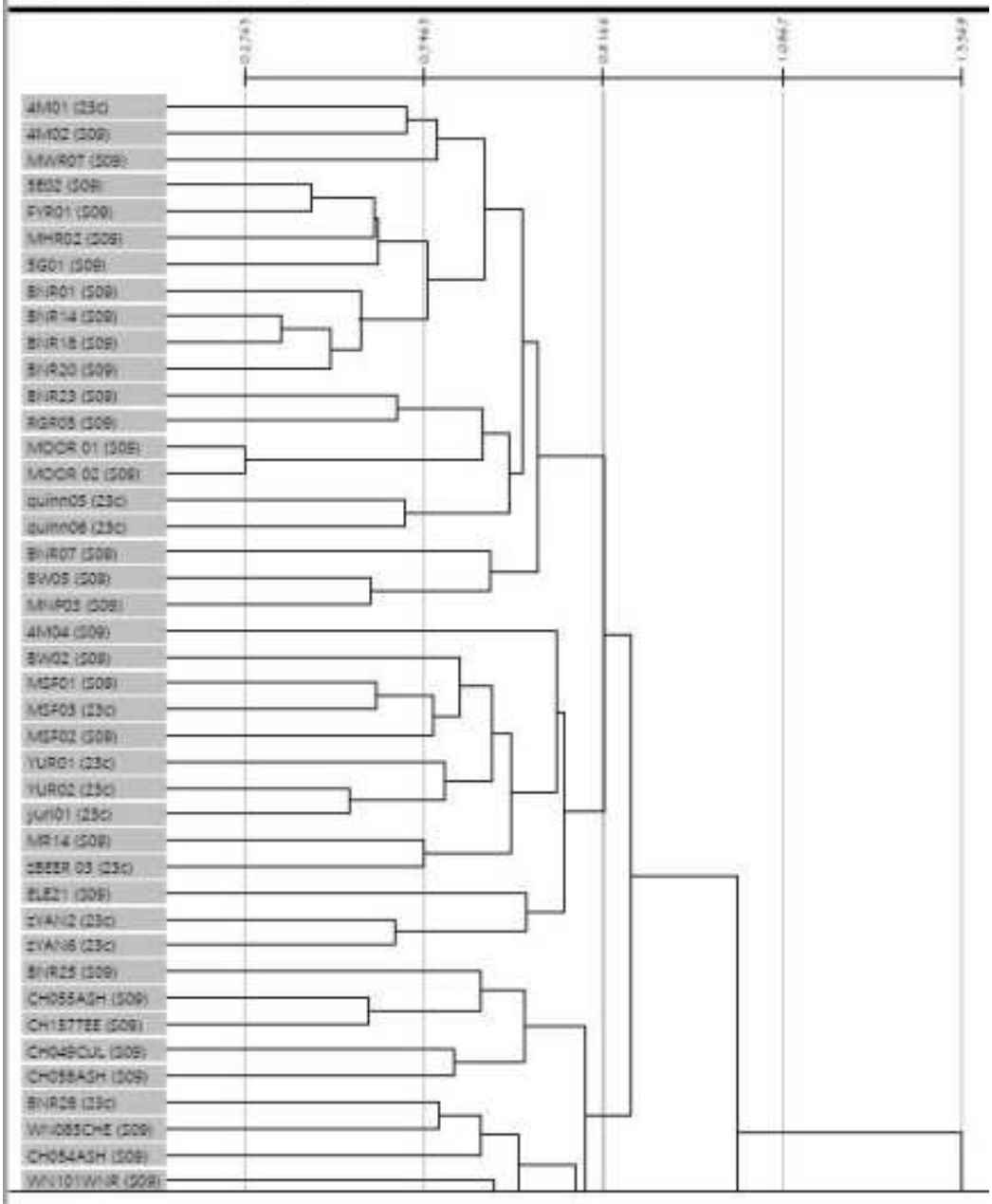
On Association: Bray & Curtis (Columns) Created on: 13:55:11, December 05, 2019

Column Fusion Dendrogram



Fusion Type: Flexible UPGMA Beta = -0.10
On Association Bray & Curtis (Columns) Created on: 13:19:05, December 05, 2019

Column Fusion Dendrogram



Fusion Type: Flexible UPGMA Beta = -0.10
On Association: Bray & Curtis (Columns) Created on: 15:19:05, December 05, 2013

Column Fusion Dendrogram

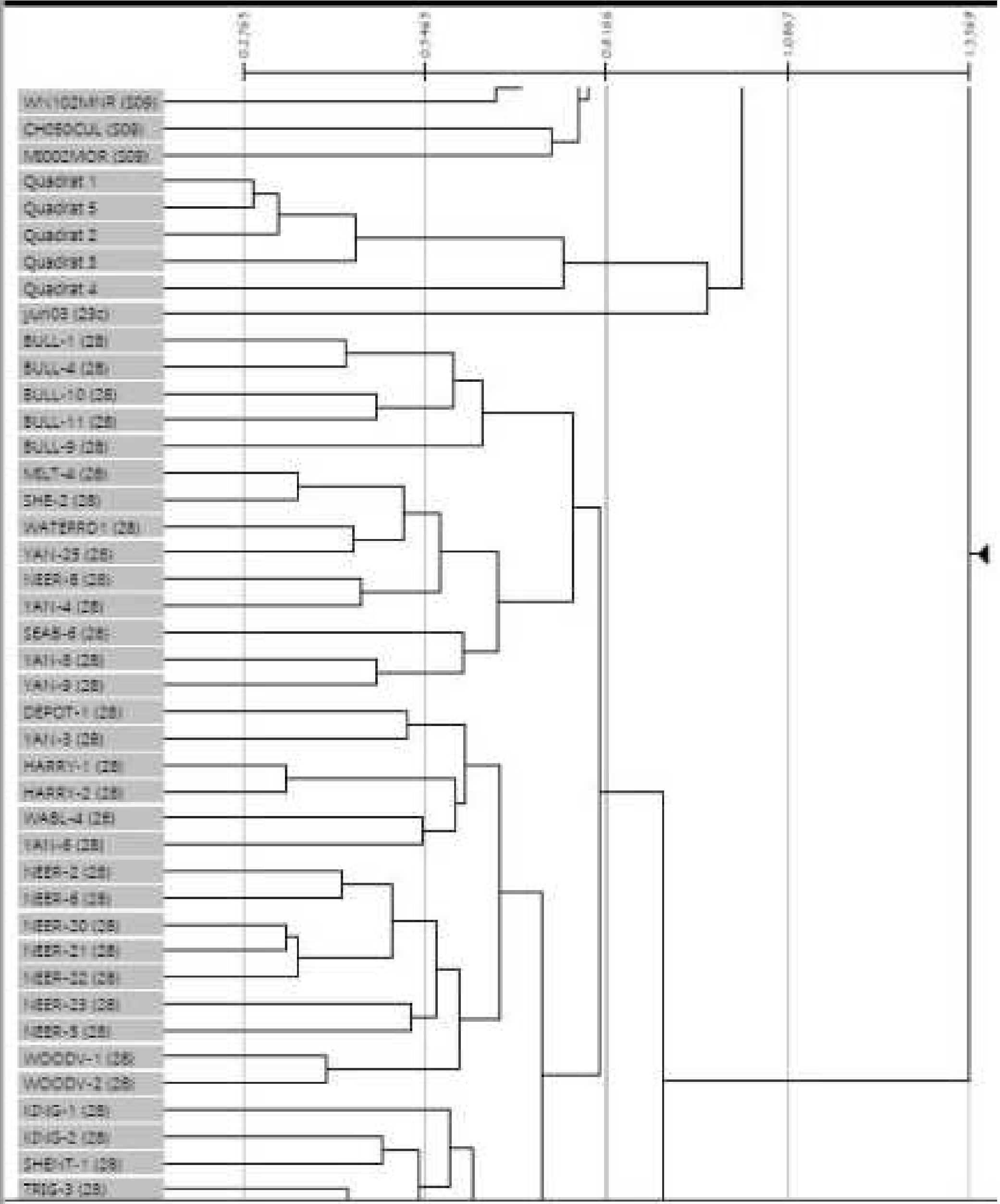
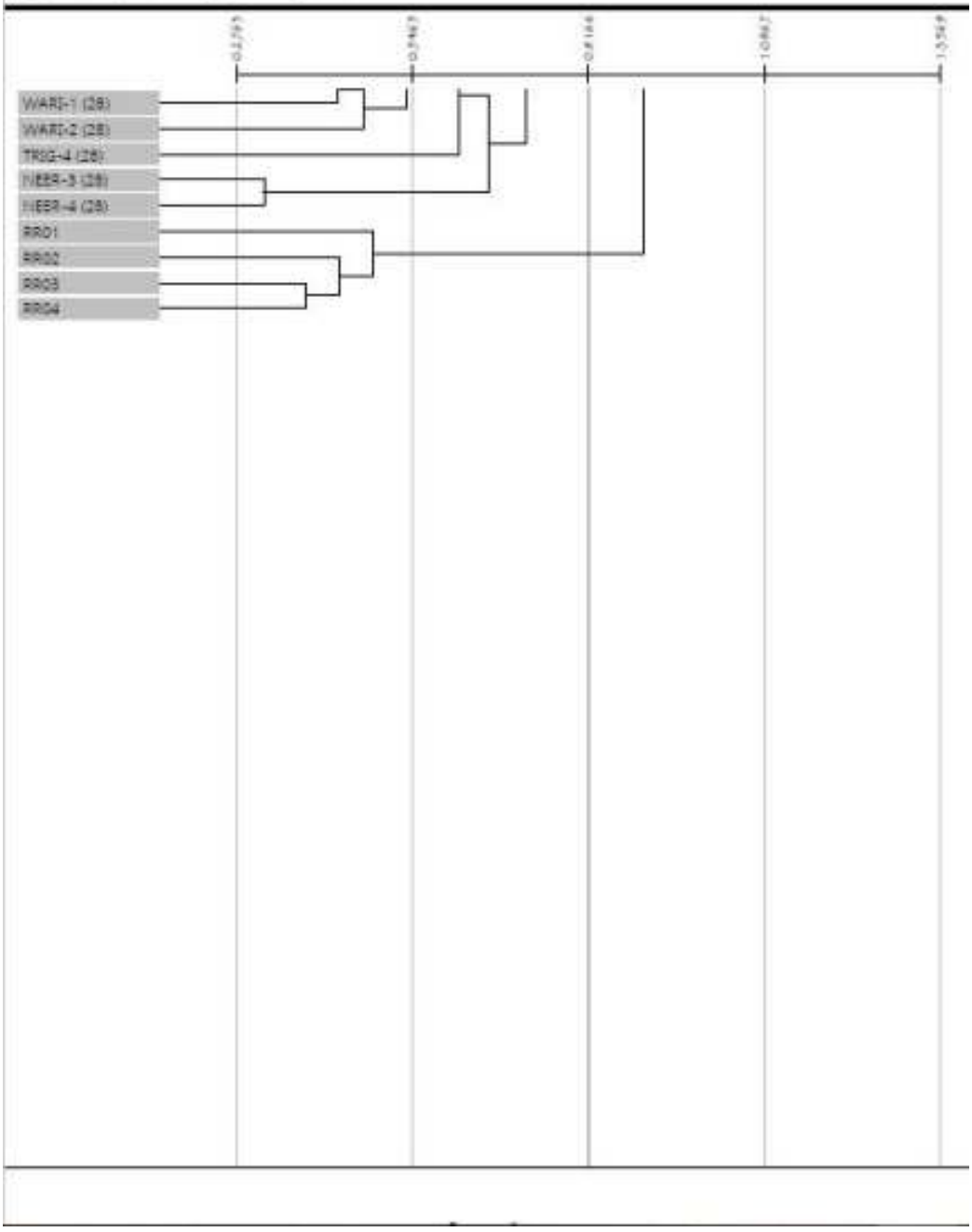


Table1

Fusion Type: Flexible UPGMA Beta = -0.10

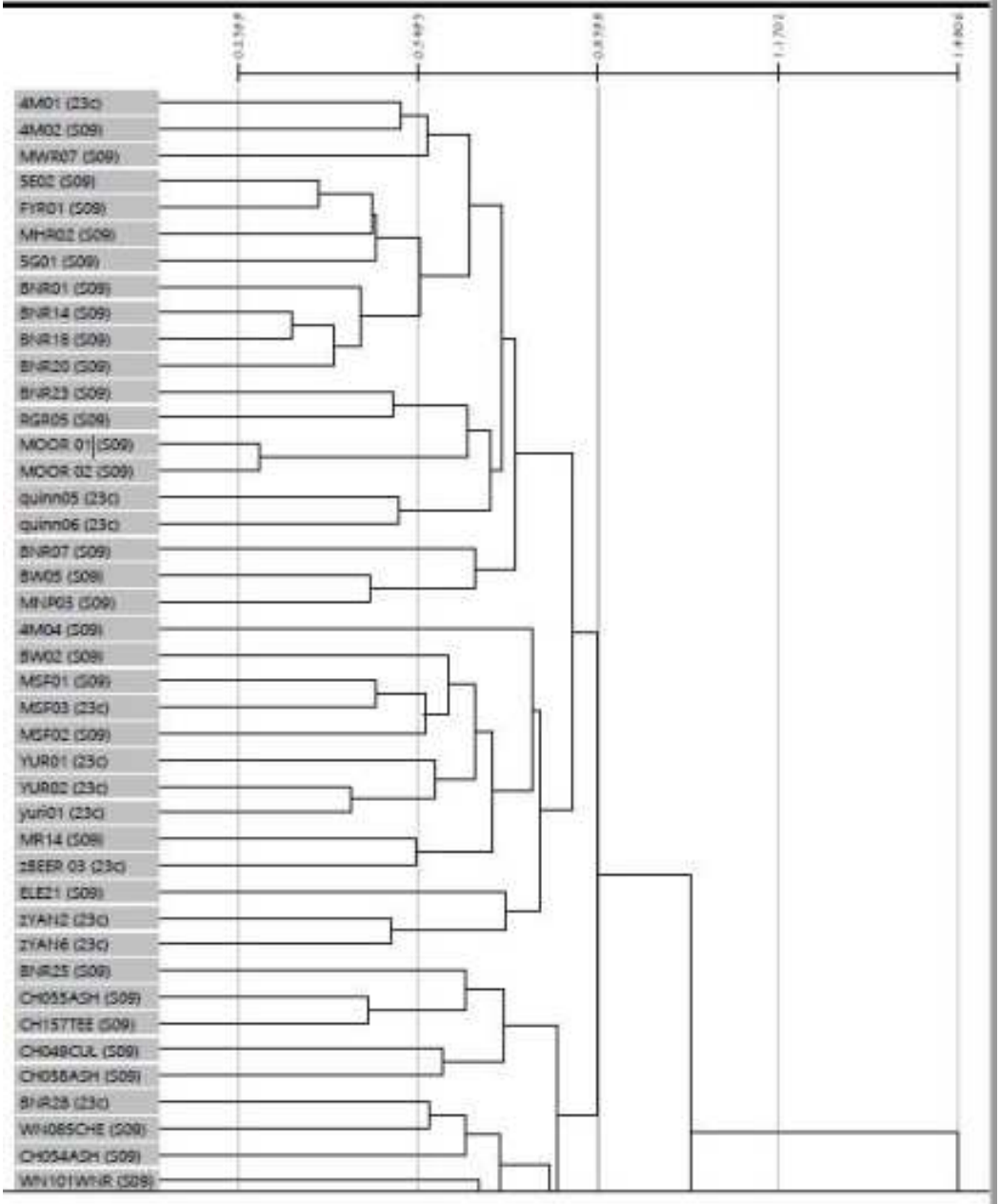
On Association: Bray & Curtis (Columns) Created on: 15:19:05, December 05, 2019

Column Fusion Dendrogram



Fusion Type: Flexible UPGMA Beta = -0.10
On Association Bray & Curtis (Columns) Created on: 13:11:07, December 05, 2019

Column Fusion Dendrogram



Fusion Type: Flexible UPGMA Beta = -0.10
On Association: Bray & Curtis (Columns) Created on: 15:11:07, December 05, 2019

Column Fusion Dendrogram

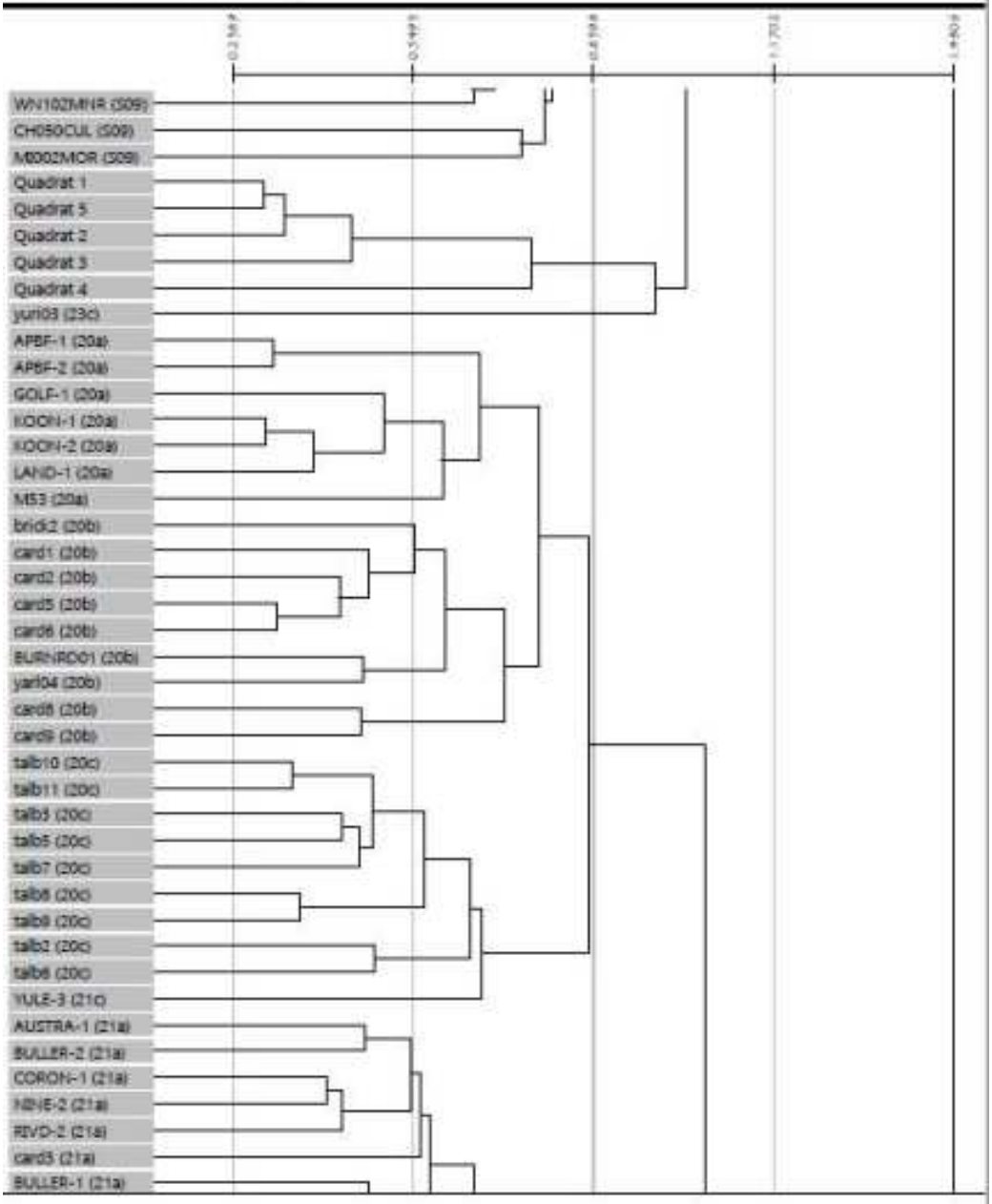
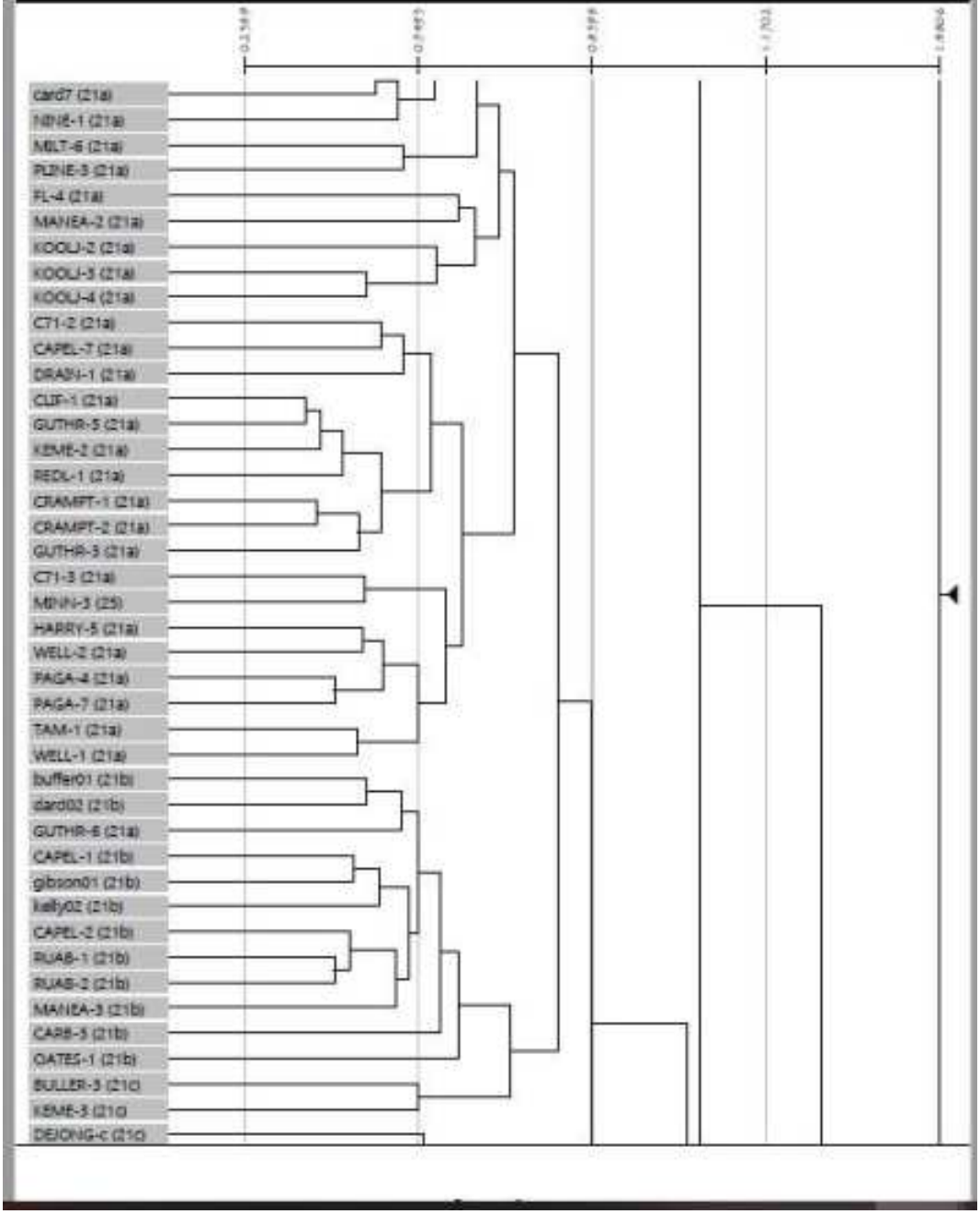


Table5

Fusion Type: Flexible UPGMA Beta = -0.10

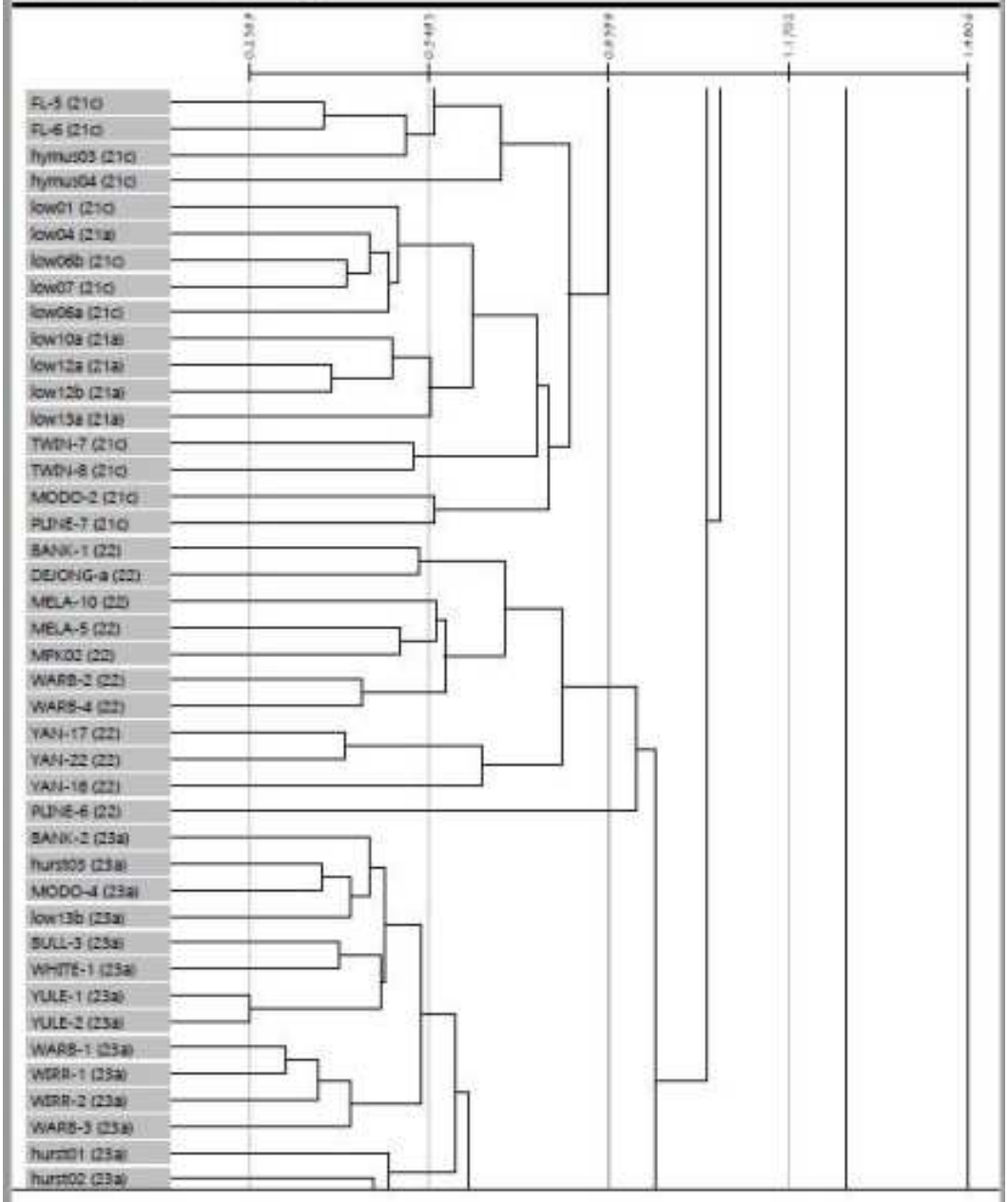
On Association: Bray & Curtis (Columns) Created on: 15:11:07, December 05, 2019

Column Fusion Dendrogram



Fusion Type: Flexible UPGMA Beta = -0.10
On Association Bray & Curtis (Columns) Created on: 15:11:07, December 05, 2019

Column Fusion Dendrogram



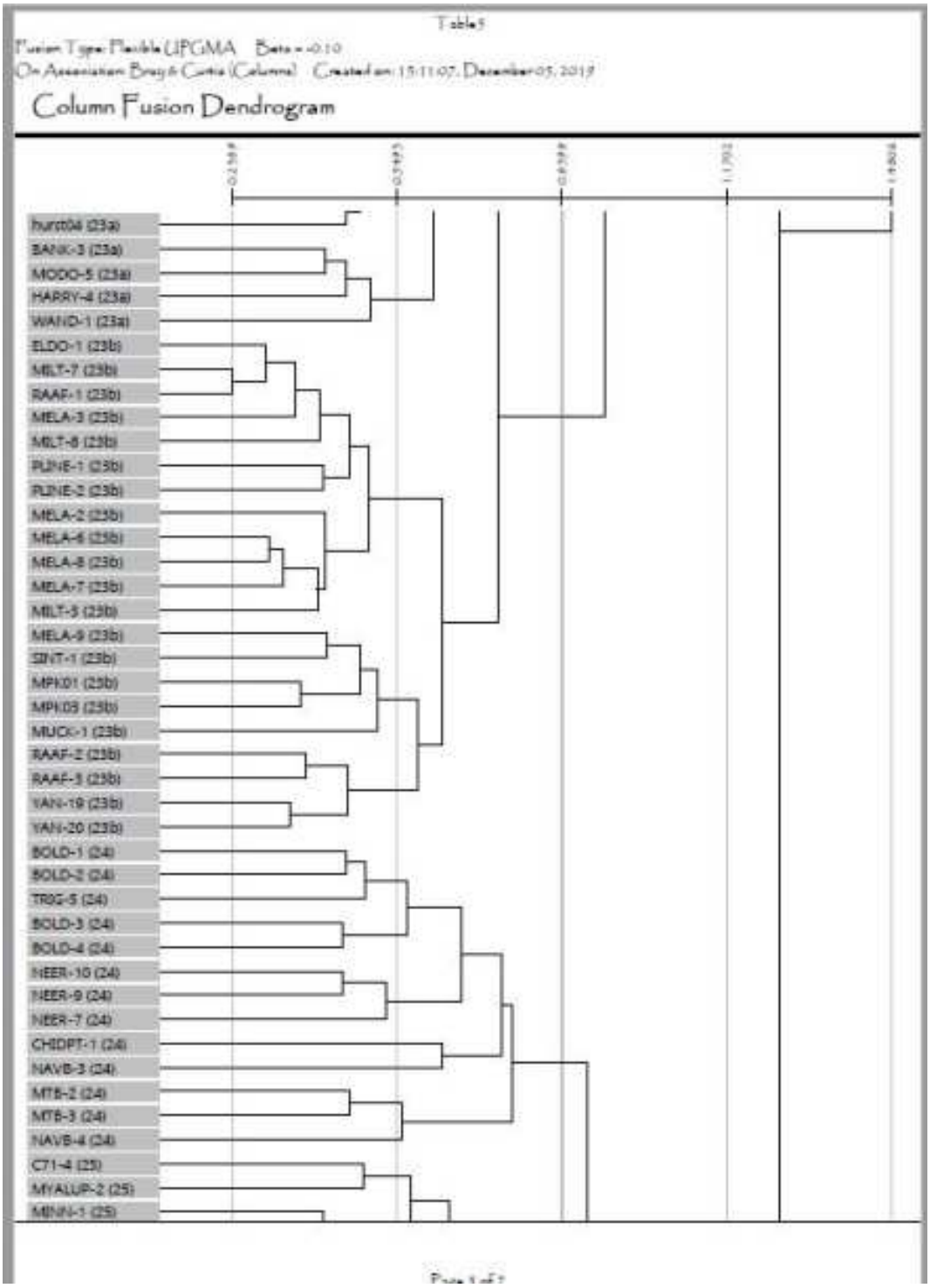
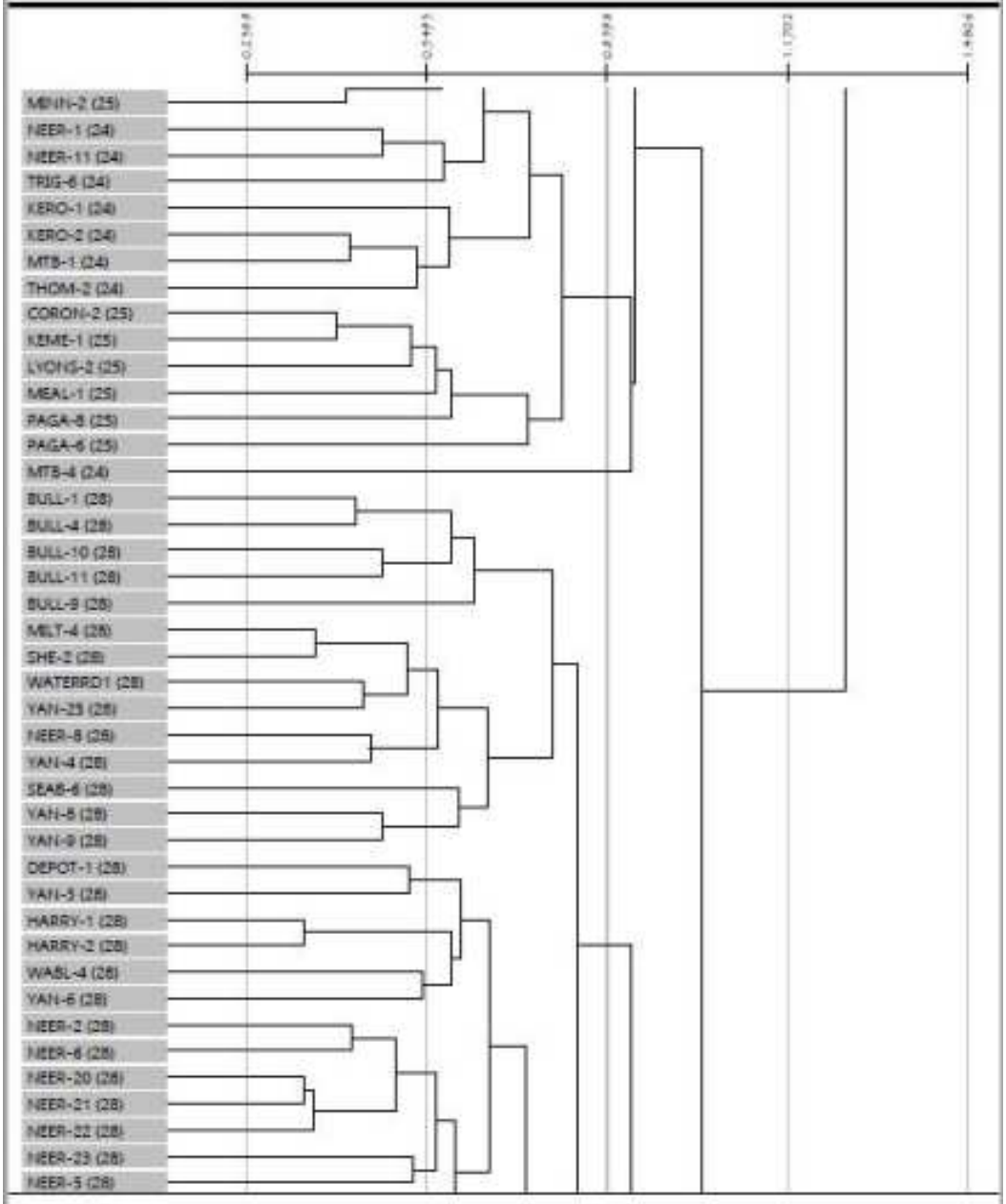


Table5
Fusion Type: Flexible UPGMA Beta = -0.10
On Association Bray & Curtis (Columns) Created on: 15:11:07, December 05, 2019
Column Fusion Dendrogram
hurst04 (23a)
BANK-3 (23a)
MODO-5 (23a)
HARRY-4 (23a)
WAND-1 (23a)
ELDO-1 (23b)
MILT-7 (23b)
RAAF-1 (23b)
MELA-3 (23b)
MILT-8 (23b)
PUNE-1 (23b)
PUNE-2 (23b)
MELA-2 (23b)
MELA-6 (23b)
MELA-8 (23b)
MELA-7 (23b)
MILT-5 (23b)
MELA-9 (23b)
SINT-1 (23b)
MPK01 (23b)
MPK03 (23b)
MUCK-1 (23b)
RAAF-2 (23b)
RAAF-5 (23b)
YAN-19 (23b)
YAN-20 (23b)
BOLD-1 (24)
BOLD-2 (24)
TROG-5 (24)
BOLD-3 (24)
BOLD-4 (24)
NEER-10 (24)
NEER-9 (24)
NEER-7 (24)
CHIDPT-1 (24)
NAVB-3 (24)
MTB-2 (24)
MTB-3 (24)
NAVB-4 (24)
C71-4 (25)
MYALUP-2 (25)
MINN-1 (25)

Fusion Type: Flexible UPGMA Beta = -0.10
On Association: Bray & Curtis (Columns) Created on: 15:11:07, December 05, 2019

Column Fusion Dendrogram



Fusion Type: Flexible UPGMA Beta = -0.10
(On Association Bray & Curtis (Columns) Created on 15:11:07, December 05, 2018

Column Fusion Dendrogram