scientific expedition group

Scientific Expedition Group

Expedition Munyaroo, Eyre Peninsula

September 2002

EXPEDITION HANDBOOK

Munyaroo Expedition 22 September-4 October, 2002.

This booklet provides information on:

- Program of activities for the scientific and adventure phases
- The locality and brief description of Munyaroo conservation Park
- Outline of the Adventure Trek.
- Notes on Safety, health, minimum impact camping and animal ethics
- What to take
- Thumbnail biographies of '*knowledgeable persons*' in the group
- Notes on projects.

Indicative Program, Munyaroo Expedition 22 September-4 October, 2002.

Subject to change, depending on field conditions and availability of people.

Project Codes: B=birds I=invertebrates P=plants V=vertebrates (other than birds)

Week 1: Munyaroo							
Group	Sun 22 Sep	Mon 23 Sep	Tues 24 Sep	Wed 25 Sep	Thurs 26 Sep	Fri 27 Sep	Sat 28 Sep
Ironstone	Adelaide → Munyaroo	Habitat familiarization and set up projects. Heritage walk	V	P	I	B	V
Quartz			B	V	P	I	B
Opal			I	B	V	P	I
Jade			P	I	B	V	P

Week 2	Munyaroo		Middleback Station				
Group	Sun 29 Sep	Mon 30 Sep	Tues 1 Oct Strike camp	Wed 2 Oct	Thurs 3 Oct	Fri 4 Oct	Sat 5 Oct
Ironstone	P	I	Adventure party: Overland trek to Middleback station			Middleback → Adelaide	
Quartz	V	P	Others: Specimen preparation, data collation, report writing.				
Opal	P	V					
Jade	I	P					

- Note that the mallee-fowl survey may involve **all groups** for some hours during a day

The 'I' Group on any particular day will be asked to contribute their time to messing duties in the afternoon.

Locality and habitat notes:

Eyre Peninsula (partly from Natural History of Eyre Peninsula, Eds. Twidale, Tyler and Davies, Royal Society of South Australia 1985, with additional notes by Kingsley Turner)

Eyre Peninsula is biogeographically interesting because it the start of the transition zone between eastern Australian and western Australian flora and fauna.

Geomorphological features of the peninsula include siliceous sand plains to the north, areas of silicious (with some carbonate) sand dunes to the east, granitic outcrops, uplands, some with banded iron formation, the relatively featureless Kimber peneplain and alluvial plains around Whyalla and Cowell.

On the west coast of the Peninsula there is a predominance of calcareous dunes with a high proportion (90%) of carbonate sands. These dunes, variously lithified and eroded, are the base material for the spectacular cliffs. The towering cliffs of the west coast of the peninsula are layered calcretes and calcarenite (aeolianite), representing discrete sequences of deposition of carbonate sands. The dune configuration is evident in the eroded faces exposed to the ocean. Marine limestones are restricted to Wilsons Bluff and Nullarbor limestones in the vicinity of the Head of the Bight (cf Short et al. 1986. Holocene Evolution of the Eyre Peninsula Coast, University of Sydney Press).

Mean annual rainfall ranges from 200mm in the north to over 450mm around Port Lincoln in the south. The area south of Whyalla which includes Munyaroo Conservation Park averages 250mm. Rainfall is predominantly in winter.

The original aboriginal inhabitants of Eyre Peninsula appear to be from three main cultures. The Gugada, who appear to have occupied the north-western side of Eyre peninsula were connected to the western desert cultures, while the Banggala on the eastern Peninsula were connected to the lakes culture which extended to Lake Torrens. The Banggala appear to have caught fish in coastal fish traps (although probably not off Munyaroo which has no suitable reefs) and also to have relied on collected shellfish. A 'nondo bean' which grew prolifically on sandhills was an important food source. Cleland (1966, Aboriginal Man in South and Central Australia. SA Govt. Printer, P. 135) reports nondo as being a common species of *Acacia* between Coffin and Sleaford Bays (bottom of Eyre Peninsula, in the vicinity of Pt Lincoln). While the species is not stated , it is possibly a sub-species of *Acacia longifolia* (based on the description of its abundance in the area). Pods were stripped from the seeds and roasted in hot ashes of campfires then eaten (perhaps similar to green snow peas)

Munyaroo Conservation Park (33˚36'S, 137˚25'E) (from notes supplied by SA Department of Environment and Heritage and Trevor Cox)

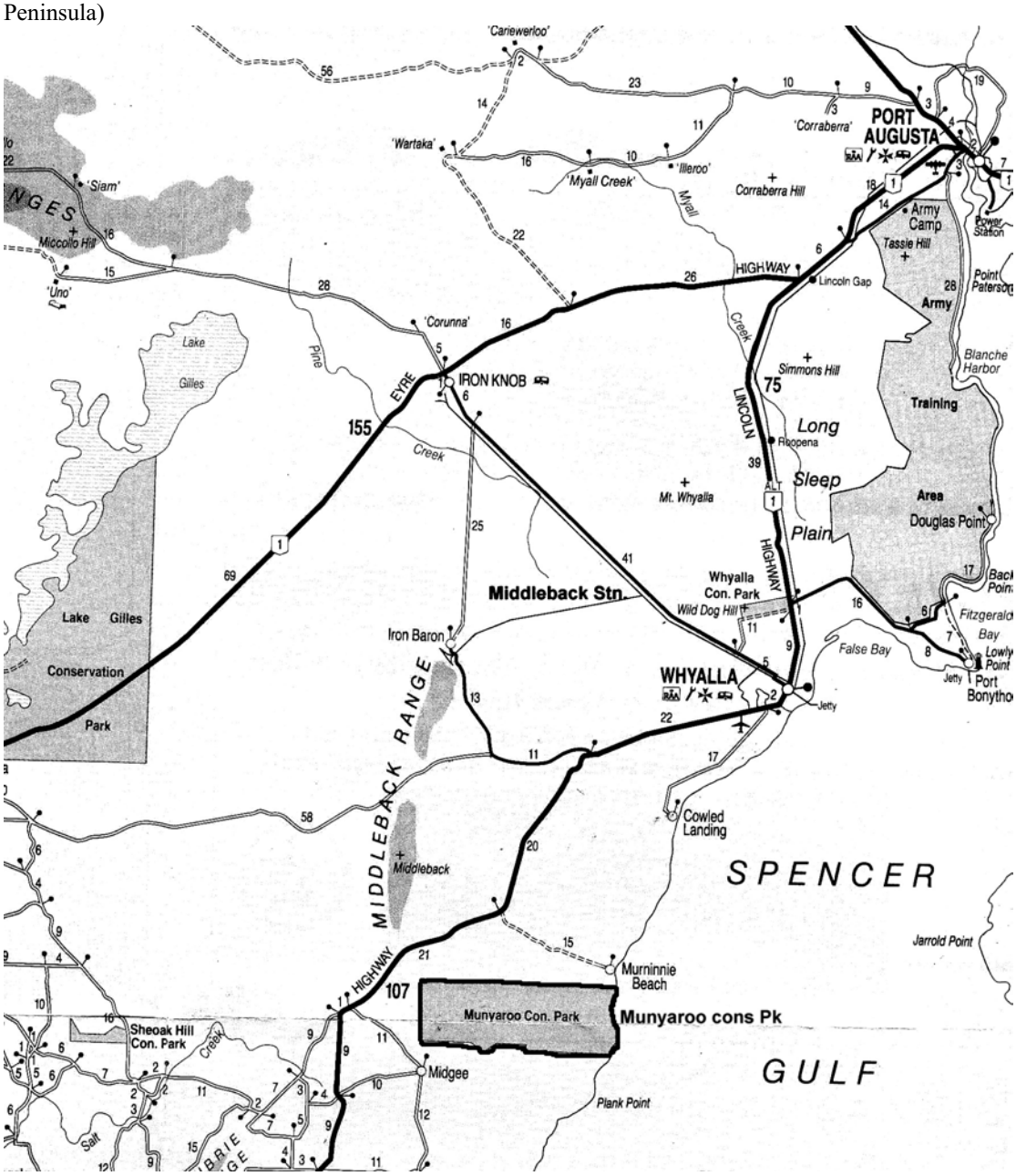
The park of 123 square km was proclaimed in 1977 with the purpose of conserving mallee and saltbush associations on the boundary between agricultural and pastoral areas in conjunction with mangrove and samphire communities along the coastal fringe. Prior to this, the park was used for grazing, and a small coastal strip was cropped. Ruins of a farm dwelling and implements remain in the park.

The park is located on the western shores of Spencer Gulf, 45 km south of Whyalla and accessed through Moonabie Station.

From the coast, with a beach suitable for fishing together with mangroves, arises coastal sand dunes, behind which are samphire flats and claypans. Further inland are a system of parallel dunes and an undulating plain. Ironstone ridges of the Moonabie Range intrude into the north west corner of the park.

Vegetation includes low open woodland of western myall and false sandalwood (*Myoporum platycarpum*) over a shrubland of bluebush and bladder saltbush, an association not well represented in South Australian reserves. Other associations include an open scrubland of gilja, yorrell and red mallee over bluebush, dryland tea tree porcupine grass, candlebush and twin leaf (*Zygophyllum* sp) on the dunes. In the northern area of the park grow native peach trees, native cypress pines, weeping pittosporum and western myall. True sandalwood (*Santalum spicatum*) is not common on Munyaroo, and Kingley Turner is offering a jelly bean to the first expeditioner who finds one (hint: look around granite outcrops). Further information on plants, botanical associations and birds are detailed in the survey sections of this booklet

Orientation map of Munyaroo Conservation Park (From RAA map of Upper Eyre Peninsula)



Detailed map of Munyaroo

Adventure Phase

What will we be doing?

During the first week, expeditioners will participate in a number of scientific surveys led by a *knowledgeable person*. For expeditioners, it is an opportunity to experience techniques used in surveys of animals and plants. It is also an opportunity to increase knowledge of the plant and associations and supported fauna of this little known area. A positive outcome of the Munyaroo expedition will be a comprehensive census of plant and animal species associated with the different habitats on Munyaroo during spring. We'll even produce a report of our activities!

During the second week, expeditioners will have the opportunity of participating in an adventure trek. For those who wish to continue their interest in scientific projects, we will transfer to the relative comfort of Middleback Station. Middleback station has accommodation in shearer's quarters and well-equipped kitchen and dining areas. There is also a well-equipped field laboratory, originally set up by Dr Bob Lange of the University of Adelaide and now maintained by the University. Here, we can sort and label specimens, and compile survey reports.

The projects which each expeditioner will have the opportunity to participate include:

- Survey of the small ground-dwelling vertebrate fauna in different habitats using pitfall traps. *Knowledgeable persons*: Loraine Jansen, Catherine Kemper and Jarrod Eaton.
- Bird survey. *knowledgeable persons:* Trevor Cox and Graham Carpenter
- Mallee fowl census. *knowledgeable persons*: Trevor Cox
- Plant associations. *knowledgeable person*: Darrell Kraehenbuehl
- Invertebrate associations with vegetation. *knowledgeable persons*: Peter Bailey, Jan Forrest, David Hirst.

Profiles

Expedition Leader: David King A.M. David was invited by Richard Willing,Chairman of SEG,to take the position of chief leader for the Munyaroo Expedition. As a retired medical general practitioner his past experience includes providing medical support for hiking in Tasmania and a "Burke and Wills" trip. He considers that the Munyaroo Expedition will provide an opportunity for a wide range of expeditioners to enjoy and participate in a biodiversity survey. Make David your first contact for any organisation or health problems relating to the Munyaroo expedition**.**

SEG Chairman: Richard Willing, Chairman of SEG since its foundation 18 years ago, and organizer of the Minnawarra Biodiversity Survey twice yearly. A retired physician with a lifelong interest in the environment, including biological work in Antarctica. **Gwen Willing:** Long suffering spouse of Richard, supporting SEG in many ways over the years.

Adjutant and Quartermaster: Trent Porter. Trent has been involved in SEG since 1991, taking part in Expedition Lake Newland '91 and later in Expedition Gammon Ranges in 1996. Trent joined the Committee in 1996 and has assisted with the eradication of foxes in the Gammon Ranges and the preservation of the Yellow-footed Rock Wallaby program running in conjunction with GraSP. Trent has also assisted in

the collection of data of mammals, birds and reptiles during the Biodiversity of Road Reserves in Southern Fleurieu Project from beginning to end. In 2000 Trent, along with Paul Wainwright, took on the role of Catering Officer for the very complex task of organising and delivering the tucker for the Gluepot Reserve Expedition in 2000. In his spare time, he runs a landscaping business. Trent will be the logistics organiser for the Munyaroo expedition

Adventure Trek: Ray Hickman. Ray is a retired university lecturer in health science. He is a SEG member and a member of Adelaide Bushwalker's club. Ray has eight years back-packing experience, mostly in South Australia. His favourite bushwalking region is the Mawson Plateau, North of Arkaroola. He combines bushwalking with stereophotography.

Heritage: **John Morley.** John has been a pastoralist and farmer. He has an extensive knowledge of farm machinery and farming heritage. He will explain the significance of rusty bits of iron around the old homestead.

Knowledgeable Persons (KP's)
Botany: Darrell Kraehenbuehl. Botanical Ecologist for Department of Environment and Heritage for 16 years, prior to retiring in 2000. WEA Lecturer (1960-1970), Tutor for the University of Adelaide Spring Schools (Flinders Ranges and Arkaroola). For this work, Darrell received the Natural History Medallion for the year 2000. He has lodged some 7000 plant specimens with the Adelaide herbarium. He is a prolific writer, with some 175 publications on botanical or conservation subjects his credit and has authored the book, 'Original Vegetation of Adelaide. A Survey from Hallett Cove'. He thanks his wife, Cynthia and four children for releasing him from family duties to undertake this expedition. Darrell will conduct the botany survey.

Birds:
Trevor Cox. Trevor has is a long-time resident of Eyre Peninsula and a keen ornithologist. He has an intimate knowledge of the bird fauna of Eyre Peninsula, and has produced a checklist of birds that he has recorded from Munyaroo. This list is reproduced in this handbook. Trevor will conduct the bird survey, including the mallee fowl survey.

Graham Carpenter: Graham is one of South Australia's leading ornithologists and has many years' experience studying the birds of SA. He has been a member of the South Australian Ornithologist Association for over 25 years. He has spent much time in the field on the Eyre Peninsula. Graham is also a very good botanist. He will be conducting the bird survey with Trevor Cox.

Vertebrates (other than birds):
Loraine Jansen: Loraine is a biologist with a background in both Botany and Zoology as well as being a qualified horticulturist. She has participated in a number of faunal surveys. She has particular interests in the bat fauna of South Australia. Loraine and Cath Kemper will conduct the survey of mammals at Munyaroo.

Catherine Kemper: Cath is Curator of Mammals at the South Australian Museum. She has expertise in both marine and terrestrial mammals, and along with three other South Australian mammalogists, is writing a field guide to the terrestrial mammals of SA. Cath has had over 20 years' experience in mammal survey. She and Loraine will be conducting the mammal survey.

Jarrod Eaton: Jarrod has completed a Bachelor of Applied Science in Environmental Management at the University of South Australia and is currently undertaking postgraduate studies at the Northern Territory University. Jarrod has a particular interest in arid zone fauna and has been involved with a number of biological surveys around the state for government agencies and private conservation organisations.

Invertebrates:
Peter Bailey. A recently retired entomologist from the Waite Campus, Peter has used a number of techniques to sample insect populations and estimate insect numbers. His latest project was on western myall dieback in the Woomera-Roxby-Glendambo area. Peter, Jan Forrest and David Hirst will jointly facilitate the invertebrate survey.

Jan Forrest is Senior Collection Manager of Terrestrial Invertebrates at the South Australian Museum. Jan has wide experience in field work throughout Australia including many biological surveys.

David Hirst is Collection Manager of the Arachnology and Myriapoda collections at the South Australian Museum. His field work experience is in arid zones, mainly South Australia. He is actively involved in research on huntsman spiders in Australasia and has published several taxonomic papers on these.

Notes on minimum impact camping, Safety, health, and animal ethics

Minimum impact code:

Scientific Expedition Group Inc endeavours to promote sound philosophies regarding the natural environment and encourages all expeditioners to practice these skills:

- Avoid damaging vegetation. Move carefully on foot. Don't drive vehicles off roads or tracks.
- Do not disturb rocks or trees, particularly in camping areas
- No campfires
- Bury toilet paper and faeces
- Garbage in, garbage out
- Waterholes are precious. Don't pollute

Safety code:

Before leaving base camp and its immediate vicinity:

- Go with at least one other person
- Notify some person at base camp of your intended movements
- Stay together in the bush. Don't split
- Take a 'minimum kit for field activities',

What to do if lost:

- Don't panic; take some time to think about where you have come and where you last saw the others. Remember, the long side of the park stretches east-west, but is only 7km wide north-south. If lost, head North or south to intersect a fence line and associated track.
- Blow your whistle or yell, then listen for a response
- If possible, climb to a vantage point to locate any familiar landmarks
- If you are away from camp long beyond a reasonable estimated time of arrival, a search party will be organised, initially by other SEG members in the party. Police and SES will be notified if you are not located by nightfall.
- If you are forced to spend the night in the open, make yourself comfortable as you can with your minimum kit for field activities. At daybreak, make yourself as conspicuous as possible.

Health and Hygiene:

- Protect against the sun: 15+ sunscreen and broad brimmed hat
- Wash hands in warm water and soap before meals. Doubly important for food handling groups
- If you have an enteric dysfunction or any other spreadable infection, please talk with Dr King
- Drinking water will be brought in with the expedition. You will be advised whether this can be drunk without boiling. Try to avoid drinking other water unless boiled. Water has to be carted into the camp. Please don't waste it.
- Toilet guidelines will be discussed when we arrive.

Snakebite.
Golden rule: Don't get bitten! Watch where you walk. If you see a snake, move away from it. Do not handle snakes, including those caught in traps. Leave it to an experienced herpetologist.

In case of snake bite:
The victim should lay still. Avoid unnecessary movement

- Apply a **broad bandage** over the bite site at about the same pressure as for a sprain. It should not act as a tourniquet.
- Do not wash, clean or wipe the bite site.
- Extend the bandage to cover as much of the bitten limb as possible. Bind over clothing rather than moving the limb to remove clothing. Include toes and fingers in the bandage to inhibit any movement of digits.
- Apply a splint to ensure the limb remains immobile.
- Give clear liquids only by mouth
- Bring transport to the victim. Do not allow the victim to stand or move about.
- Transport expeditiously to hospital.
- Should the victim become unconscious or nauseous, or have difficulty breathing or develop drooling, gently move them onto their side to reduce the chance of inhaled vomitus.
- If the victim should develop major breathing difficulty, support breathing by expired air respiration (mouth to mouth).

Animal ethics: The South Australian Wildlife Animal Ethics Committee has guidelines relating wild animals. For this expedition, the relevant guidelines are contained in the Standard Operating Procedure (SOP) for the **Use Of Pitfall Traps For The Capture Of Vertebrate Animals:**

- Do not use wet pitfalls because the animals drown
- Pitfalls to be visited at least twice a day – around sunset and within 1.5 hours of sunrise
- During hot or wet weather more frequent visits should be made or a method of protecting captures from the weather used.
- If necessary spray pitfalls with an environmentally safe insecticide to protect captured animals from ant attack
- All pitfalls to be removed and holes filled – or made inoperable at the end of the trapping period by filling with soil of other suitable substrate

What to Bring: Suggested Equipment Check List.

CAMPING EQUIPMENT. (Flinders Camping, Rundle Street has tents, sleeping mats and sleeping bags for hire and offer discounts on purchases)
Backpack Must be comfortable to carry and (for Adventure Phasers) large enough for 3 days hiking. For non-Adventure Phasers; a **day pack**.
Tent Lightweight (especially for adventure phasers..you have to carry it!)
Sleeping mat For adventure phasers, Thermarest/earthmat are best, but foam is OK. For others, Huff 'n puff type air mattress or swags are OK.
Sleeping bag Warm for expected cold nights and for adventure phasers, backpack-packable.
Cooker For adventure phasers only, Trangia or similar.
Fuel for your stove in a leak proof container
Eating utensils Unbreakable bowl,mug, knife, fork, spoon **in a drawstring bag**.
Tea towel with your name on it**.**
2 or 4 litre wineskins. (for adventure phasers) Empty and washed. (winey water makes you whiney).
Lunch box or other container for lunch.
Torch and spare batteries.
Folding camp stool or chair.
Small musical instruments. Optional, but no double bass, tuba or learner bagpipes.

Clothing Suggestions
Boots. Must be strong with deep non-slip tread and good ankle support. Uppers should be leather or leather/synthetic combination. A suitable size is one which feels comfortable when worn with one or two pairs of thick socks. (Hint: try on candidate boots in the afternoon when your feet are warm and swollen). **They should be well broken in before walking long distances.**
Warm jumper or Polartec type jacket (1).
Warm shirts (2) long sleeves.
Warm trousers (2). Trackies OK.
Light weight shirts (2+) with long sleeves.
Shorts (2+) in case of really hot weather or water wading
Bathers. Beach is nearby.
Socks and jocks etc (4+prs). Limited washing opportunities.
Towel and personal toiletries (including soap)
Waterproof garment (1). Heavy duty poncho type OK and cheap. For those who want to lash out, Japara or Gortex.
Hat that will protect your face and ears.
Camp shoes. Sneakers OK. Thongs..watch out for prickles and crabs.
Gaiters are good for preventing seeds and stones getting into boots and socks.

Personal Survival Kit (must be carried when away from camp)

- Minimum of 1 litre of water (more in hot weather). 1.5l PET bottles can be carried in a day pack
- Snack food (not supplied by SEG) Scroggin (a mixture of dried fruits, nuts, glucose, lollies) muesli bars or other high energy food. Remember, chocolate melts!
- Sunscreen (15+)
- Insect repellent

- Jumper
- Hat, waterproof jacket
- First Aid Kit. Including a broad bandage, painkillers, alcohol swabs, assorted band aids, antiseptic cream etc.
- Box of matches (waterproof if possible).
- Whistle, and if possible, a compass (or GPS) and map.
- Pocket knife

Field Gear
Binoculars. Highly recommended for bird watching.
Pen, pencil, notebook or clipboard.
Camera and film
Hand lens (x10) useful for invertebrate identification.
Your favourite book(s) on bird, mammal, reptile, plant or invertebrate identification.

Scientific Surveys

In each of the major habitats (for example, dunes, swales, Triodia grasslands, samphire plains, coastal dunes, Moonabie Ranges) a 30 x 30 m sampling area or 'quadrat' will be marked out, and the species composition of the flora and fauna will be quantified using some of the techniques outlined below. The methods used conform to National Parks and Wildlife SA guidelines for biological surveys in South Australia.

Vertebrate Fauna Survey using Biological Survey of South Australia methodology.

Knowledgeable persons: Catherine Carpenter, Loraine Jansen, Jarrod Eaton.

Pitfalls

Data will be collected in two ways at each site; trapping and observations (active search and incidental sightings). Four trapping methods will be employed during the survey. At each site there will be one line within the same habitat type. The line will consist of 1 pit-line (6 macro-pits in total), 1 Elliott trap line, 2 cage-traps, and 1 micro-pitfall line. Trap-lines should be positioned so they are not easily visible from public access roads (Owens, 2001). The standard pit-line consists of 6 macro-pits placed at 10 metre intervals in the ground flush with the surface. The line is then connected by a 60-metre flywire fence. Figure 1 below outlines the general set-up of a pit line.

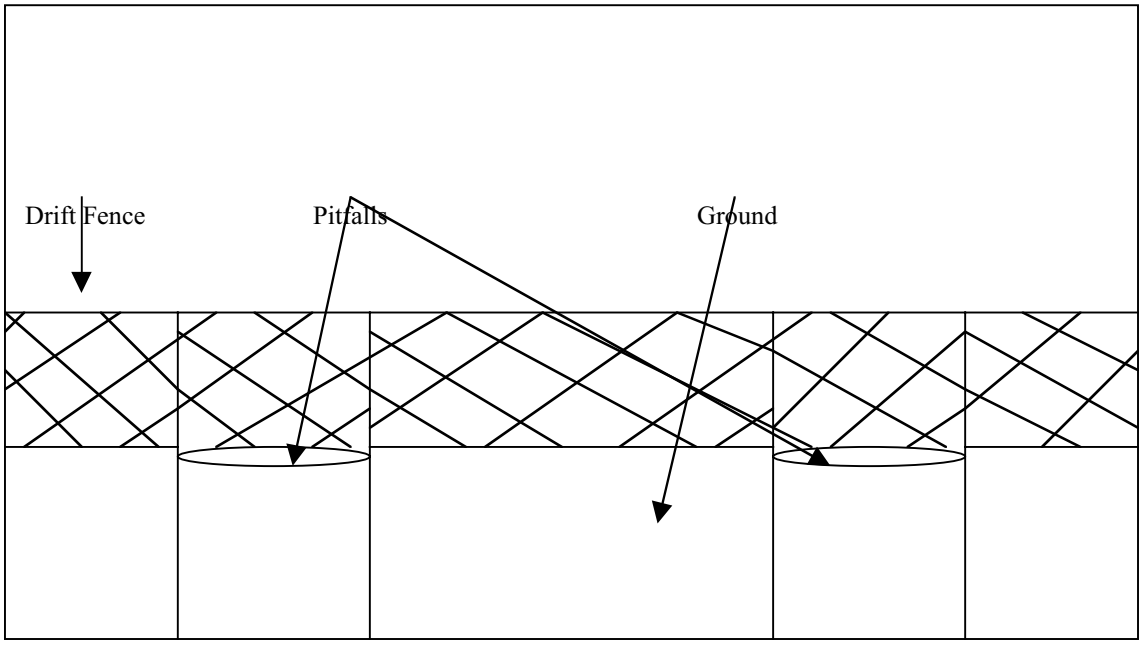


Figure 1. Pitline layout

Trap-lines are open for four nights. Installation is a team effort as it takes a long time to establish pit-lines. However, the country is relatively sandy so digging should be fairly easy. A trench also needs to be dug between the pits and a couple of metres either side of the start and finish to stand the fence up in which is then buried. Pins

will be used either side of the pits however, the fence should be able to stand up on its own.

The fence must run centrally over the pit and should not have any folds otherwise some small skinks can run along it. Under no circumstances should a length of drift fence be torn or cut in half to use elsewhere. Weather conditions may be quite variable so toilet rolls and/or leaf litter should be placed in the bottom of the pits to reduce the risk of exposure to captures. A glass jar full of ethanol should be placed in the first macro-pit to collect any invertebrate specimens found in the pitline.

The micro-pit line (small plastic vials containing 75% ethanol) are to be placed in the ground flush with the surface and parallel to the macro-pit line. The micro-pits need to be placed about 2 metres away from the macro-pits to avoid people walking on them. Flagging tape should be used to mark the position. Micro-pits are to be left open for the whole trapping period i.e. 4 days. Micro-pits need to be checked daily and filled up with ethanol when necessary.

Elliott Traps

A standard Elliott trap-line consists of 15 Elliott traps placed approximately 10 metres apart. These are generally placed parallel to, but approximately 10 metres away from, the pit-lines. A small ball amount of bait rolled oats and peanut butter (about the size of a 20 cent piece) is placed at the back of the trap ensuring it is not under the trigger plate. The elliotts need to be placed flat on the ground and preferably placed under shrubs or on the western side of any vegetation to reduce the risk of exposure from the morning sun. Each individual trap must be laid in consecutive number sequence and marked with flagging tape. Ensure that the traps are keep in the same vegetation type.

Cage Traps

Each trap-line requires two cage traps which are either placed at both ends or other locations for example next to a fallen tree. The cage traps are baited with a peanut butter and rolled oats mixture. A small rock should placed on top of the cage trap to minimise disturbance from birds and foxes. To limit exposure leaf litter can be spread over the top of the trap. The door should be able to close without brushing against sticks and stones.

Active searching

Each site will need to be checked for at least 1 hour over the 4 days for reptiles and frogs. Searching will is done lifting rocks and logs, raking leaf litter etc. Any tracks or scats should also be recorded and if any sub-fossil material is found a sample and location details may be recorded. Spotlighting will also occur in each site for nocturnal reptiles and mammals. **Please bring a torch along.**

Opportunistic sightings

Any observations during the day or night outside the sites and while travelling between them should be recorded.

Voucher specimens

If requested by the SA Museum, a small number of specimens may be taken for scientific purposes, subject to conditions of our collecting permits.

Animal handling

If any snakes are encountered either in the pit-falls or while active searching please advise one of the scientific leaders immediately. **You must not handle snakes.** Some species of legless lizards look remarkably like snakes. If you are unsure of the species please inform your group leader promptly. All animals need to be handled with care as some creatures may bite and then escape. Safe handling of animals will be shown to you by the scientific leaders. All captures should be marked to ascertain recapture numbers.

Equipment

Calico Bags	Callipers or ruler
Data sheets and folder	GPS
Flagging Tape	Hat and sunscreen
Pencil and eraser	Identification books – Reptiles (Cogger),)Mammals (Strahan), Birds (Simpson & Day, Pizzey etc

Reference

Owens, H. (Ed.) (2000) *Guidelines for Vertebrate Surveys in South Australia Using the Biological Survey of South Australia*. Biological Survey and Research Section, National Parks and Wildlife SA, Department for Environment and Heritage.

Example of a data sheet which will be used during the Munyaroo Expedition

GUIDELINES FOR VERTEBRATE SURVEYS IN SOUTH AUSTRALIA

EXAMPLE

BIOLOGICAL SURVEY —*FLINDERS RANGES SURVEY #104*
SA Department for Environment & Heritage

PID Number .....

BIRDS
SITE/QUADRAT DATA

Sheet number: 1

Camp: WEETOOTLA GORGE **SiteID:** WET0501

Observer/s: LPP **Time Start:** 0630 **End:** 0730

Weather: cool / light breeze **Date:** 23 11 98

SPECIES	TIME (24 hr)	NUMBER OBSERVED	METHOD (a)	(b) STRATA	(b) MACRO	(b) MICRO	COMMENTS (c)
GYMNORHINA TIBICEN	0630	2	6	34	17	17	
CACATUA ROSEICAPILLA	0630	2	6	34	17	17	
PHAPS CHALCOPTERA	0630	1	6	34	17	17	
ACANTHAGENYS RUFOGULARIS	0645	1	7	-	-	-	
FALCO BERIGORA	0645	1	6	36	33	14	
DROMAIUS NOVAEHOLLANDIAE	0700		11+17	-	-	-	
HIRUNDO NIGRICANS	0715	1	6	35	-	19	

(a) METHOD
1=pit
2=elliott
3=Harp trap
4=Mist net
5=captured while foraging
6=observed
7=heard
8=nest
9=eggs
10= skeleton/feathers
11=droppings
12=other (in comments)
13=diggings
14=cage trap
15=seen while spotlighting
16=heard while spotlighting
17=tracks
18=roadkill
21=shot

(b) STRATA
34=<0.5m
35=0.5m-5.0m
36=>5.0m

MACROHABITAT
16=Shrub**
17=On ground
33=Tree*

****SHRUB**
multi-stemmed woody plant <5m

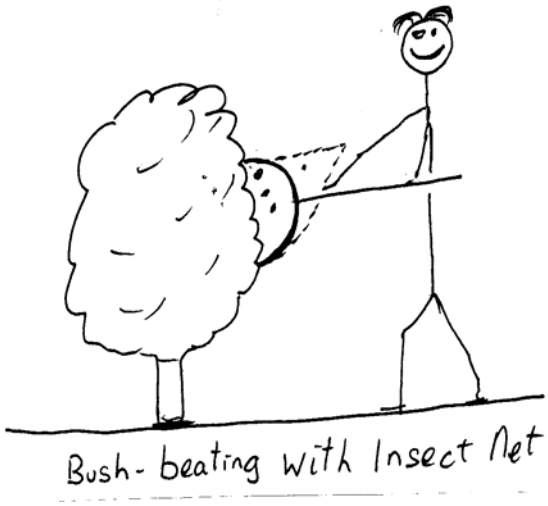
***TREE**
single stemmed woody plant >5m

MICROHABITAT
1=under rocks
2=on rocks
3=around rocks
4=under log
5=on log
6=in log
7=tree hollow
8=loose bark, live tree
9=foliage
10=in leaf litter
11=in burrow
12=on termite mound
13=canopy
14=upper branches
15=lower branches
17=on ground
18=over canopy
19=overhead
20=on trunk
21=in soil, under log
22=bark, dead tree
23=under leaf litter
24=in soil, under leaf litter
25=in termite mounds
26=under plants on ground
27=under plants on litter
28=over dam/pool
29=on surface of dam/pool
30=at canopy height
31=under canopy height
32=other (put in comments)

(c) COMMENTS
DO NOT record bird species from adjacent patches by indicating this in the comments. Put on separate patch data sheet.

Invertebrate surveys

Knowledgeable persons: Peter Bailey, Jan Forrest, David Hirst



Sorting and identification: Most captured invertebrates will be released after noting their taxonomic Phylum, Order and Family. Those for which a plant association has been noted will be retained and lodged in the South Australian Museum.

Bird Survey

Trevor Cox and Graham Carpenter

There will be two bird activities offered:

Survey of birds within habitat quadrats and in other parts of the park

Mallee fowl survey

Table 1. Check list of birds recorded from Munyaroo is from The South Australian Ornithologist 2001 33: 127-131 by Trevor Cox

The following birds have been recorded at Munyaroo Conservation Park. * = an introduced bird species.

Emu *Dromaius novaehollandiae*. A few sightings in thick scrub; footprints and scats on tracks on all visits.

Malleefowl *Leipoa ocellata*. Many mounds in central area of park (>5 km from coast), in areas of higher sand ridges, thicker scrub and a wider variety of shrubs. Several mounds known to be active in 1997 and 1998, and sightings of birds on previous visits. Suspended activity at mounds visited in July 1999, possibly due to dry year.

Stubble Quail *Coturnix pectoralis*. One sighting on 13/10/98 in clearing near the coast.

Grey Teal *Anas gracilis*. 6 birds on sea on 5/10/94.

Little Pied Cormorant *Phalacrocorax melanoleucos*. Small numbers on all visits.

Pied Cormorant *Phalacrocorax varius*. Small numbers on all visits.

Australian Pelican *Pelecanus conspicillatus*. Up to 6 birds on several visits; 20 birds on 13/7/99.

White-faced Heron *Egretta novaehollandiae*. 1 bird on beach on 5/10/94.

Collared Sparrowhawk *Accipiter cirrhocephalus*. A pair or single birds on all visits; a breeding record on 13/10/85.

Wedge-tailed Eagle *Aquila audax*. 1 bird on 28/8/87.

Little Eagle *Hieraaetus morphnoides*. A breeding pair on 13/10/85 and a single bird on 28/8/87.

Brown Falcon *Falco berigora*. Recorded on 13/10/85 & 5/10/94.

Nankeen Kestrel *Falco cenchroides*. Recorded on 13/10/85, 28/8/87 & 5/10/94.

Eurasian Coot *Fulica atra*. One obviously sick bird wandering on mud flats on 13/10/85.

Little Button-quail *Turnix velox*. 1 bird in thick scrub on 5/10/94.

Painted Button-quail *Turnix varia*. 1 bird on 10/7/98.

Common Greenshank *Tringa nebularia*. 2–3 birds on beach on most visits.

Grey-tailed Tattler *Heteroscelus brevipes*. 10–20 birds feeding on tidal flats on 13/10/85 & 28/8/87.

Ruddy Turnstone *Arenaria interpres*. A few records of small numbers.

Great Knot *Calidris tenuirostris*. 1 bird on 13/10/85.

Red-necked Stint *Calidris ruficollis*. Small groups on 13/10/85 & 5/10/94.

Pied Oystercatcher *Haematopus longirostris*. 2 birds on 13/10/85 & 8 birds on 28/10/87.

Sooty Oystercatcher *Haematopus fuliginosus*. Pairs on 13/10/85, 28/8/87 & 5/10/94.

Grey Plover *Pluvialis squatarola*. 5 birds on 28/8/87 and single birds on 13/10/85 & 5/10/94.

Red-capped Plover *Charadrius ruficapillus*. A few birds on 13/10/85.

Greater Sand Plover *Charadrius leschenaultii*. 1 bird with a group of stints on 5/10/94.

Banded Lapwing *Vanellus tricolor*. Sightings in coastal samphire on 5/10/94, 19/10/94 & 20/8/98.

Pacific Gull *Larus pacificus*. 2–3 birds seen on most visits.

Silver Gull *Larus novaehollandiae*. Always present in small numbers.

Caspian Tern *Sterna caspia*. 1 bird on 13/10/85, 28/8/87 & 5/10/94.

Crested Tern *Sterna bergii*. Small groups of 2–10 birds seen scattered along coast.

Fairy Tern *Sterna nereis*. Small numbers seen on some visits.

*Rock Dove *Columba livia*. 1 bird on 13/10/85.

Common Bronzewing *Phaps chalcoptera*. Single birds scattered throughout scrub seen on all visits. Drinks at dawn and dusk when rain falls or dew collects on old shed and tank in the park and dams outside the park.

Crested Pigeon *Ocyphaps lophotes*. 3–4 birds seen on every visit in park in open country on northern boundary.

Galah *Cacatua roseicapilla*. Small numbers of birds, usually less than six, seen on every visit.

Cockatiel *Nymphicus hollandicus*. 6 birds on 13/10/85 & 2 birds on 19/10/89.

Purple-crowned Lorikeet *Glossopsitta porphyrocephala*. Common in small groups especially when eucalypts were flowering.

Australian Ringneck *Barnardius zonarius*. Moderately common.

Mulga Parrot *Psephotus varius*. Moderately common.

Pallid Cuckoo *Cuculus pallidus*. Small numbers seen in every year.

Fan-tailed Cuckoo *Cacomantis flabelliformis*. Small numbers seen in every year.

Black-eared Cuckoo *Chrysococcyx osculans*. Small numbers seen in every year.

Horsfield's Bronze-Cuckoo *Chrysococcyx basalis*. Small numbers seen in every year.

Southern Boobook *Ninox novaeseelandiae*. 1 bird heard on 13/10/85.

Barn Owl *Tyto alba*. 1 bird heard on 20/8/98.

Spotted Nightjar *Eurostopodus argus*. Single birds heard on 20/8/89 & 19/10/98.

Australian Owlet-nightjar *Aegotheles cristatus*. Seen or heard on all visits.

Rainbow Bee-eater *Merops ornatus*. Common in spring/summer in flocks of 20 birds.

Rufous Treecreeper *Climacteris rufa*. 1 bird on 13/10/85.

Splendid Fairy-wren *Malurus splendens*. The race *callainus* is common in the park, especially in open areas with chenopods and nitre-bush, where it breeds.

Blue-breasted Fairy-wren *Malurus pulcherrimus*. Common in the mallee, whereas the two other fairy-wren species are more common in non-eucalypt habitat.

White-winged Fairy-wren *Malurus leucopterus*. Common in park in saline areas near coast in samphire and nitre-bush and in open areas with saltbush *Atriplex* sp., bluebush and broom emubush *Eremophila scoparia*.

Spotted Pardalote *Pardalotus punctatus*. Common. Seen or heard on all visits.

Striated Pardalote *Pardalotus striatus*. Common. Seen on all visits, with greater numbers seen when eucalypts are flowering heavily.

Shy Heathwren *Hylacola cauta*. Single birds seen on most visits.

Redthroat *Pyrrholaemus brunneus*. A breeding record from the south of the park in October 1987.

Weebill *Smicrornis brevirostris*. Common in flowering eucalypts. Seen on every visit.

Inland Thornbill *Acanthiza apicalis*. Common, seen on every visit, especially in higher sand ridges with grass-leaf hakea.

Chestnut-rumped Thornbill *Acanthiza uropygialis*. Uncommon. A few birds seen on some visits.

Yellow-rumped Thornbill *Acanthiza chrysorrhoa*. Small groups of 10–15 seen in open areas on all visits.

Southern Whiteface *Aphelocephala leucopsis*. A few on northern boundary of park, with numbers declining in recent years.

Red Wattlebird *Anthochaera carunculata*. Common. Many seen on all visits.

Spiny-cheeked Honeyeater *Acanthagenys rufogularis*. Very common. Many birds seen or heard at all times of the day when moving through the bush.

Yellow-throated Miner *Manorina flavigula*. Common. 4–6 groups of 20–30 birds scattered throughout the scrub.

Singing Honeyeater *Lichenostomus virescens*. Common. Small numbers compared with Yellow-plumed Honeyeaters, but 2–3 seen on every walk through the scrub.

White-eared Honeyeater *Lichenostomus leucotis*. Common, especially in thicker scrub on higher dunes in the central part of the park. Heard throughout the area on all visits.

Purple-gaped Honeyeater *Lichenostomus cratitius*. Large numbers on 13/10/85 and 10/7/98 visits when large areas

of eucalypts were flowering.

Yellow-plumed Honeyeater *Lichenostomus ornatus*. Very common. Most common honeyeater in the park with large numbers throughout the scrub.

Brown-headed Honeyeater *Melithreptus brevirostris*. 20–30 birds seen in a group moving through the area when eucalypts were flowering well.

White-fronted Honeyeater *Phylidonyris albifrons*. Common. Heard or seen throughout park on all visits.

Crimson Chat *Epthianura tricolor*. 4 birds seen on coastal samphire on 13/10/85. No breeding recorded within the park.

Orange Chat *Epthianura aurifrons*. 4 birds seen on coastal samphire on 13/10/85. No breeding recorded within the park.

White-fronted Chat *Epthianura albifrons*. Small numbers seen on all visits in samphire and nitre-bush.

Jacky Winter *Microeca fascinans*. Very common. Seen on all visits in open areas of mallee.

Red-capped Robin *Petroica goodenovii*. Small numbers seen on most visits before 1994, seen less frequently in recent years.

Western Yellow Robin *Eopsaltria griseogularis*. Small numbers seen in association with dryland tea-tree *Melaleuca lanceolata*.

Southern Scrub-robin *Drymodes brunneopygia*. 2–3 birds recorded on 13/10/85, 19/10/89 & 10/7/98.

White-browed Babbler *Pomatostomus superciliosus*. Common. 5–6 groups of birds seen on all visits.

Chestnut Quail-thrush *Cinclosoma castanotus*. A few pairs seen on all visits on sandy flats with a diversity of shrubs, e.g. tar bush *Eremophila glabra*, broom emubush and daisy-bush.

Varied Sittella *Daphoenositta chrysoptera*. Two sightings of small groups on 19/10/88 and 19/10/89.

Crested Bellbird *Oreoica gutturalis*. Common. Heard calling throughout on all visits.

Gilbert's Whistler *Pachycephala inornata*. 1 bird seen on 13/10/85 & 10/7/98.

Rufous Whistler *Pachycephala rufiventris*. 1 bird seen on 19/10/89 & 5/10/94.

Grey Shrike-thrush *Colluricincla harmonica*. Common. Seen on all visits.

Restless Flycatcher *Myiagra inquieta*. A few on most visits; many seen & 4 nests on 28/8/87.

Grey Fantail *Rhipidura fuliginosa*. Small numbers in open areas.

Willie Wagtail *Rhipidura leucophrys*. Small numbers in open areas. 2–3 birds seen on all visits.

Black-faced Cuckoo-shrike *Coracina novaehollandiae*. Common. Group of 5–6 birds seen on all visits.

White-winged Triller *Lalage sueurii*. Seen on 13/10/89 and 5/10/94.

Masked Woodswallow *Artamus personatus*. In mixed flocks with the next species on 13/10/85, 19/10/89 & 5/10/94.

White-browed Woodswallow *Artamus superciliosus*. In mixed flocks with the previous species on 13/10/85, 19/10/89 & 5/10/94.

Black-faced Woodswallow *Artamus cinereus*. Seen on all visits in small numbers in open areas on northern edge of park. More common in open saltbush to the north.

Dusky Woodswallow *Artamus cyanopterus*. Groups of up to 20 birds on most visits.

Grey Butcherbird *Cracticus torquatus*. Common. Seen on all visits.

Australian Magpie *Gymnorhina tibicen*. 2–3 birds seen in open areas on all visits.

Grey Currawong *Strepera versicolor*. Common throughout the park. Seen on all visits.

Australian Raven *Corvus coronoides*. Ranged from 2–3 birds to large flocks.

Singing Bushlark *Mirafra javanica*. 1 bird on 20/8/89.

Richard's Pipit *Anthus novaeseelandiae*. Common along tracks and in open areas.

*House Sparrow *Passer domesticus*. 1 bird on 13/10/85.

Zebra Finch *Taeniopygia guttata*. A small flock on 13/10/85.

Mistletoebird *Dicaeum hirundinaceum*. 1 bird in a mistletoe on a bullock bush *Alectryon oleifolius* on the northern boundary on 10/7/98.

Welcome Swallow *Hirundo neoxena*. 5 birds at old tank at shed.

Tree Martin *Hirundo nigricans*. 20–30 birds recorded on 13/10/85 & 5/10/94.

Rufous Songlark *Cincloramphus mathewsi*. 3 birds recorded on 19/10/89.

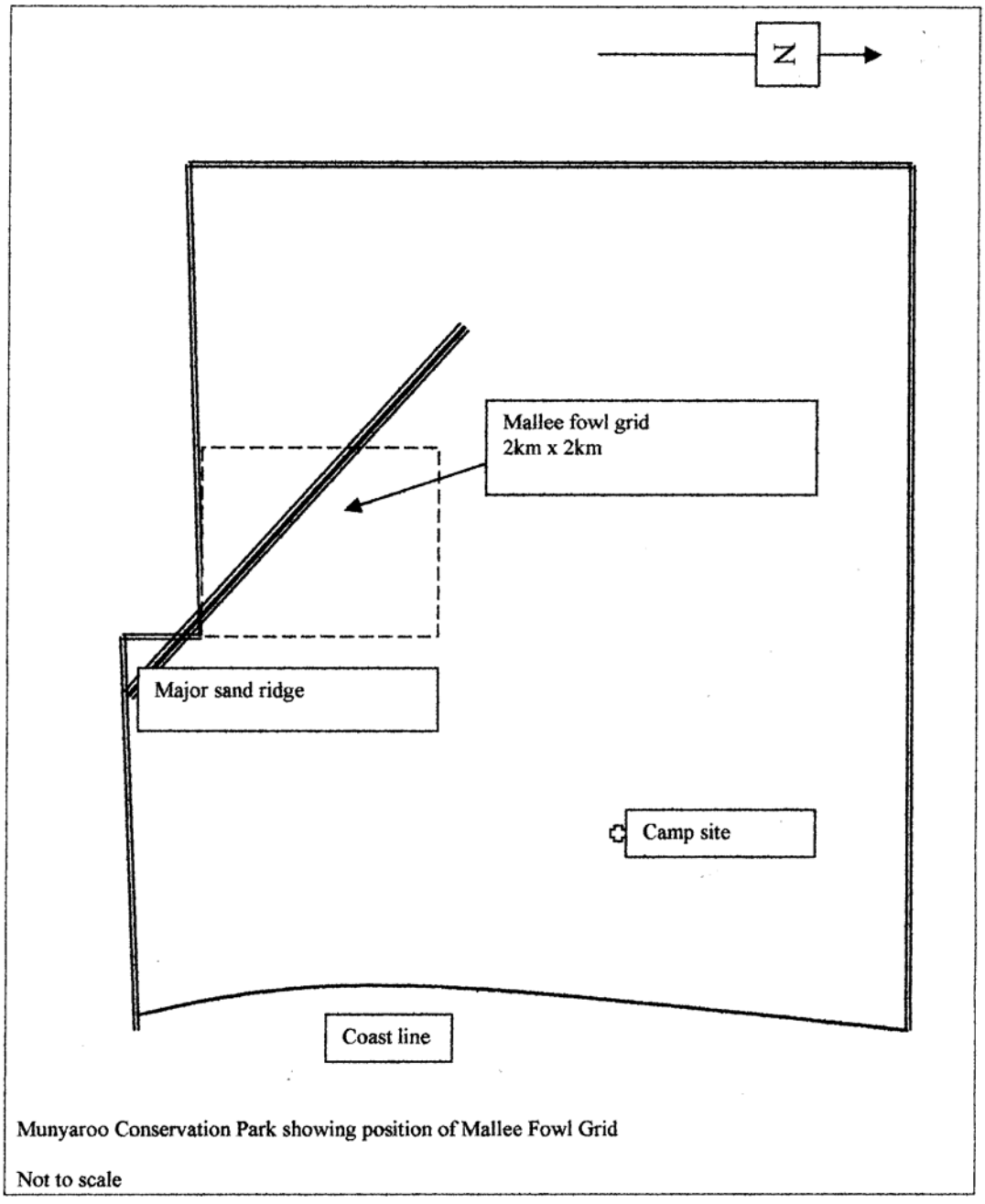
Brown Songlark *Cincloramphus cruralis*. 1 bird recorded on 13/10/85 & 20/8/89.

Silvereye *Zosterops lateralis*. Uncommon. 3–4 birds seen on most visits.

*Common Starling *Sturnus vulgaris*. 2–3 birds seen near coast on most visits.

Mallee Fowl Survey.

MALLEE FOWL SURVEY
Grid set up and brief overview of technique.



Munyaroo Conservation Park showing position of Mallee Fowl Grid

Not to scale

Botanical Survey

Darrell Kraehenbuehl

The objectives of this survey are:

- Quantify the species composition of some of the plant communities on Myunyaroo using nested and linear quadrats.
- Add to the checklist of plants recorded from Munyaroo and collect plant and lichen specimens for the State Herbarium, Adelaide.
- Show expeditioners rare and endangered plants and unusual plant communities.

Table 2 .The following preliminary check list of plants at Munyaroo was prepared by Kingsley Turner following a recce. trip in April, 2002. It is likely that many more species will be in flower and identifiable in September. Use the habitat classifications provided by Kingsley to record any positive identifications of plants which you encounter during your survey.

Botanical survey data sheet

Observer (you)	Date(s)	Identifying authority

PLANT SPECIES LIST FOR MUNYAROO CONSERVATION PARK.
List is incomplete, based on AKT field books 8/88.

FAMILY / SCIENTIFIC NAME	COMMON NAME	VEGETATION ASSOCIATION
84.004 CUPRESSACEAE		
Callitris canescens ???	scrubby cypress pine	
Callitris preissii	southern cypress pine	A1 A2 A3 B4 B5
Callitris verrucosa	scrub cypress pine	
91.001 CASUARINACEAE		
Allocasuarina muelleriana ssp. muelleriana	common oak-bush	
91.019 PROTEACEAE		
Grevillea huegelii	comb grevillea	A1 A2 A3 A4 B5
Hakea francisiana	bottlebrush hakea	B1 B2
Grevillea pterosperma	dune grevillea	

FAMILY / SCIENTIFIC NAME	COMMON NAME	VEGETATION ASSOCIATION

91.026 SANTALACEAE		
Exocarpos aphyllus	leafless cherry	A1 A2 A3 A4 B5
Exocarpos sparteus	slender cherry	B1 B2 B3
Santalum acuminatum	quandong	A1 A2 A3 A4 B5
91.028 LORANTHACEAE		
Amyema miquelii	box mistletoe	
Lysiana exocarpi ssp. exocarpi	harlequin mistletoe	
91.037 GYROSTEMONACEAE		
Gyrostemon ramulosus	bushy wheel-fruit	
91.040 AIZOACEAE		
Carpobrotus sp.	pigface	
Disphyma crassifolium ssp. clavellatum	round-leaf pigface	
Tetragonia implexicoma	bower spinach	
91.047 CHENOPODIACEAE		
Atriplex paludosa ssp. cordata	marsh saltbush	
Atriplex stipitata	bitter saltbush	A1 A2 A3 A4 B5
Atriplex vesicaria ssp. *variabilis*	bladder saltbush	A1 A2 A3 A4 B5
Dissocarpus paradoxus	ball bindyi	
Enchylaena tomentosa var. *tomentosa*	ruby saltbush	A1 A2 A3 A4 B5
Maireana brevifolia	short-leaf bluebush	
Maireana erioclada	rosy bluebush	A1 A2 A3 A4 B5
Maireana pentatropis	erect mallee bluebush	
Maireana pyramidata	black bluebush	
Maireana radiata	radiate bluebush	A1 A2 A3 A4 B5
Maireana sedifolia	bluebush	A1 A2 A3 A4 B5
Rhagodia crassifolia	fleshy saltbush	A1 A2 A3 A4 B5
Rhagodia preissii ssp. *preissii*	mallee saltbush	B5
Rhagodia spinescens	spiny saltbush	
Rhagodia ulicina	intricate saltbush	A1 A2 A3 A4
Sclerolaena diacantha	grey bindyi	A1 A2 A3 A4 B5
Sclerolaena obliquicuspis	bindyi	A1 A2 A3 A4 B5
Sclerostegia arbuscula	shrubby samphire	
Threlkeldia diffusa	coast bonefruit	
91.049 AMARANTHACEAE		
Ptilotus obovatus var. obovatus	silver mulla mulla	
Ptilotus sp.	mulla mulla	

FAMILY / SCIENTIFIC NAME	COMMON NAME	VEGETATION ASSOCIATION

91.072 LAURACEAE		
Cassytha glabella forma dispar ?	slender dodder-laurel	
91.139 CRUCIFERAE		
**Carrichtera annua*	Ward's weed	A1 A2 A3 A4 B5
91.173 PITTOSPORACEAE		
Bursaria spinosa	sweet bursaria	A1 A2 A3 A4 B5
Pittosporum phylliraeoides var. *microcarpa*	native apricot	A1 A2 A3 A4 B5
91.182 LEGUMINOSAE		
Acacia ancistrophylla var. *lissophylla*	hook-leaf wattle	B5
Acacia ligulata	umbrella bush	B3 B4 B5 B6
Acacia notabilis	notable wattle	
Acacia oswaldii	umbrella wattle	
Acacia papyrocarpa	western myall	A1 A2 A3 A4
Acacia rigens	nealie	B1 B2 B3 B6
Daviesia benthamii ssp. humilis	mallee bitter-pea	
Senna artemisioides ssp. *filifolia*	fine-leaf desert senna	A1 A2 A3 A4 B5
91.188 OXALIDACEAE		
Oxalis sp.	sorrel	
91.197 ZYGOPHYLLACEAE		
Nitraria billardierei	nitre-bush	A4 C2
Zygophyllum ammophilum	sand twinleaf	B3 B4 B5 B6
Zygophyllum apiculatum	pointed twinleaf	A1 A2 A3 A4 B4 B5
Zygophyllum aurantiacum/eremaeum	shrubby twinleaf	
Zygophyllum billardierei	coast twinleaf	
Zygophyllum glaucum???	pale twinleaf	

FAMILY / SCIENTIFIC NAME	COMMON NAME	VEGETATION ASSOCIATION

91.204 EUPHORBIACEAE		
Euphorbia drummondii	caustic weed	
91.212 RUTACEAE		
Geijera linearifolia	sheep bush	B4 B5
Microcybe pauciflora	yellow microcybe	B3 B4 B5
Phebalium bullatum	silvery phebalium	B1 B2 B3
91.236 SAPINDACEAE		
Alectryon oleifolius ssp. *canescens*	bullock bush	A1 A2 A3 A4 B5
Dodonaea viscosa ssp. *angustissima*	narrow-leaf hop-bush	A1 A2 A3 A4 B5
91.263 RHAMNACEAE		
Cryptandra amara var. amara	spiny cryptandra	
91.269 MALVACEAE		
Alyogyne sp		
91.271 STERCULIACEAE		
Lasiopetalum behrii	pink velvet-bush	
91.282 VIOLACEAE		
Hybanthus floribundus ssp. floribundus	shrub violet	
91.295 FRANKENIACEAE		
Frankenia sp	sea-heath	

FAMILY / SCIENTIFIC NAME	COMMON NAME	VEGETATION ASSOCIATION

91.306 MYRTACEAE		
Baeckea crassifolia	desert baeckea	
Calytrix tetragona	common fringe-myrtle	B3 B4 B5 B6
Eucalyptus brachycalyx	gilja	B3 B4 B5
Eucalyptus gracilis	yorrell	B4 B5 B6
Eucalyptus leptophylla	narrow-leaf red mallee	
Eucalyptus incrassata	ridge-fruited mallee	B1 B2 B3
Eucalyptus oleosa	red mallee	B4 B5 B6
Eucalyptus socialis	beaked red mallee	B1 B2 B3 B4
Leptospermum coriaceum	dune tea-tree	B1 B2 B3
Melaleuca lanceolata ssp. *lanceolata*	dryland tea-tree	B3 B4 B5 A
Melaleuca pauperiflora ssp. *mutica*	boree	
Melaleuca uncinata	broombush	
91.346 EPACRIDACEAE		
Leucopogon cordifolius	heart-leaf beard-heath	
91.367 GENTIANACEAE		
**Centaurium* sp	centaury	
91.369 APOCYNACEAE		
Alyxia buxifolia	sea box	
91.386 AVICENNIACEAE		
Avicennia marina var. resinifera	grey mangrove	
91.392 LABIATAE		
**Marrubium vulgare*	horehound	
Westringia rigida	stiff westringia	A1 A2 A3 A4 B5

FAMILY / SCIENTIFIC NAME	COMMON NAME	VEGETATION ASSOCIATION

91.395 SOLANACEAE		
Grammosolen dixonii	Dixon's ray-flower	C2
**Lycium ferocissimum*	African boxthorn	Weed species in most assocs
*Nicotiana glauca	tree tobacco	
*Solanum nigrum	black nightshade	
Solanum sp		
91.415 MYOPORACEAE		
Eremophila crassifolia	thick-leaf emubush	B1 B2 B3 B4 B5
Eremophila glabra ssp. glabra	tar bush	
Eremophila oppositifolia var. oppositifolia	opposite-leaved emubush	
Eremophila scoparia	broom emubush	A1 A2 A3 A4 B5
Myoporum insulare	common boobialla	C2
Myoporum platycarpum	false sandalwood	A1 A2 A3 A4 B5
91.430 GOODENIACEAE		
Goodenia varia	sticky goodenia	B3 B4 B6
Scaevola spinescens	spiny fanflower	A1 A2 A3 A4 B5
91.435 COMPOSITAE		
Calotis sp	burr-daisy	
**Carthamus lanatus*	saffron thistle	
**Centaurea calcitrapa*	star thistle	
**Cotula coronopifolia ???*	water buttons	
Cratystylis conocephala	bluebush daisy	A1 A2 A3 A4 B5
Olearia axillaris	coast daisy-bush	
Olearia brachyphylla	short-leaf daisy-bush	
Olearia lepidophylla	clubmoss daisy-bush	
Olearia muelleri	Mueller's daisy-bush	B4 B5
Olearia pimeleoides ssp. *pimeleoides*	pimelea daisy-bush	A1 A2 A3 A4 B5
Podolepis capillaris	wiry podolepis	
Senecio lautus	variable groundsel	

FAMILY / SCIENTIFIC NAME	COMMON NAME	VEGETATION ASSOCIATION

91.451 LILIACEAE		
**Asphodelus fistulosus*	onion weed	
Dianella revoluta		All but extremely saline assocs
Lomandra effusa	scented mat-rush	B3 B4 B5 B6
91.495 GRAMINEAE		
Stipa sp		
Triodia irritans	spinifex	B1 B2 B3 B6
91.504 CYPERACEAE		
Lepidosperma viscidum	sticky sword-sedge	All but extreme saline areas.

Vegetation association

A Heavy textured soil types types. Soils with high proportion of clays, +/- calcretes, nodular carbonate, buckshot gravels in parts. Gilgai development may be evident with associated micro-relief.

A1 *Acacia papyrocarpa* Low Open Woodland

A2 *Alectryon oleifolius* ssp. *canescens* shrubland to low open woodland

A3 *Dodonaea viscosa* ssp. *angustissima* Shrublands

A4 Chenopod shrublands

B Linear dune development. Dunes with a general NW/SE alignment. Dunes often with pale orange crests and reddish flanks. Texture shifts across dune profile from sands on crests to loamy sands/sandy loams at foot slopes. Swales often with heavy textured soils equivalent to Type A variants, alternatively sands may extend through swale structures. Dunes may be anchored to underlying topographic high points which will cause a shift in patterning from the sequence suggested below. These ""anomalies""may be interpreted on the basis of deviation from expected.

B1	*Eucalyptus incrassata* Open Scrub	Dune crests
B2	*Callitris verrucosa* shrubland	Dune crests (not recorded, but expected)
B3	*Eucalyptus socialis* Open Scrub	Dune slopes
B4	*Eucalyptus brachycalyx* Open Scrub	Footlopes
B5	*Eucalyptus oleosa +/- Eucalyptus gracilis* Open Scrub to low open woodland	Swale areas with heavy textured soils +/- calcretes. *E. gracilis* usually indicator of calcrete at shallow depth.
B6	*Triodia irritans* Hummock Grassland	Sand spread rather than distinct dune structure.

C1	Samphire flats	Developed inland of coastal dunes.
C2	Subcoastal shrublands	Developed on and adjacent to coastal dunes.
C3	Mangroves	Tidal creeks, minimal representation.

D areas of rock outcrop in the west of the park. Rock outcrop with a thin veneer of soils. Melaleuca uncinata shrublands appear to predominate. In parts rock outcrops are overlain by dune system and associated vegetation.

The following sp list is for an area to the immediate south of the reserve
TR1486 Olsen Hd McGregor
NVMB FB data
N.V.M.B. file: 86/0010/922
Surveyor/Source: AKT fb 15/4/86
Date: 15/4/86
84.004 CUPRESSACEAE
Callitris preissii

91.019 PROTEACEAE
Grevillea huegelii
Hakea francisiana
H. leucoptera

91.026 SANTALACEAE
Choretrum glomeratum
Exocarpos aphyllus
E. sparteus
Santalum acuminatum

91.037 GYROSTEMONACEAE
Gyrostemon ramulosus

91.040 AIZOACEAE
Carpobrotus rossii
Disphyma crassifolium
Tetragonia implexicoma

91.047 CHENOPODIACEAE
Atriplex sp.
A. vesicaria
Enchylaena tomentosa
Maireana radiata
M. triptera
Rhagodia crassifolia
R. preissii
Sclerolaena diacantha
Threlkeldia diffusa

91.072 LAURACEAE
Cassytha sp

91.173 PITTOSPORACEAE

Pittosporum phylliraeoides

91.182 LEGUMINOSAE
Acacia ligulata
A. oswaldii
A. rigens
A. sclerophylla var. *lissophylla*
A. spinescens
Eutaxia microphylla var. *microphylla*
Senna artemisioides nothossp. *coriacea*

91.197 ZYGOPHYLLACEAE
Zygophyllum apiculatum
Z. aurantiacum

91.204 EUPHORBIACEAE
Beyeria lechenaultii

91.212 RUTACEAE
Geijera linearifolia
Phebalium bullatum

91.236 SAPINDACEAE
Alectryon oleifolius ssp. *canescens*
Dodonaea bursariifolia
D. stenozyga
D. viscosa ssp. *angustissima*

91.269 MALVACEAE
Lawrencia squamata

91.271 STERCULIACEAE
Lasiopetalum behrii

91.306 MYRTACEAE
Eucalyptus brachycalyx
E. gracilis
E. incrassata
E. leptophylla
E. oleosa
E. socialis
Leptospermum coriaceum
Melaleuca acuminata
M. lanceolata
M. pauperiflora
M. uncinata

91.369 APOCYNACEAE
Alyxia buxifolia

91.381 BORAGINACEAE
Halgania cyanea

91.392 LABIATAE
Westringia rigida

91.395 SOLANACEAE
Lycium australe

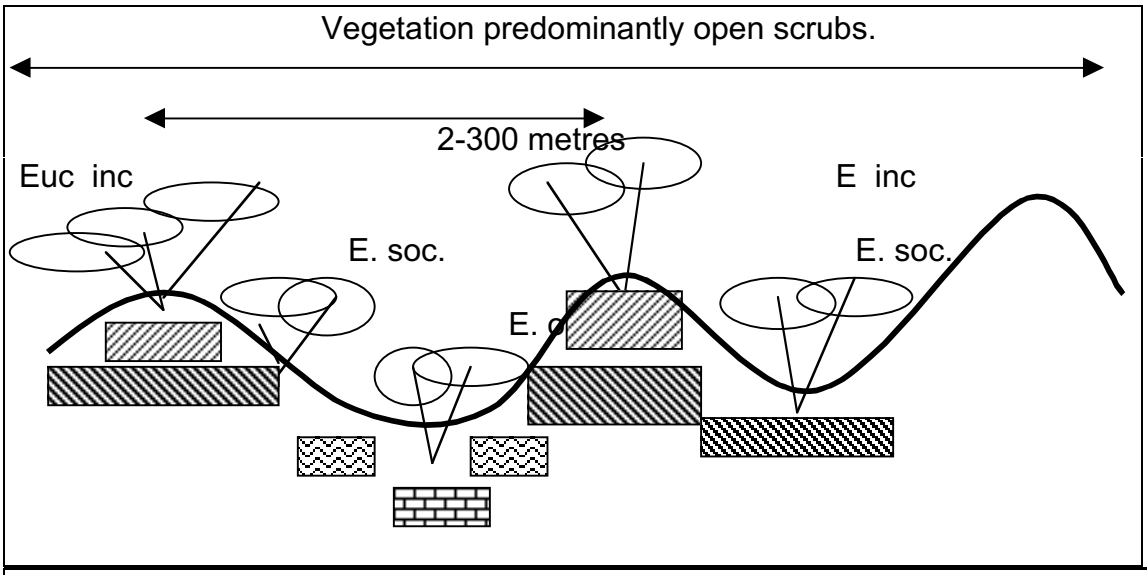
91.415 MYOPORACEAE
Eremophila alternifolia
E. crassifolia
E. deserti
E. scoparia
E. subfloccosa
Myoporum platycarpum

91.430 GOODENIACEAE
Dampiera rosmarinifolia
Goodenia varia
Scaevola spinescens

91.433 COMPOSITAE
Cratystylis conocephala
Olearia axillaris
O. muelleri
O. pimeleoides

91.451 LILIACEAE
Dianella revoluta
Lomandra collina
L. effusa

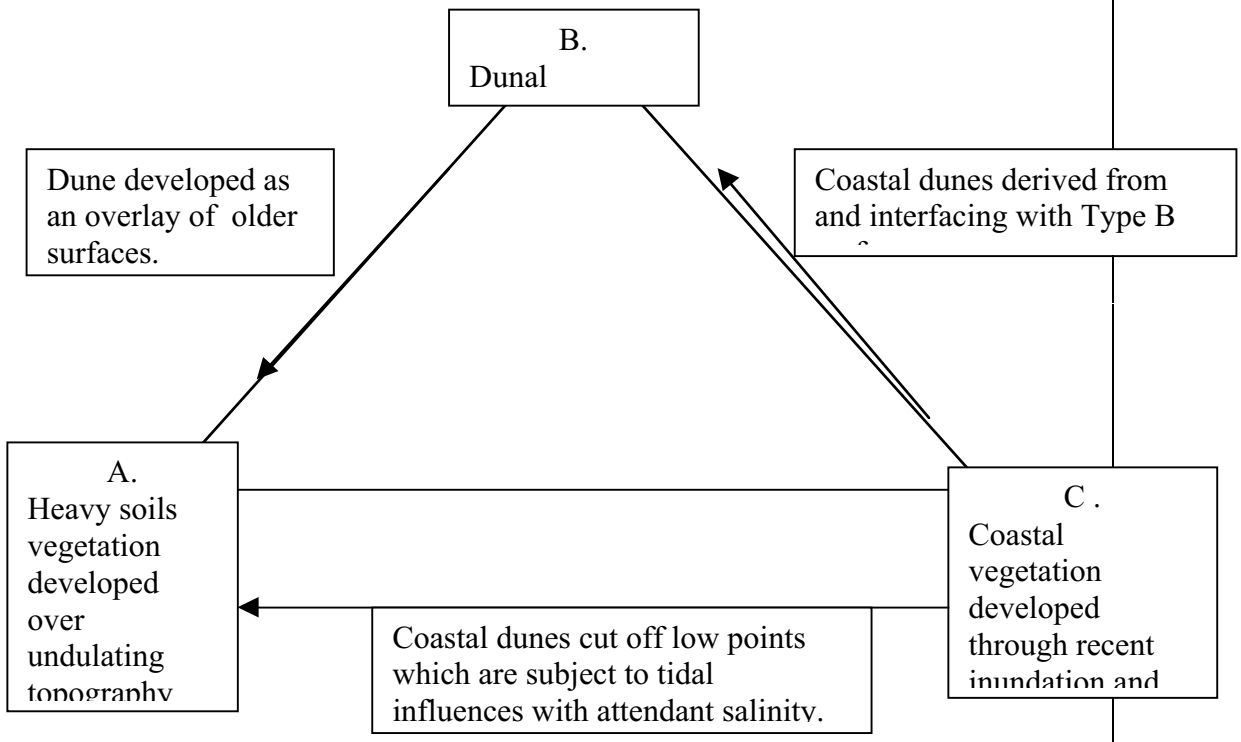
91.495 GRAMINEAE
Triodia sp



LEGEND

SOILS		**DOMINANT MALLEES**	
	Deep, pale siliceous sands	E. inc (ridge	Eucalyptus incrassata fruited Mallee) Calltris verrucosa (Warty Cypress Pine) Shrubland.
	Orange to red siliceous sands	E. soc (Summer	Eucalyptus socialis. Red Mallee)
	Loamy sands to sandy loams	No symbol (gilja)	Eucalyptus brachycalyx,
	Heavy textured loams often With Calcrete inclusions.	E. ol mallee)	Eucalyptus oleosa (red +/- Eucalyptus gracilis

Type B dunes and associated vegetation.
Topographic shifts in soil and vegetation types across a sand dune system
Apparent anomalies to this pattern occur and reflect the particular dune being anchored to some underlying topographic feature (e.g.. calcrete rise, gypsum lunette, granite outcrop etc.) at fairly shallow depth.
Spacing between dunes shown is usual for dune systems, but may vary.



Diagramatic representation of soil types and vegetation association development.

Type A vegetation associations on a variety of older soil types.

Type B vegetation on dunes that overlay type A soils & vegetation. Swales, low points in the dune system often as windows to underlying soils, these windows may also include components of Type A vegetation.
Dune systems are active (in a long time frame) and may show evidence of invasion or retreat from an area. This evidence on the basis of marked anomalous vegetation patterns with relictual sand presence.

Type C vegetation associations are the youngest types, developed through the invasion of dry land by rising sea levels c 6 000 years ago. Subsequent reworking of the inundated Type B dune sands into beach dunes has generally acted to isolate these areas from direct tidal action, however localised soil salinity has persisted.

Type D vegetation. Developed on oldest substrates, being outcropping rock and associated soils. Types A and B substrates and vegetation may merge with these areas. Type B dunes may be developed over these rocks in parts.