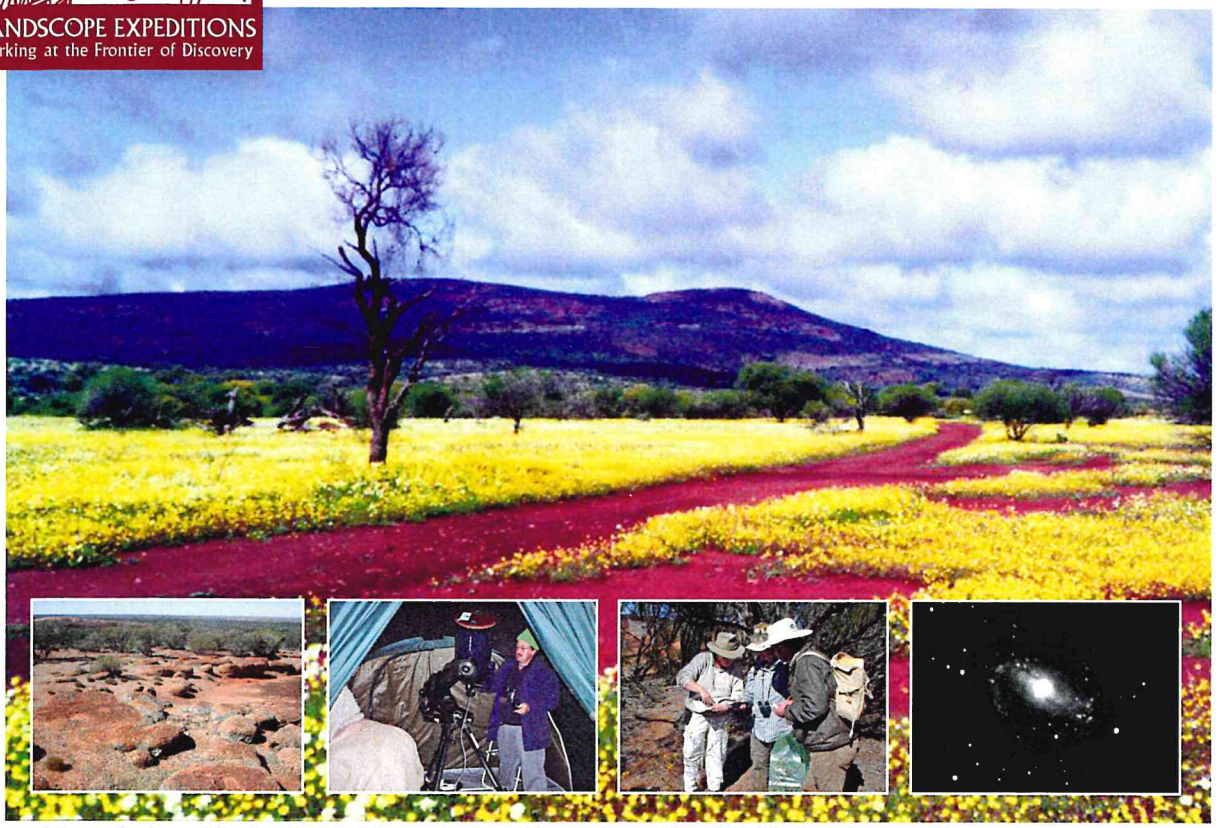
LANDSCOPE EXPEDITIONS
Working at the Frontier of Discovery

Expedition briefing



Mount Singleton, Ninghan Station (photo – Daphne Edinger). Insets: (from left) Wardagga Rock on Ninghan Station, conducting astronomical measurements, collecting plant specimens, spiral galaxy NGC-5236 (photos – DEC).

Moon over the Murchison

Astronomical and Botanical Explorations at Mount Singleton

20 – 26 May 2007

Leaders:

- Dr James Biggs, Government Astronomer, Director of Perth Observatory, DEC
- Daphne Edinger, Honorary Research Scientist, LANDSCOPE Expeditions, DEC

Representatives of the Pindiddy Aboriginal Corporation, Indigenous Protected Area managers, Ninghan Station, Western Australia

This expedition is offered by *LANDSCOPE*, the Department of Environment and Conservation's (DEC's) quarterly magazine devoted to wildlife, conservation and environmental issues in Western Australia. It is run in association with UWA Extension, The University of Western Australia.

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Murchison Region, Western Australia

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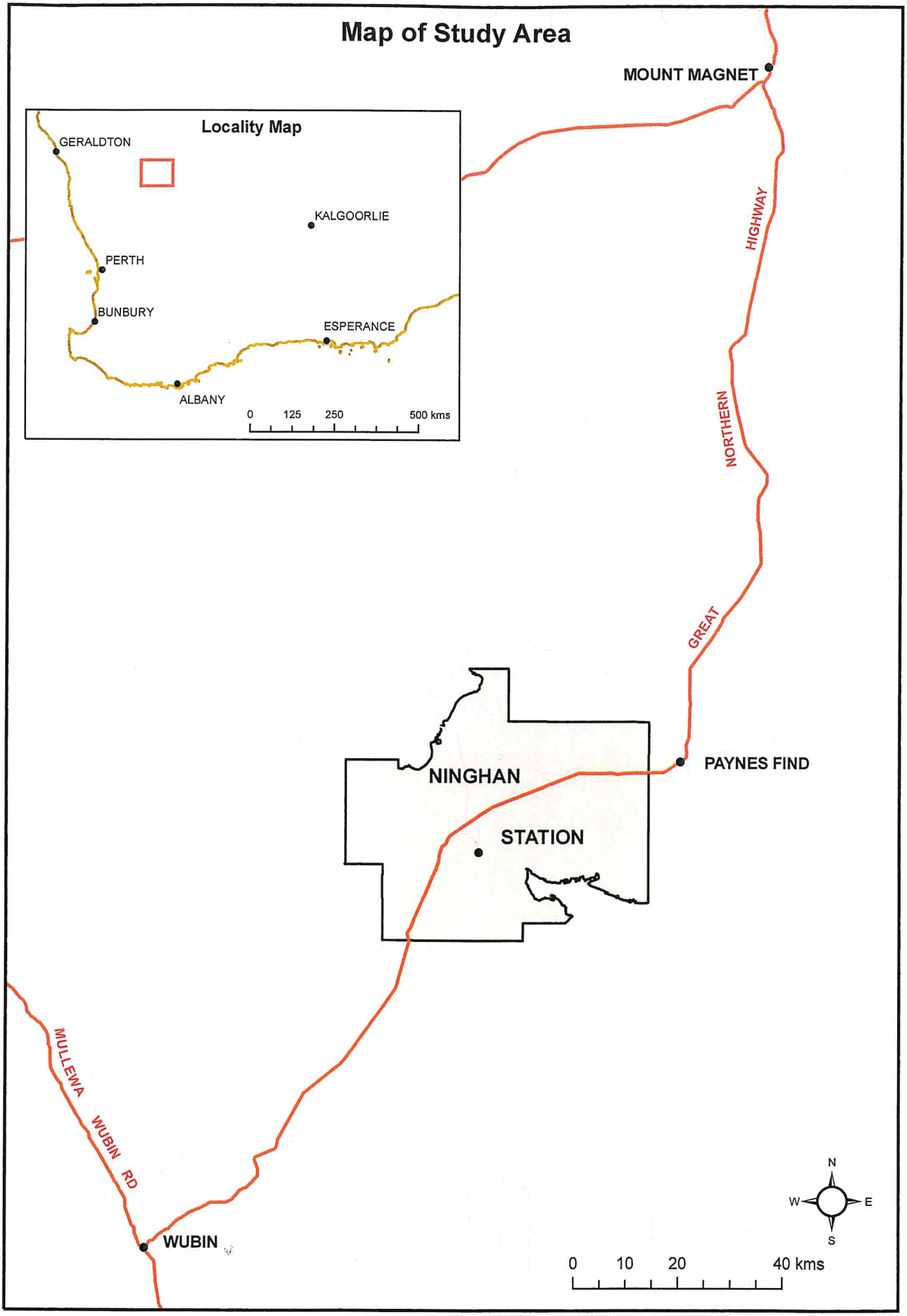

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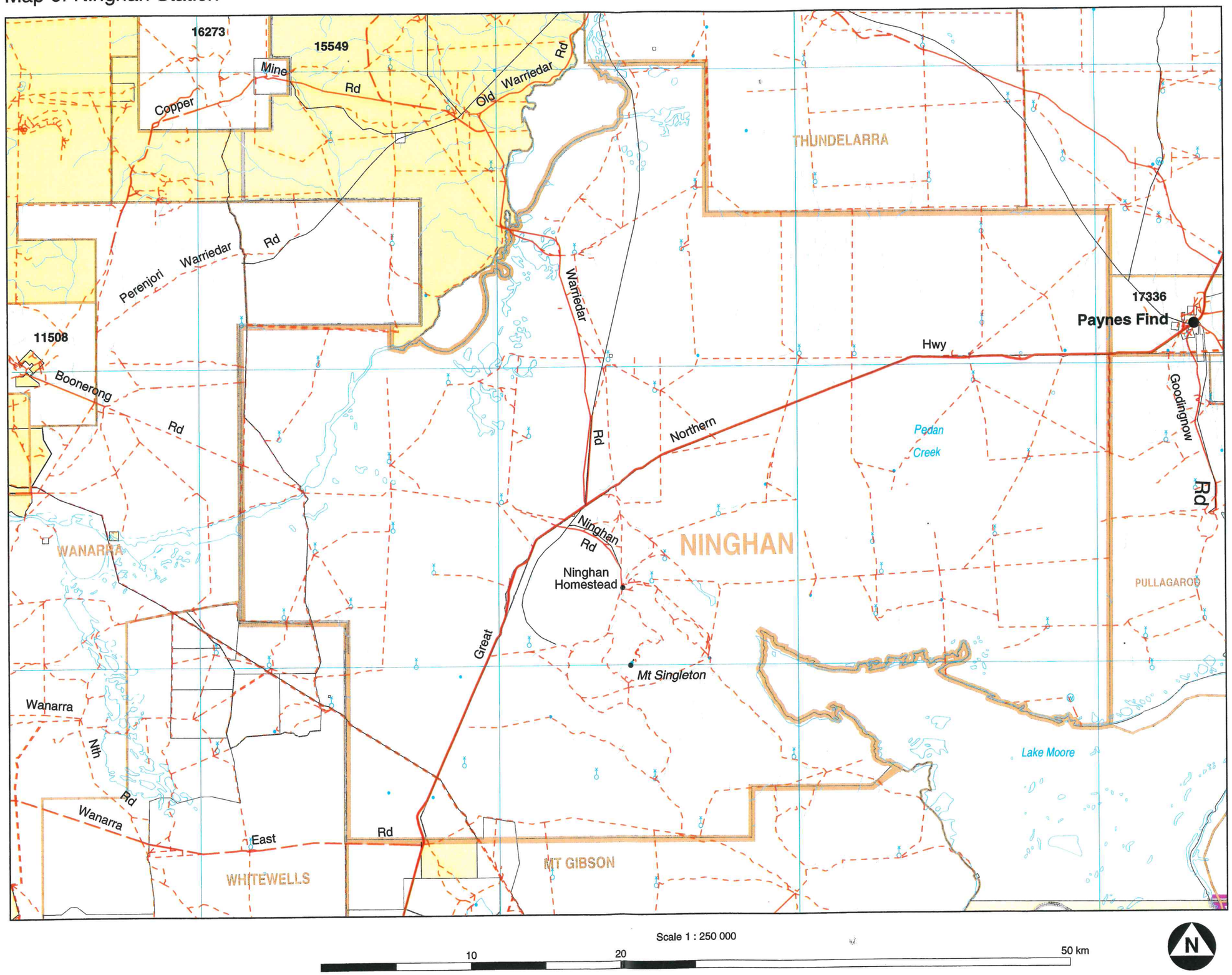
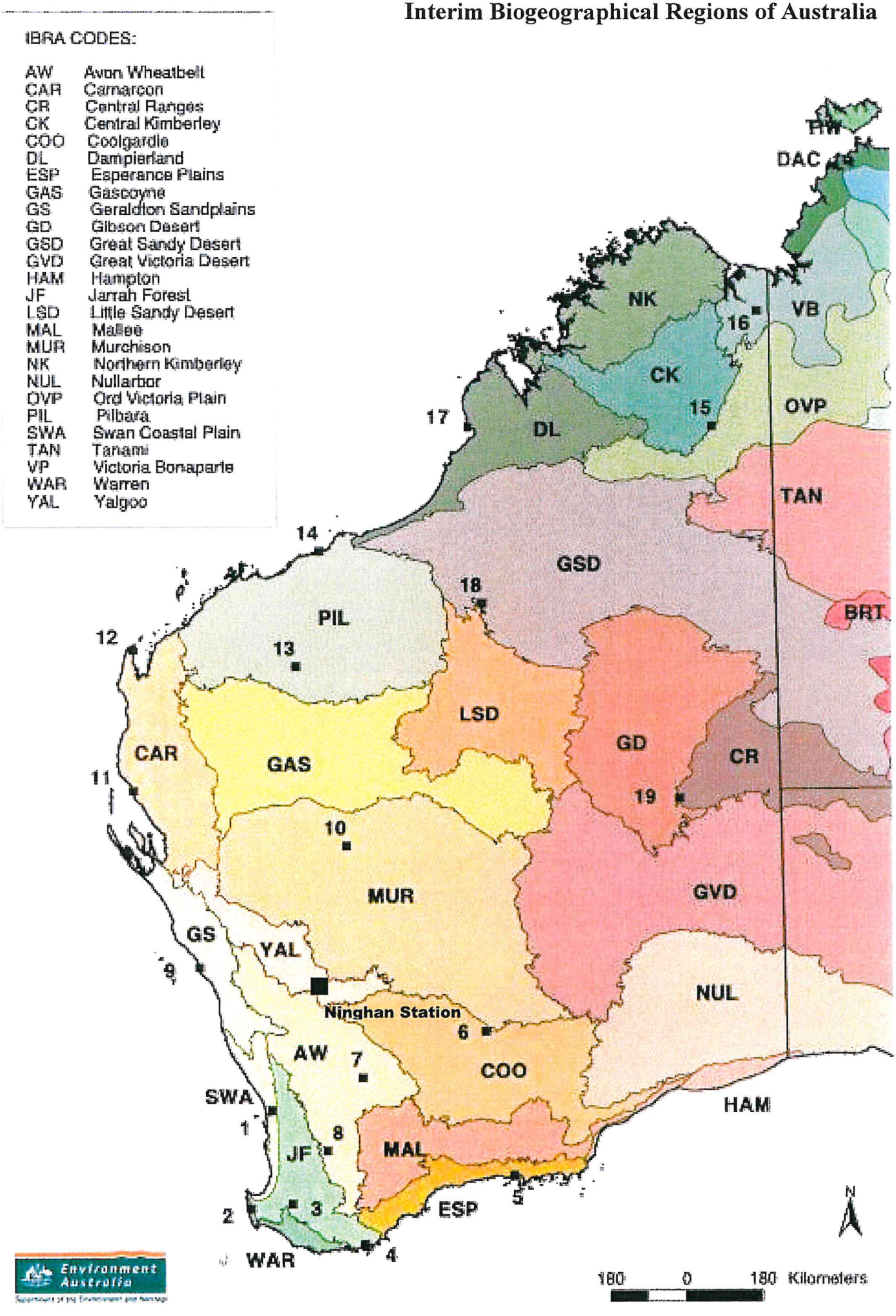


Interim Biogeographical Regions of Australia



RESEARCH AREA

Ninghan Station lies 370 kms north east of Perth in the Murchison region of Western Australia. The Station is approximately 207 000 ha in size and is located on either side of the Great Northern Highway, 50 kms to the south west of the town of Paynes Find (see map page 4). The homestead is situated on the southern side of the Great Northern Highway. The Station sits at the convergence of four national biogeographical regions and as such is an interestingly diverse area. The area is dominated by a mountain with the Aboriginal name *nyingarn* (meaning echidna). Later named by Europeans as Mount Singleton, it rises some 350 m above the surrounding landscape to a height of 678 m above sea level and is the highest point on Ninghan Station and clearly the most prominent peak in the general area.

The research area is within the vast Yilgarn block comprised of ancient granite with intrusions of sedimentary and metamorphic rocks. The landscape contains sandstones, banded iron formations, greenstone, granite domes and lateritic breakaways. Dispersed throughout these major landforms are alluvial (sediments deposited by rivers or other moving water) and colluvial (sediments moved by gravity) plains. The region contains two large salt lakes, Lake Moore and Lake Monger.

The immediate area is of particular botanical interest with a large range of plant communities on its many geological formations and soil types. The main vegetation types are mallee woodlands and sedgelands with other areas of eucalypt woodlands including salmon gums. Over 730 species of flowering plant plus lichens and mosses have been recorded including 34 species of priority plants. The Mount Singleton range is composed of greenstones, and seven of the poorly known plant species occur there. Other important areas include Wardagga Rock, a granite dome, and hills to the north of Mt Singleton (see map page 5).

Bird life is abundant on the station with 104 bird species listed. However other native fauna is scarce. Over 20 mammal species that had previously been recorded are no longer present and it is thought that bilbies were wide spread over the area until the 1920's. The station managers wish to reintroduce native animals in the future and have commenced feral animal control with results already being seen with regard to bird life.

An Indigenous Protected Area (IPA) managed by Pindiddy Aboriginal Corporation is incorporated into Ninghan Station. The IPA is part of a wider National Reserves System program that aims to establish a network of protected representative types of ecosystems across Australia. Indigenous owners manage the natural and cultural features in these IPA's with the support of the National Heritage Trust. The IPA on Ninghan Station is 48000 ha in size and was declared in 2006. It is one of 22 IPA's that have been declared across Australia by the end of 2006. Another 9 were being developed at that time.

Four biogeographical regions converge near Ninghan Station (see map on page 6). The Interim Biogeographic Regionalisation for Australia (IBRA) divides the Australian continent into 85 bioregions. The bioregions are the reporting unit for assessing the status of native ecosystems, their protection in the national reserve system and for use in the monitoring in the Australian Government's current Natural Resource Management

initiatives. The IBRA regions have been used for continent-wide assessments of landscape health and biodiversity by the National Land and Water Resources Audit.

THE PROJECT

Astronomical research will be the priority of this expedition and will be carried out from the summit of Mt Singleton. Meteorological observations at Paynes Find suggest that this locality has, on average, little rain and cloud. Both its height, the climate data, and its isolation from human activity suggest that Mt Singleton may be a good location for optical astronomy observing. This *LANDSCOPE* expedition will evaluate the suitability of this site for astronomical viewing. Apart from the scientific work, expeditioners will be given a guided tour of the night sky, stars and constellations. The latest astronomical theories on many objects visible through the Perth Observatory portable telescopes will be discussed.

Ninghan Station has amazing botanical diversity with over 730 species of flowering plants, including seventeen priority species. We shall visit hills and rocky areas in particular, in an effort to find more populations of priority plants. However, as the primary focus of the expedition is overnight Astronomical research, the daytime field program will be dictated by availability of volunteers, expedition staff and time. There are many options that could be investigated by the expedition team to assist the IPA mangers and to determine the floristic representation in the area.

Specific areas that are of particular interest are the central Ninghan range and the Wardagga Rock and Pedan Rockhole area. These areas have had some botanical investigation, but not as much as other areas. This research will add to what is known about the distribution of plants in the Ninghan area

VOLUNTEER ASSIGNMENTS

Conservation Volunteers

Being a volunteer allows you to discover first hand what the Department is doing. You will be part of a force of 3800 people involved in a wide range of activities that include tree planting, trail building, interpretation and assisting with scientific projects. If you wish to be involved with future DEC Volunteer projects, please contact DEC's Community Involvement Coordinator, Margaret Buckland, on (08) 9334 0251 on your return. The Department relies very much on its volunteer work force. In 2005/2006 volunteers supplied 470 000 hours of effort. Volunteer assistance with remote area work, such as this expedition plans to carry out, is especially helpful.

Field Tasks – Astronomical

A small telescope system (and shelter) will be erected on Mt Singleton. One or two volunteers are required to assist with the site evaluation telescope work, weather permitting, each evening on Mt Singleton. The work is not demanding and there will probably be time to sleep or just view the stars from this vantage point. A roster will be compiled on arrival taking into account, as far as practical, each person's enthusiasm for observing. Night observers will depart for Mt Singleton each evening around 1700 hrs and return around 0630 hrs. Volunteers can then relax or participate in the botanical field work. In the afternoon, the night's observations will be backed up onto computer disk and some data

analysis can be undertaken. Access to Mount Singleton will be via 4WD vehicles over a rough track.

The main components to the astronomical research on Mt Singleton are;

- Assembly and use of the site monitoring telescope and its computer on Mount Singleton
- Entering data on a computer at the base camp
- Naked eye Astronomy, introduction to the constellations, planets, stars, the Moon, comets, meteors, basic astronomy and navigation
- Binocular astronomy - see fainter objects such as nebulae and clusters using these versatile optical instruments
- Telescope astronomy - learn how to set up and operate, view even fainter objects, or greater detail of lunar features, the planets etc with the Observatory's 8 inch, and 10 inch telescopes.

Those volunteers not working on Mt Singleton can participate in the evening star viewing from the base camp at the Station using the Observatory's transportable telescopes. Weather permitting, they will able be able to observe stars, clusters of stars and gaseous nebulae, and as time progresses into the expedition, the Moon and its craters will be available. Early risers will also get to view the planets, Venus, Mars, Jupiter and Saturn
NOTE: In order to conduct the astronomical activities successfully, cloudless skies are required - this is beyond the control of the expedition organisers.

Basic astronomy training such as star and constellation identification will be provided as well as a discussion of the basic tools such as the Astronomical Handbook, planisphere, binoculars, telescopes, and astrophotography.

Field Tasks – Botanical

Volunteers will have the opportunity to assist with all aspects of the flora survey work in the various habitats visited by the expedition. We will collect, press and identify flora specimens where possible, using relevant publications and survey new populations of priority plants that we find.

Activities will include:

- opportunistic plant collections
- assisting with plotting of locations of specimens collected (using a GPS)
- assist with collecting voucher specimens
- assist with general field notes
- assist with identification and keying out of specimens and compilation of data at the end of the day
- assist with pressing plant specimens
- preparation of Rare Flora Report forms
- photography
- write up notes and the trip diary

As the expedition is astronomy based, expeditioners may find that there is little time to participate in botanical work during the day. However, we shall arrange the botanical work

briefings on research procedures and objectives. There will also be informal lectures, campfire talks, daily reviews of progress and sharing of expeditioners' discoveries. Due to the range of habitats covered on this expedition, volunteers can expect to see a wide variety of plants.

The identification of flora in the field is a skilled business; it requires patience, a sharp eye, and aids such as field guides and hand lenses. Many of our native flora species look very similar to each other, and telling them apart can be a humbling process for even the most experienced botanist. However, identification is a basic skill in field botany and by the end of our expedition, members should all have a good grasp of the basics.

Plant collecting is a great excuse to visit any interesting looking area. However, the collections need to be processed and pressed, and again this is an activity we will share among the team.

Searches for plants will be confined to opportunistic methods. Leaders will be happy to discuss any aspect of the work with expedition members, and are looking forward to a shared learning experience.

Base Camp Tasks

- assist with identification and keying out of specimens and compilation of data at the end of the day
- assist with pressing plant specimens
- preparation of Rare Flora Report forms
- write up notes and the trip diary

Base Camp Maintenance

- Assist with general camp maintenance
- Assist with meal preparation and clean up

Expedition Diary

An exercise book will be provided for volunteers to take turns recording each day's events. Anything goes! Each person takes a turn. This will be transcribed and a copy distributed to each expedition member as a memento of the trip. However, it also provides valuable information to be included in the official **Expedition Report**, which is produced after each trip. Please include highlights of each day, interesting data, and anything of interest to you. Much information can be gleaned at 'Show and Tell' and 'Meet the Scientist' each evening when the leaders summarise the day's activities and plan for the following day. So, if you have the diary for the day, take it to 'Show and Tell' and record the day's events.

FIELD TRAINING

Upon arrival at Ninghan Station an orientation will be held outlining the site, expedition schedule, daily timetables, base camp procedures and safety protocols. There will also be informal talks, daily reviews of progress and sharing of participants discoveries.

Further information sessions will cover the project and research objectives. Techniques and the specific skills to identify and record data will be discussed and demonstrated by leaders prior to volunteers undertaking these tasks, ensuring that you are well versed in the procedures required for this type of research.

Team leaders will be available to discuss aspects of their work with expedition members, and are looking forward to a shared learning experience.

APPLICATION OF RESULTS

The astronomical site testing aims to measure the atmospheric effects that define the minimum resolution (astronomers call this the "seeing") achievable by optical telescopes at this site. In due course, similar tests will be undertaken at other sites around the State. These results will facilitate direct and quantitative comparison of astronomical seeing conditions with other optical astronomy sites around Australia and elsewhere. This in turn will guide the planning of any new optical telescope facilities within WA and possibly Australia. The results will eventually be published in the appropriate astronomical journals.

The information gained on the rare and poorly known species will be used to help assess their conservation status and will help the Midwest Region in their work on rare and priority plant taxa. Plant specimens will be lodged at the Western Australian Herbarium. Results of botanical and other field work conducted will be used by Pindiddy Aboriginal Corporation to enable them to better manage the Indigenous Protected Area on Ninghan Station.

EXPEDITION LEADERS

Dr. James Biggs is the Government Astronomer for Western Australia and the director of Perth Observatory. He is also an Adjunct Associate Professor at both Curtin University and James Cook University. During his career, Jamie has researched radio pulsars through various appointments at the University of Sydney and in the UK at the Jodrell Bank radio telescope. He has also worked with the Hubble Telescope at NASA's Goddard Space Flight Centre. Jamie's current research interests are asteroid, comet and transient source detection, radio pulsars and astronomy education. Jamie has led four *LANDSCOPE* Expeditions to a variety of WA locations.

Daphne Edinger graduated from UWA with a BSc (Honours) in zoology. A science teacher for sixteen years, on retirement Daphne became an honorary research scientist with the WA Herbarium and has worked as a volunteer with *LANDSCOPE* Expeditions Coordinator Kevin Kenneally since 1983. She has conducted numerous botanical field trips throughout the state and has been with the *LANDSCOPE* Expeditions program as a leader since 1993. Daphne, Tim Willing and Kevin Kenneally were recipients of the 1996 CSIRO Medal for Research Achievement for the project and book, *Broome and Beyond: Plants and People of the Dampier Peninsula.*

ASSOCIATE LEADERS

Pindiddy Aboriginal Corporation Three generations of the Bell family currently live on, own and manage Ninghan Station and comprise Pindiddy Aboriginal Corporation (PAC) of which Leah Bell is the chairperson. Members of the Bell family first worked on Ninghan Station in the 1950's and returned when the Ninghan pastoral lease was purchased for PAC in 1993. They are the managers of the Indigenous Protected Area on Ninghan Station declared in 2006. Pindiddy Aboriginal Corporation is committed to reducing the reliance on sheep grazing for income and has reduced stock number drastically since 1994 resulting in significant landscape regeneration and erosion reduction.

John Williamson will be providing the catering and base camp management on this expedition. John has several years experience in expedition operations principally with the UWA Geology Department. Originally from Kenya, John now lives in the Perth hills and is an active member of the Glen Forrest bushfire brigade, grows trees for the Farm Tree Help Scheme and is a volunteer at the Hills Community Support Group. This is John's first *LANDSCOPE* Expedition

Catherine Page is a conservation officer with the Department of Environment and Conservation. She has a Bachelor of Environmental Science and has been working for DEC for two years. Her first position was in Manjimup where she worked on dieback projects. She is now based in Geraldton as a flora conservation officer and will be assisting the search for rare flora on this expedition.

EXPEDITION REPORT AND REUNION

A copy of the expedition diary will be provided soon after the conclusion of the expedition, and this will be followed in due course by the Expedition Report.

A reunion for all 2007 expeditions will be held in December in Perth. An invitation will be issued with details of the venue and other arrangements approximately one month prior to the evening. The reunion provides an opportunity to catch up with old friends, see other participants' photographs and records of their trips, and review the results of the *LANDSCOPE* Expeditions program.

FIELD LOGISTICS

RENDEZVOUS

Expedition participants will meet at **0700 hrs on Sunday 20 May, 2007** at the car park at UWA Nedlands Campus in Clifton Street, Nedlands. Gear will be loaded and the expedition will depart Nedlands at 0730 hrs sharp. If you are running late on the morning of departure please contact Dr. Jamie Biggs on 0407 977 747

ITINERARY 20 – 26 MAY 2007

Day 1	**Sun 20 May**	**Perth to Ninghan Station**
AM		Depart Perth, travel via the Great Northern Highway through New Norcia and Wubin to Ninghan Station, with lunch en route.
PM		Settle into accommodation. After dinner there will be information on the expedition schedule and research tasks. Observing team departs for first nights observing.
Day 2	**Mon 21 May**	**Ninghan Station**
AM		Observing team returns from Mt Singleton. Rest. Botanical fieldwork or other activities
PM		Rest for Observing team. Continue botanical activities
EVE		Observing Team leaves for Mt Singleton for O/N Astronomical Observing
Day 3	**Tues 22 May**	**Ninghan Station**
AM		Observing team returns from Mt Singleton. Rest. Botanical fieldwork or other activities
PM		Rest for Observing team. Continue botanical activities
EVE		Observing Team leaves for Mt Singleton for O/N Astronomical Observing
Day 4	**Wed 23 May**	**Ninghan Station**
AM		Observing team returns from Mt Singleton. Rest. Botanical fieldwork or other activities
PM		Rest for Observing team. Continue botanical activities
EVE		Observing Team leaves for Mt Singleton for O/N Astronomical Observing
Day 5	**Thur 24 May**	**Ninghan Station**
AM		Observing team returns from Mt Singleton. Rest. Botanical fieldwork or other activities
PM		Rest for Observing team. Continue botanical activities
EVE		Observing Team leaves for Mt Singleton for O/N Astronomical Observing
Day 6	**Fri 25 May**	**Ninghan Station**
AM		Observing team returns from Mt Singleton. Rest. Botanical fieldwork or other activities

PM	Rest for Observing team. Continue botanical activities
EVE	Observing Team leaves for Mt Singleton for O/N Astronomical Observing

Day 7 Sat 26 May **Ninghan Station to Perth**

AM	Late morning departure for Perth. Arrive Perth at approximately 6.00 pm

DAILY SCHEDULE

0630	Arise and have breakfast
0730	Briefing on day's travelling and activities
	Observing team return to Station
0830	Depart for botanical activities
	Rest for observers
1030	Morning tea – either billy tea or thermos
1230	Lunch
1315	Depart or continue activity
1500	Afternoon tea – either billy tea or thermos
1600	Arrive back at camp. Commence pressing plant collections made during day, and identification where possible.
	Dinner time for Observing team.
1700	Observing team depart for Mt Singleton
1800	Dinner
	Observing team set up equipment
1900	Discuss day's events, complete pressing of plants, record keeping and plant notes.
	Star viewing at Station.
	Observing Team: Observing throughout the night atop Mt Singleton.

TEAM DEVELOPMENT

Team spirit will initially be built by travelling together in the expedition convoy to Ninghan Station– there will be regular stops, and team members will be rotated between vehicles. Having meals together, sharing in preparation and clean-up, working and living together, and being involved with this exciting project will enhance team spirit.

ACCOMMODATION

We will be accommodated at Ninghan Station in single "Donga" style accommodation. Male and female toilets and showers are provided. A kitchen area will be available for meals and post field work. You will need to bring a sleeping bag and a pillow. Beds and mattresses are supplied in the accommodation.

Volunteers should have four items of luggage – your *LANDSCOPE* Expeditions duffel bag, sleeping bag (lightweight, compact but warm), daypack, and pillow. Bag labels are provided, however, as all the bags look the same, you may wish to mark your bag with a coloured ribbon, or something else that helps you spot your bag quickly. You may also wish to bring a large plastic heavy duty garden bag with ties to protect your bag from damp, dust, or rain.

FOOD AND DRINKS

Food will be provided from morning tea of day one (Sun 20 May 2007) until afternoon tea on Day 7 (Sat 26 May 2007). To facilitate the efficient running of the expedition, participants may be required to assist in the preparation of meals each day.

Please advise Cheryl Tonts by 4 May 2007 if you have special dietary needs (Work 08 9334 0319 or email: cheryl.tonts@dec.wa.gov.au).

After we leave Perth there will be no opportunity for you to restock your personal supplies, so we recommend you bring all you need with you at the start of the trip. If you wish to have "something extra" to drink with your evening meal, you will need to bring that with you. Overnight observing on Mount Singleton will be long, and we recommend you bring some of your favourite snacks (chocolate, nibbles etc) with you in case you get peckish. The expedition will supply some cask wine for evening meals.

PHYSICAL CONDITION

The expedition will not demand an elite level of fitness. However, some level of physical fitness is required to conduct botanical fieldwork and for those expeditioners who wish to climb Mt Singleton. You should be prepared to cope with warm days and cold nights. The weather can change very quickly and participants should be prepared for a range of climatic conditions. **Adequate wet weather gear and warm windproof clothing is essential for overnight work.** A beanie is recommended for overnight work. There will be as much walking, exploring and searching as you want, so ensure that you have comfortable, solid boots. You will maximise your enjoyment of the activities by ensuring a reasonable level of fitness in the weeks leading up to the commencement of the expedition.

ENVIRONMENTAL CONDITIONS

Climate: At this time of year temperatures and conditions can vary widely. Average daytime temperatures are 23°C, although it can be much warmer (up to 30°C). You can expect night time temperatures around 9°C (but they can drop as low as 0°C).The average rainfall in May is 40 mm.

Terrain: The land surface away from rocky areas is generally flat. Walking through bush areas will be an essential part of the work and there are few formal walking tracks. To

reach some of the scenic vantage points, participants will need to walk reasonably long uphill sections. The more arduous walks will be optional.

SAFETY AND HEALTH

Your safety, health and comfort are of paramount importance at all times.

Sunburn: This is possibly the greatest medical problem that may arise. You must guard against it. Loose-fitting, long-sleeved shirts, full-brimmed hats, sunglasses, sunscreen lotion and lip-block are all essential. Wear your hat in the field, as you will be out in the open a lot.

Dehydration: This can be a significant issue in the field. To guard against dehydration, it is vital to always carry an adequate supply of drinking water with you in your daypack. Drinking water will be available at camp, and you must fill your bottle regularly. Remember to drink plenty of water during the day.

Exposure: Combined wind and rain can be a dangerous mix for the unprepared. It is vital that you bring along clothing and equipment that will ensure your comfort as well as your protection. Please bring good quality wet weather gear (preferably a jacket with a hood and waterproof pants) and adequate warm clothing including a beanie. Cotton clothing is not appropriate to wear in inclement weather as it stays wet and gets very cold. **NB: During overnight observing, the temperature can drop as low as zero degrees. Please ensure that you are adequately prepared with appropriate warm clothing.**

Safety mates: To improve volunteer safety in the field, expeditioners will be assigned a 'safety mate' for the duration of the expedition. At all times, you should know where your 'safety mate' is. If you cannot locate your 'mate' and are concerned as to their whereabouts, please advise a leader. This system is designed to improve safety in the field. Leaders will explain the 'safety mates' protocol on Day 1 and you will be advised who your "safety mate" is.

Insect pests: Insect repellent and fly nets for your hats will make it more pleasant as flies can be a nuisance during the day. Mosquitoes can also be a minor problem during the night. Repellents are effective, and antihistamine tablets and creams are advised if you are particularly susceptible to insect bites. Ticks may be encountered.

Please familiarise yourself with the enclosed brochures from the Health Department of Western Australia.

Medications: Check that you have any required prescriptions filled beforehand, and bring a spare supply. Include antihistamines if you think you may need them.

Snakes: For safety reasons volunteers are not to handle snakes. A number of highly venomous Brown Snakes and the Desert Death Adder are present in the area. It is essential to wear footwear and leggings (or gaiters) at all times. Two elasticised bandages should be carried in your daypack at all times as first aid treatment in the event of a snake bite. If you are moving around at night, always wear closed footwear (not thongs) and take a torch. Reptiles are still active at night.

Clothing and footwear: Long pants and boots that protect your ankles are recommended. If you prefer wearing shorts, bring some canvas gaiters or leggings; shorts leave your legs susceptible to sunburn, bites and exposed skin can be badly scratched by vegetation. Leather boots with ankle protection, suitable for walking, are recommended – well worn in

to avoid blisters. You will need comfortable light shoes to wear in camp and in the evenings. A pair of thongs (for showertime) will be useful. Canvas garden gloves may be used to protect the hands when in the field. As mentioned previously you are advised to bring good quality wet weather gear (preferably a jacket with a hood and waterproof pants) and adequate warm clothing, including a beanie. Shake any clothing left outside overnight in case insects have taken up residence.

Safety at night: A good head torch and a spare, small back-up torch is essential. If you get up at night, use a torch to illuminate the ground, and put your boots on (not thongs or open sandals) to minimise bite risk, as reptiles and insects etc. can be active at night. Keep your boots inside a bag at night so nothing crawls into them.

Camp hygiene: In camp, wear **disposable gloves** if helping with food preparation. These will be supplied. Separate bowls will be supplied for washing up, and the rinse bowl should contain some Milton preparation. A separate bowl will be supplied for washing hands, together with a plunger pack of antibacterial hand-washing liquid.

Personal hygiene: For washing bodies and clothing, Peter G's liquid soap is a good soap to use in hard water. Showers will be available. Medicated soaps such as gamophen, or sandalwood, which is natural to the bush, are also good choices. Don't use highly scented soaps, or perfumed toiletries, as these are irresistible to insects, flies in particular. Away from camp, moisturised wipes can be used for cleaning hands, and can be disposed of later. Some pegs for your washing may be useful.

Wilderness survival: *Please familiarise yourself with the enclosed Wilderness survival card, and carry it in your daypack when in the field.* It is easy to become disoriented when walking away from tracks or vehicles. Take careful note of landscape features to guide you back to the vehicle or study area if you move away.

Most importantly, never leave the group without telling one of the leaders or your safety mate where you are going, and preferably you should be accompanied by at least one other person.

First aid: The expedition will carry a comprehensive first aid kit.

Avian Influenza: Wild birds in Australia pose a negligible avian influenza risk to humans at the present time, however, all birds, particularly water fowl (ducks, geese, swans) are potential carriers of the disease. As there maybe some contact with birds on expeditions, volunteers are advised that they are not permitted to handle birds, especially those that appear to be sick or injured. For further information please refer to the following website on Avian Influenza.

http://www.health.gov.au/internet/wcms/publishing.nsf/content/health-avian_influenza-index.htm

Medical Evacuation: The Royal Flying Doctor Service (RFDS) has been advised that we will be working in the area. There is an RFDS approved airstrip at Paynes Find which would be used in the event that an emergency evacuation is required. There is a hospital at Dalwallinu that has a 24 hour emergency department.

FIELD COMMUNICATIONS

There is a telephone at the Ninghan Station in case of an emergency. However, most of our communications will be through DEC's office at Geraldton as we will be in the field for most of the day.

A satellite phone will be carried by the expedition for emergencies and for communications with the DEC office in Geraldton. Mobile phones do not work at Ninghan Station. UHF radios will be used for intra expedition communications.

If you need to be contacted urgently while you are away, communication can be established through the *LANDSCOPE* Expeditions office: 08 9334 0561.

ADVANCE PREPARATION

FIELD SUPPLIES

Check each item carefully. Small plastic bags have a range of uses. You may wish to bring a large, sturdy plastic garden bag with ties to protect the contents of your bag from dust or moisture during transport or when in camp.

Check List
❑ sturdy, comfortable, worn-in walking boots or shoes with good tread
❑ light shoes for around camp
❑ thick walking socks
❑ underwear
❑ long trousers, loose and tough
❑ shorts
❑ bathers
❑ long-sleeved, loose-fitting shirts
❑ casual clothes for travelling, and around camp
❑ t-shirts
❑ jumper, warm jacket, or 'polarfleece' (Additional warm clothing for night time observing is recommended)
❑ warm beanie to wear at night
❑ warm scarf
❑ protective, windproof and wet weather gear – rain jacket and trousers.
❑ cord to anchor hat (if not using your volunteer's hat)
❑ sunglasses
❑ fly net (optional)
❑ gaiters (optional) (useful protection if you like wearing shorts)
❑ sleeping bag (with a rating of 0°C)
❑ sleeping bag liner (protects the bag and adds warmth)
❑ pillow
❑ 2 X 1-litre water bottles, leak-proof
❑ personal toiletries, including tissues
❑ towel
❑ moisturised wipes
❑ insect repellent and sunscreen
❑ personal first aid, prescription medicine and spectacles
❑ matches or lighter
❑ small robust torch plus spare batteries and spare globe. (A head torch is preferable as it leaves both hands free) A second small backup torch.
❑ A daypack (rucksack) to carry camera, film, water bottle, snacks, etc
❑ camera and film
❑ binoculars (field glasses), and field guides if you have an interest in the local bird life
❑ hand lens and canvas garden gloves if you have an interest in botany
❑ notebook and pen
❑ compass and whistle
❑ small clothesline and a few pegs
❑ pocket knife
❑ lots of enthusiasm and smiles

LANDSCOPE Expeditions will supply a canvas bag for your gear, a luggage tag, a DEC volunteer's full-brimmed hat, a stubby holder and a thermal mug.

MAPS

The following maps cover the Ninghan area

The 1:250 000 topographic map for NINGHAN (SH 50 -7) covers the station.

At scale 1:50 000 the following topographical maps cover the station, MARANALGO 2439, NINGHAN 2339, MOUNT GIBSON 2338.

RESOURCES PROVIDED BY ASTRONOMICAL STAFF

The following resources will be given to participants on day one of the expedition.

Planisphere

Astronomy 2007 (WA edition).

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How to choose and use binoculars for astronomy, from Skywatch '97.

How to start out right in Astronomy, from Skywatch '97.

How to take sky photographs, from Skywatch '97.

REFERENCE LIST

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Mitchell, A.A. & Wilcox, D.G (1994) *Arid Shrubland Plants of Western Australia*. University of Western Australia Press and Dept. of Agriculture, WA.

Payne, A.L., Van Vreeswyk, A.M.E., Pringle, H.J.R., Leighton, K.A. and Hennig, P.(1998) *An inventory and condition survey of the Sandstone-Yalgoo-Paynes Find area, Western Australia*. Agriculture Western Australia.

**In addition any general book such as the Phillips guide to Astronomy is a good reference.*

LANDSCOPE Magazine

The following LANDSCOPE magazine articles in chronological order of publication contain information on the rangelands in general and Indigenous Protected Areas.

Brandis, T. 'Rescuing the Rangelands', *Landscope*, Spring 1997

Thomas, R., Noble, K. and Clews, M. 'Common Ground', *Landscope*, Summer 1999 - 2000

**The expedition will carry some reference books. Please bring your own field guides.*

Websites and Online Resources

www.naturebase.net
Department of Environment and Conservation website

www.perthobservatory.wa.gov.au
Perth Observatory website

www.nht.gov.au/publications/journal/nht24/natural.html
Natural Heritage Trust information on Ninghan Station

www.environment.gov.au/indigenous/fact-sheets/ipa.html
Commonwealth Department of Environment and Water Resources information on Indigenous Protected Areas.

http://www.environment.gov.au/parks/nrs/ibra/
Commonwealth Department of Environment and Water Resources information on Interim Biogeographical Regionalisation of Australia.

NOTES

APPENDIX

LANDSCOPE EXPEDITIONS

Lend your body to research

Lend your body to research...

LANDSCOPE Expeditions are non-profit, self-supported study and research projects. Since their inception in 1992, the expeditions have been offered by the Department of Environment and Conservation (DEC) publication *LANDSCOPE*, a quarterly magazine devoted to wildlife, conservation and environmental issues in Western Australia. The expeditions are offered in association with UWA Extension, a department of The University of Western Australia.

DEC is responsible for the management and sustainable use of more than 25 million hectares of lands and waters around Western Australia, including national parks, conservation parks, marine parks, State forests and timber reserves, nature reserves and marine nature reserves. It is also responsible for conserving the State's rich diversity of plants and animals.

UWA Extension has been operating as a public outreach arm of UWA since 1913. It is a Centre for Continuing Education and promotes community awareness in a variety of ways, including educational travel. Scientists and regional staff identify the research projects and lead the expeditions. DEC and UWA administer the expeditions. The private sector and local communities are contracted to provide logistical support.

LANDSCOPE Expeditions answer the need for research to protect the environment, while they respond to the demand for first class interpretation by scientists and specialists. They provide paying volunteers with an opportunity to work alongside scientists and promote wider cooperation in addressing conservation and land management challenges in Western Australia. Anyone can be involved subject to fitness. You must be 13 years of age or over to be registered as a conservation volunteer.

You can visit and gain an understanding of remote places and natural ecosystems. You can take part in important wildlife recovery programs. You can have the satisfaction of knowing you have contributed to our knowledge of threatened environments and endangered species. Unique photo opportunities and close encounters with unusual animals are a bonus.

Participants are not the only beneficiaries. The community also profits from the enriched lives of its members, and from the benefits that flow on from research findings and outcomes. Future generations benefit from the natural and cultural resources that volunteers help to identify and conserve. And, on a global scale, *LANDSCOPE* Expeditions help to perpetuate cultural and biological diversity.

Expedition members collecting plant samples, Doolgunna Station. Photo - Bill Muir

LANDSCOPE EXPEDITIONS

Lend your body to research

LANDSCOPE Expeditions - You can make a difference

When you travel with *LANDSCOPE* Expeditions, you help in a variety of ways:

FUNDING

You and your financial contribution make the research possible. This alone is a significant factor in making the expedition a success.

SCIENTIFIC DISCOVERY

You can help by collecting key information. Although some interpretations will be made in the field, much of the synthesis takes place back in the laboratory, where final identifications and analyses are made and results prepared for publication. You will discover that fieldwork can be repetitive and time consuming as it has to be done in a systematic way. Outcomes are not always obvious at first–but there's always the chance of that surprise discovery.

Extra pairs of hands and eyes are of great benefit in helping to achieve goals, as fieldwork is very intensive. Leaders will maximise time spent on fieldwork, but will provide instruction in techniques as time permits.

You may be asked to collect plant specimens and make animal sightings to increase our knowledge of the distribution of species. However, with plants, only representative specimens will be kept. Do not be disappointed if some are discarded, as redundancy is often part of the scientific process. With bird observations, it is the collective experience that confirms the sighting and produces advances in our knowledge.

YOU DON'T NEED TO BE A SCIENTIST

Anyone can be of help–be assured that your assistance will make a contribution to nature conservation in Western Australia. Remember scientists and leaders have spent many years developing their level of expertise–they welcome your questions and are there to guide you.

Your point of view or personal expertise may help in unexpected ways. Please feel free to share your ideas.

Expect to return home with a broader understanding of the natural world, the role of scientific methods, the value of nature conservation and the rewards of knowing you have contributed to pioneering studies in remote areas. *LANDSCOPE* Expeditions aims to whet your appetite for nature, give you a taste of scientific discovery, and provide an experience that may not otherwise be a part of your life.

IT'S NOT ALL SCIENCE

Many elements combine to make an expedition successful, not just the scientific activities. An affinity for team work, a flexible approach and a willingness to help in whatever way you can, help to create the best results for nature conservation.

Lend your body to research

Distant places, close encounters... of the scientific kind

Expedition members in a sea of daisies.
Photo - Bill Muir

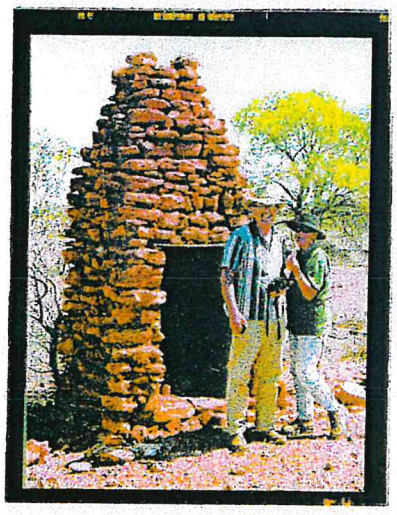
Western Australia covers almost a third of the Australian continent, stretching from the tropical Kimberley to temperate areas of the south coast. Of Australia's 80 recognised natural biogeographic regions, no fewer than 26 occur in Western Australia–more than in any other State. These biogeographic regions are defined principally by landform, soils and vegetation types. They range from the monsoon forests (rainforests) and savannas of the northern Kimberley through the diverse desert regions and the mulgas and mallees of arid inland Western Australia to the tall karri forests of the south-west. Coastlines cover a similar diversity of environments from the extensive coral reefs, mudflats and mangroves of the tropical Kimberley through the shallow sandy embayments of the west coast to the granite promontories and islands in the ocean off Albany and Esperance to the south.

These extensive land and seascapes provide a magnificent natural setting for a vast array of plant and animal species. However, such a diverse and extensive State poses a formidable hurdle for scientists in determining the first among many questions that are essential to effective research and conservation–what occurs where? A major emphasis of the scientific research undertaken by *LANDSCOPE* Expeditions is directed toward answering this intriguing and pivotal question.

In the sparsely populated western third of the continent, the distribution of most plant and animal species is very poorly known and many *LANDSCOPE* Expeditions are focused on trying to improve scientists' understanding of species' distributional patterns. Detailed records and prudent collections are made of many species, using the most scientifically acceptable methods and techniques, so that biologists from many institutions can carry out more detailed studies. Such documentation and collection has the dual purpose of helping to define the distribution of many botanical and zoological species as well as facilitating research by State herbaria and museums on the level of variation within species. Studies of specimens and records of species from a wide geographic area are often the precursors to the description of species new to science.

Western Australia's conservation reserve system plays a pivotal role in conserving the State's rich biodiversity, but this reserve system is not comprehensive, adequate or representative. Many land surface types and their associated wildlife are not represented in reserves, or are very poorly represented. This pattern was documented in the 1995 Interim Biogeographic Regionalisation for Australia (IBRA) Report, which demonstrated that many of Australia's major bioregions are poorly served by the existing conservation reserve system. Bioregions provide a framework for identifying gaps in the reserve system. Conservation reserves should protect representative samples of each bioregion. *LANDSCOPE* Expeditions help identify which areas should be included to protect and enhance the State's biodiversity.

LANDSCOPE Expeditions encourage the public to travel with us to distant places for close encounters of the scientific kind. You are a vital partner. Join us and be part of a scientific team–record observations, collect, prepare and help identify specimens. Many conservation goals are difficult to achieve by scientists working alone–your support can make the difference.



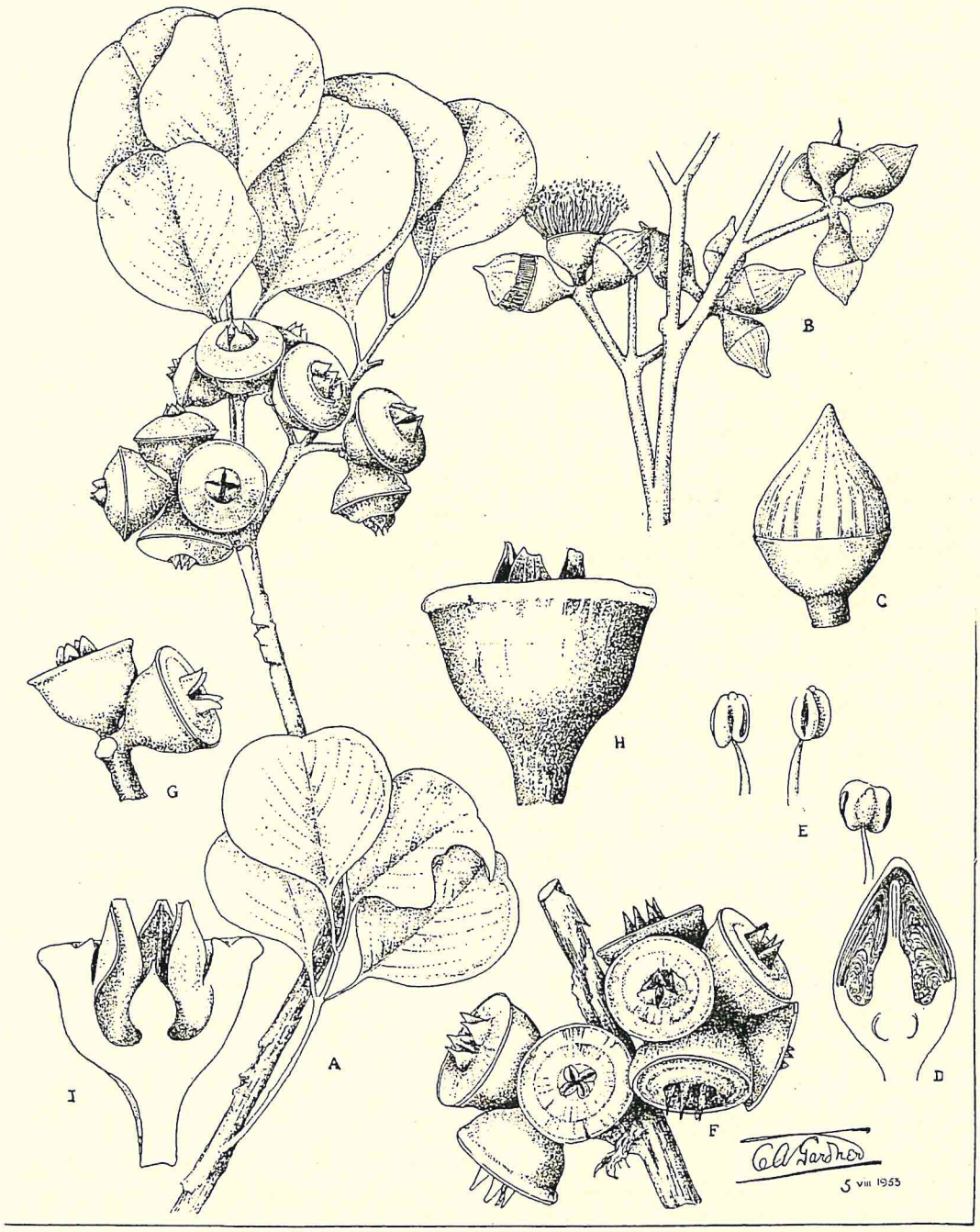


Fig. 22

Eucalyptus orbifolia A—Branchlets with leaves and fruits; B—Flower buds; C—Flower bud; D—Flower bud in section; E—Anthers; F—Fruits; G—Two buds detached from the umbel; H—Fruit (enlarged). (Pigeon Rocks, G. E. Brockway, 1940).

THESE DATA HAVE BEEN PROVIDED BY THE WESTERN AUSTRALIAN HERBARIUM ON 30 MARCH 2004

The grid coordinates used were: Lat 29 deg 05 min, 29 deg 37 min, 117 deg 00 min, 117 deg 41 min so include some specimens with collection coordinates slightly beyond the legal boundaries. These include a number from the southern boundary area with Mt Gibson station.

Abutilon oxycarpum (F.Muell.)Benth. subsp. prostratum R.M.Barker ms
~~Acacia ? anthochaera~~
~~Acacia ? burkittii~~
Acacia Plurinerves - Microneurae Phyllodes >8-nerved, terete (Misc. Eremaean)
Acacia Sect. Juli. (Microneurae, terete)
Acacia acanthoclada subsp. glaucescens Maslin P3
Acacia acanthoclada F.Muell. subsp. glaucescens Maslin P3
Acacia acuaria W.Fitzg.
Acacia acuminata Benth.
Acacia acuminata Benth. subsp. burkittii (Benth.)Tindale & Kodela ms
Acacia acuminata(narrow phyllode variant) Maslin ms
Acacia andrewsii W.Fitzg.
Acacia aneura var. ? argentea
Acacia aneura Benth.
Acacia aneura x ayersiana var. ? argentea
Acacia aneura x craspedocarpa
Acacia aneura x minyura var. ? fuliginea
Acacia anthochaera Maslin
Acacia assimilis S.Moore subsp. assimilis
Acacia aulacophylla R.S.Cowan & Maslin
Acacia ayersiana x minyura
Acacia burkittii Benth.
Acacia cerastes Maslin P1
Acacia colletioides Benth.
Acacia coolgardiensis subsp. effusa (Pedunculate variant)
Acacia coolgardiensis subsp. effusa (sessile-head variant)
Acacia coolgardiensis Maiden subsp. coolgardiensis
Acacia coolgardiensis Maiden subsp. effusa R.S.Cowan & Maslin
Acacia eremaea C.R.P.Andrews
Acacia erinacea Benth.
Acacia exocarpoides W.Fitzg.
Acacia formidabilis R.S.Cowan & Maslin P3
Acacia grasbyi Maiden
Acacia imitans Maslin R
Acacia inceana Domin subsp. conformis R.S.Cowan & Maslin
Acacia jibberdingensis Maiden & Blakely
Acacia kochii Ewart & Jean White
Acacia ligulata Benth.
Acacia longiphyllodinea Maiden
Acacia longispinea Morrison
Acacia masliniana R.S.Cowan
Acacia murrayana Benth.
Acacia neurophylla W.Fitzg. subsp. erugata R.S.Cowan & Maslin
Acacia obtecta Maiden & Blakely
Acacia palustris Luehm.
Acacia prainii Maiden
Acacia quadrimarginea F.Muell.
Acacia ramulosa W.Fitzg.
Acacia ramulosa W.Fitzg. var. ramulosa
Acacia resinimarginea W.Fitzg.
Acacia resinosa R.S.Cowan & Maslin

Acacia roycei Maslin
Acacia scleroclada Maslin
Acacia sibina Maslin
Acacia sp.
Acacia sp.Juliflorae-flat, Eremaean region
Acacia sp.Kalannie(B.R.Maslin 7706) PN
Acacia sp.Murchison(B.R.Maslin 7331) PN
Acacia stereophylla Meisn. var. stereophylla
Acacia stowardii Maiden
Acacia subsessilis A.R.Chapman & Maslin P3
Acacia tetragonophylla F.Muell.
Acacia tysonii Luehm.
Acacia unguicula R.S.Cowan & Maslin R
Acacia victoriae Benth.
Acacia yorkrakinensis C.A.Gardner subsp. acrita R.S.Cowan & Maslin
Acarospora novae-hollandiae
Acarospora sp. Smegma ?
Actinobole uliginosum (A.Gray)H.Eichler
Actinotus leucocephalus Benth.
Allocasuarina acutivalvis (F.Muell.)L.A.S.Johnson subsp. prinsepiana (C.R.P.Andrews)L.A.S.Johnson
Allocasuarina campestris subsp. tessellata
Allocasuarina campestris (Diels)L.A.S.Johnson
Allocasuarina dielsiana (C.A.Gardner)L.A.S.Johnson
Allocasuarina eriochlamys (L.A.S.Johnson)L.A.S.Johnson
Allocasuarina tessellata (C.A.Gardner)L.A.S.Johnson P1
Aluta aspera subsp. hesperia Rye & Trudgen
Aluta aspera (E.Pritz.)Rye & Trudgen subsp. hesperia Rye & Trudgen
Alyogyne hakeifolia (Giord.)Alef.
Alyogyne pinoniana (Gaudich.)Fryxell
Alyssum linifolium Willd.
Alyxia buxifolia R.Br.
Amaranthus lividus L.
Amaranthus powellii S.Watson
Amphibromus nervosus (Hook.f.)Baill.
Amphipogon caricinus F.Muell. var. caricinus
Amphipogon strictus R.Br.
Amyema gibberula (Tate)Danser var. gibberula
Amyema gibberula (Tate)Danser var. tatei (Blakely)Barlow
Amyema nestor (S.Moore)Danser
Amyema preissii (Miq.)Tiegh.
Angianthus aff. micropodioides P3
Angianthus cornutus P.S.Short
Angianthus tomentosus J.C.Wendl.
Anthocercis anisantha Endl.
Anthocercis anisantha Endl. subsp. anisantha
Anthotroche pannosa Endl.
Arthropodium dyeri (Domin)Brittan
Arthropodium sp. A
Asphodelus fistulosus L.
Asterella drummondii
Astroloma serratifolium (DC.)Druce
Atriplex bunburyana F.Muell.
Atriplex codonocarpa Paul G.Wilson
Atriplex holocarpa F.Muell.
Atriplex hymenotheca Moq.
Atriplex semilunaris Aellen
Austrostipa elegantissima (Labill.)S.W.L.Jacobs & J.Everett
Austrostipa nitida (Summerh.& C.E.Hubb.)S.W.L.Jacobs & J.Everett
Austrostipa trichophylla (Benth.)S.W.L.Jacobs & J.Everett
Baeckea benthamii Trudgen ms
Baeckea crispiflora F.Muell.
Baeckea elderiana E.Pritz.
Baeckea sp.Paynes Find(S.Patrick 1095) PN P1

Balaustion pulcherrimum Hook.
Barbula hornschuchiana
Bellida graminea Ewart
Blennospora drummondii A.Gray
Boronia aff. coerulescens
Boronia coerulescens F.Muell. subsp. spicata Paul G.Wilson
Borya sp.
Borya sphaerocephala R.Br.
Bossiaea walkeri F.Muell.
Brachychiton gregorii F.Muell.
Brachymenium preissianum
Brachyscome cheilocarpa F.Muell.
Brachyscome ciliaris (Labill.)Less.
Brachyscome lineariloba (DC.)Druce
Brachyscome sp.
Brachysema sp.
Brunonia australis R.Br.
Bryum caespiticium
Bryum pachytheca
Bulbine semibarbata (R.Br.)Haw.
Bursaria occidentalis E.M.Benn.
Caladenia doutchiae O.H.Sarg.
Caladenia hirta subsp. rosea Hopper & A.P.Br.
Caladenia incensa Hopper & A.P.Br.
Caladenia incensa x incrassata
Caladenia incrassata Hopper & A.P.Br.
Caladenia mesocera Hopper & A.P.Br.
Caladenia pachychila Hopper & A.P.Br.
Caladenia remota Hopper & A.P.Br.
Caladenia roei Benth.
Caladenia sp.
Caladenia x lavandulacea R.S.Rogers
Calandrinia sp.Bungalbin(G.J.Keighery & N.Gibson 1656) PN
Callistemon phoeniceus Lindl.
Callitris glaucophylla Joy Thomps.& L.A.S.Johnson
Calocephalus multiflorus (Turcz.)Benth.
Calocephalus sp.Pilbara-Desert(M.E.Trudgen 11454) PN
Calothamnus chrysantherus F.Muell.
Calothamnus gilesii F.Muell.
Calotis multicaulis (Turcz.)Druce
Calotis sp.
Calycopeplus paucifolius (Klotzsch)Baill.
Calytrix amethystina Craven
Calytrix depressa (Turcz.)Benth.
Calytrix leschenaultii (Schauer)Benth.
Calytrix strigosa A.Cunn.
Calytrix uncinata Craven P3
Canoparmelia macrospora Elix & J.Johnst. P3
Casuarina obesa Miq.
Caustis gigas K.A.Meney & K.W.Dixon ms P2
Centaurea melitensis L.
Centrolepis cephaloformis Reader subsp. cephaloformis
Centrolepis humillima Benth.
Cephalipterum drummondii A.Gray
Chamaexeros fimbriata (F.Muell.)Benth.
Chamaexeros macranthera Kuchel
Chamelaucium pauciflorum (Turcz.)Benth. subsp. thryptomenioides (D.A.Herb.)N.G.Marchant & Keighery ms
Cheilanthes austrotenuifolia H.M.Quirk & T.C.Chambers
Cheilanthes lasiophylla Pic.Serm.
Cheiranthera filifolia Turcz. var. filifolia
Cheiranthera filifolia Turcz. var. simplicifolia E.M.Benn.
Chenopodium gaudichaudianum (Moq.)Paul G.Wilson
Chenopodium glaucum L.

Chorizema genistoides (Meisn.)C.A.Gardner
Chrysothrix candelaris
Chthonocephalus pseudevax Steetz
Codonocarpus cotinifolius (Desf.)F.Muell.
Collaria elegans
Comesperma integerrimum Endl.
Comesperma volubile Labill.
Commersonia stowardii S.Moore
Crenidium spinescens Haegi
Cryptandra apetala Ewart & Jean White var. apetala
Cryptandra imbricata Rye ms P3
Cryptandra micrantha Rye ms
Cuscuta epithymum (L.)L.
Cyanicula amplexans (A.S.George)Hopper & A.P.Br.
Cyanicula fragrans Hopper & A.P.Br.
Cyanostegia angustifolia Turcz.
Cyanostegia microphylla S.Moore
Cymbopogon ambiguus A.Camus
Cyperus tenellus L.f.
Cyperus vaginatus R.Br.
Cyphanthera odgersii (F.Muell.)Haegi subsp. occidentalis Haegi R
Dampiera eriocephala de Vriese
Dampiera lavandulacea Lindl.
Dampiera luteiflora F.Muell.
Dampiera stenostachya E.Pritz.
Dampiera tenuicaulis E.Pritz. var. curvula (K.Krause)Rajput & Carolin
Darwinia capitellata Rye
Darwinia masonii C.A.Gardner R
Darwinia purpurea (Endl.)Benth.
Daucus glochidiatus (Labill.)Fisch.,C.A.Mey.& Ave-Lall.
Daviesia grahamii Ewart & Jean White
Dicrastylis soliparma Rye & Trudgen
Didymanthus roei Endl.
Didymodon torquatus
Diuris porrifolia Lindl.
Dodonaea adenophora Miq.
Dodonaea inaequifolia Turcz.
Dodonaea petiolaris F.Muell.
Dodonaea rigida J.G.West
Dodonaea sp.
Dodonaea sp.Ninghan(H.Demarz 5121) PN P1
Dodonaea viscosa Jacq. subsp. angustissima (DC.)J.G.West
Dodonaea viscosa Jacq. subsp. mucronata J.G.West
Drosera andersoniana Ewart & Jean White
Drosera bulbosa subsp. major (Diels)N.G.Marchant & Lowrie
Drosera bulbosa Hook.
Drosera macrantha Endl. subsp. macrantha
Drosera stolonifera Endl. subsp. rupicola N.G.Marchant
Duboisia hopwoodii (F.Muell.)F.Muell.
Eccremidium pulchellum
Eichhornia crassipes (Mart.)Solms
Emex australis Steinh.
Enchylaena lanata Paul G.Wilson
Enchylaena tomentosa R.Br.
Enekbatus stowardii (S.Moore)Trudgen & Rye ms
Enneapogon caerulescens (Gaudich.)N.T.Burb.
Enneapogon caerulescens (Gaudich.)N.T.Burb. var. caerulescens
Eragrostis australasica (Steud.)C.E.Hubb.
Eremophila aff. clarkei
Eremophila alternifolia R.Br.
Eremophila clarkei A.F.Oldfield & F.Muell.
Eremophila compacta subsp. fecunda Chinnock
Eremophila decipiens Ostenf.

Eremophila deserti (Benth.)Chinnock
Eremophila drummondii F.Muell.
Eremophila eriocalyx F.Muell.
Eremophila forrestii F.Muell. subsp. forrestii ms
Eremophila georgei Diels
Eremophila glabra (R.Br.)Ostenf. subsp. elegans Chinnock ms
Eremophila glutinosa Chinnock
Eremophila latrobei F.Muell. subsp. latrobei ms
Eremophila longifolia (R.Br.)F.Muell.
Eremophila miniata C.A.Gardner
Eremophila oldfieldii F.Muell.
Eremophila oldfieldii F.Muell. subsp. angustifolia (S.Moore)Chinnock ms
Eremophila oldfieldii F.Muell. subsp. oldfieldii
Eremophila oppositifolia subsp. angustifolia (S.Moore)Chinnock
Eremophila oppositifolia R.Br. subsp. angustifolia (S.Moore)Chinnock
Eremophila pantonii F.Muell.
Eremophila platycalyx F.Muell. subsp. platycalyx ms
Eremophila punicea S.Moore
Eremophila serrulata (A.DC.)Druce
Eremophila spuria Chinnock ms
Eremophila subfloccosa Benth. subsp. subfloccosa
Erodium cicutarium (L.)L'Her.
Erymophyllum glossanthus Paul G.Wilson
Erymophyllum ramosum (A.Gray)Paul G.Wilson subsp. ramosum
Eucalyptus brachycorys Blakely
Eucalyptus clelandii (Maiden)Maiden
Eucalyptus crucis subsp. praecipua Brooker & Hopper R
Eucalyptus crucis Maiden subsp. praecipua Brooker & Hopper R
Eucalyptus ewartiana Maiden
Eucalyptus horistes L.A.S.Johnson & K.D.Hill
Eucalyptus kochii Maiden & Blakely subsp. kochii
Eucalyptus kochii Maiden & Blakely subsp. plenissima (C.A.Gardner)Brooker
Eucalyptus leptopoda Benth. subsp. arctata L.A.S.Johnson & K.D.Hill
Eucalyptus loxophleba subsp. lissophloia L.A.S.Johnson & K.D.Hill
Eucalyptus loxophleba subsp. supralaevis L.A.S.Johnson & K.D.Hill
Eucalyptus loxophleba Benth. subsp. supralaevis L.A.S.Johnson & K.D.Hill
Eucalyptus oldfieldii F.Muell.
Eucalyptus orbifolia F.Muell.
Eucalyptus petraea D.J.Carr & S.G.M.Carr
Eucalyptus pileata Blakely
Eucalyptus rigidula Maiden
Eucalyptus salmonophloia F.Muell.
Eucalyptus salubris F.Muell.
Eucalyptus sp.
Eucalyptus stowardii Maiden
Eucalyptus subangusta subsp. pusilla Brooker & Hopper
Eucalyptus subangusta (Blakely)Brooker & Hopper subsp. pusilla Brooker & Hopper
Eucalyptus synandra Crisp R
Eucalyptus trichopoda L.A.S.Johnson & K.D.Hill ms
Euphorbia boophthona C.A.Gardner
Euphorbia drummondii Boiss.
Euphorbia drummondii Boiss. subsp. drummondii
Euphorbia tannensis Spreng. subsp. eremophila (A.Cunn.)Hassall
Euryomyrtus recurva Trudgen P3
Eutaxia microphylla (R.Br.)C.H.Wright & Dewar var. microphylla
Exocarpos aphyllus R.Br.
Feldstonia nitens P.S.Short
Fissidens sp.
Flavoparmelia rutidota
Flavoparmelia sp.
Fossombronia sp.
Frankenia aff. laxiflora
Frankenia fecunda Summerh.

Frankenia pauciflora DC.
Frankenia punctata Turcz.
Frankenia setosa W.Fitzg.
Frankenia sp.
Gahnia drummondii (Steud.)K.L.Wilson
Gastrolobium floribundum S.Moore
Gastrolobium laytonii Jean White
Genus sp.
Gilberta tenuifolia Turcz.
Gilruthia osbornei Ewart & Jean White
Glischrocaryon aureum (Lindl.)Orchard
Glischrocaryon aureum (Lindl.)Orchard var. aureum
Glischrocaryon flavescens (Hook.)Orchard
Glycine canescens F.J.Herm.
Glycine clandestina Willd.
Glycorchis saccharata (Rchb.f.)D.L.Jones & M.A.Clem.
Gnephosis acicularis Benth.
Gnephosis arachnoidea Turcz.
Gnephosis cassiniana P.S.Short P1
Gnephosis tenuissima Cass.
Gnephosis uniflora (Turcz.)P.S.Short
Gomphrena sp.Belele(D.W.Goodall 3215) PN
Goodenia havilandii Maiden & Betche
Goodenia helmsii (E.Pritz.)Carolin
Goodenia mimuloides S.Moore
Goodenia perryi Carolin P3
Goodenia pinnatifida Schltdl.
Goodenia sp.
Grevillea acacioides McGill.
Grevillea deflexa F.Muell.
Grevillea didymobotrya Meisn. subsp. didymobotrya
Grevillea eriobotrya F.Muell. P3
Grevillea eriostachya Lindl.
Grevillea eriostachya x juncifolia
Grevillea extorris S.Moore
Grevillea globosa C.A.Gardner P3
Grevillea granulosa McGill. P3
Grevillea hakeoides subsp. stenophylla (W.Fitzg.)McGill.
Grevillea hakeoides Meisn. subsp. stenophylla (W.Fitzg.)McGill.
Grevillea juncifolia Hook. subsp. juncifolia
Grevillea juncifolia Hook. subsp. temulenta Olde & Marriott
Grevillea levis Olde & Marriott
Grevillea nana C.A.Gardner subsp. nana
Grevillea nematophylla F.Muell. subsp. nematophylla
Grevillea nematophylla F.Muell. subsp. supraplana Makinson
Grevillea obliquistigma C.A.Gardner subsp. obliquistigma
Grevillea paniculata Meisn.
Grevillea pityophylla F.Muell.
Grevillea sarissa S.Moore subsp. sarissa
Grevillea scabrida C.A.Gardner P3
Grevillea subtiliflora McGill. P1
Grevillea teretifolia Meisn.
Grevillea yorkrakinensis C.A.Gardner
Grimmia laevigata
Gunniopsis quadrifida (F.Muell.)Pax
Gunniopsis rodwayi (Ewart)C.A.Gardner
Haematomma eremaeum
Hakea arida Diels
Hakea francisiana F.Muell.
Hakea invaginata B.L.Burtt
Hakea minyma Maconochie
Hakea preissii Meisn.
Hakea recurva Meisn.

Hakea recurva Meisn. subsp. recurva
Halgania cyanea Lindl. var. latisepala Randell ms
Halgania cyanea Lindl. var. tuberculosa (Schltdl.)Randell ms
Halgania gustafsenii F.Muell. var. compactus Randell ms
Halgania sp.
Haloragis odontocarpa F.Muell.
Haloragis odontocarpa F.Muell. forma octoforma Orchard
Haloragis odontocarpa F.Muell. forma pterocarpa Orchard
Haloragis trigonocarpa F.Muell.
Halosarcia aff. pruinosa
Halosarcia aff. sp.Angel Fish Island(B.Davey 4)
Halosarcia indica (Willd.)Paul G.Wilson
Halosarcia indica (Willd.)Paul G.Wilson subsp. bidens (Nees)Paul G.Wilson
Halosarcia sp.
Hannafordia bissillii F.Muell. subsp. latifolia (E.Pritz.)C.F.Wilkins
Harmsiodoxa brevipes (F.Muell.)O.E.Schulz var. brevipes
Hedypnois rhagadioloides (L.)F.W.Schmidt
Helipterum craspedioides W.Fitzg.
Hemigenia sp.
Hemigenia sp.Cue(K.F.Kenneally 47A) PN
Hemigenia sp.Edah(J.W.Green 1601) PN
Hemigenia sp.Gibson(R.Coveny 7893 & B.R.Maslin) PN
Hemigenia sp.Paynes Find(A.C.Beauglehole 49138) PN
Hemigenia sp.Yalgoo(A.M.Ashby 2624) PN
Hemigenia sp.Yuna(A.C.Burns 95) PN
Heppia sp.
Hibbertia arcuata J.R.Wheeler
Hibbertia exasperata (Steud.)Briq.
Hibbertia glomerosa (Benth.)F.Muell.
Hibbertia hypericoides (DC.)Benth.
Hibbertia sp.
Hibbertia stenophylla J.R.Wheeler
Homalocalyx coarctatus (F.Muell.)Craven
Homalocalyx thryptomenoides (F.Muell.)Craven
Hordeum glaucum Steud.
Hyalochlamys globifera A.Gray
Hyalosperma glutinosum Steetz subsp. glutinosum
Hyalosperma glutinosum Steetz subsp. venustum (S.Moore)Paul G.Wilson
Hyalosperma zacchaeus (S.Moore)Paul G.Wilson
Hybanthus cymulosus C.A.Gardner(R)
Hybanthus floribundus (Lindl.)F.Muell. subsp. curvifolius E.M.Benn.
Hybanthus floribundus (Lindl.)F.Muell. subsp. floribundus
Hybanthus sp.
Hypochaeris glabra L.
Indigofera occidentalis Peter G.Wilson & Rowe ms
Isoetes australis S.Williams
Isoetes caroli E.R.L.Johnson
Isoetes inflata E.R.L.Johnson
Isoetes mongerensis E.R.L.Johnson
Isoetes muelleri A.Braun
Isoetopsis graminifolia Turcz.
Isolepis cernua var. setiformis (Benth.)Muasya
Isolepis congrua Nees
Isotoma petraea F.Muell.
Isotropis forrestii F.Muell.
Isotropis sp.
Jacksonia acicularis Chappill ms
Jacksonia arida Chappill ms
Juncus aridicola L.A.S.Johnson
Keraudrenia velutina subsp. elliptica C.F.Wilkins ms
Keraudrenia velutina Steetz subsp. velutina
Korthalsella japonica forma japonica
Kunzea pulchella (Lindl.)A.S.George

Labichea lanceolata Benth. subsp. brevifolia (Meisn.)J.H.Ross
Lachnostachys coolgardiensis S.Moore
Lachnostachys verbascifolia F.Muell. var. verbascifolia
Lamarckia aurea (L.)Moench
Lawrencella davenportii (F.Muell.)Paul G.Wilson
Lawrencella rosea Lindl.
Lechenaultia macrantha K.Krause
Lecidea sp.
Lemooria burkittii (Benth.)P.S.Short
Lepidium muelleri-ferdinandii Thell.
Lepidium platypetalum Hewson
Lepidosperma costale Nees
Leptodontium paradoxum
Leptosema aphyllum (Hook.)Crisp
Leptosema daviesioides (Turcz.)Crisp
Leucopogon sp.Clyde Hill(M.A.Burgman 1207) PN S of Ninghan, more locality range est.
Levenhookia leptantha Benth.
Lichen sp.
Lobelia rarifolia E.Wimm.
Lobelia sp.small flowers(K.F.Kenneally 7705)
Lobelia winfridae Diels
Lysiana casuarinae (Miq.)Tiegh.
Maireana amoena (Diels)Paul G.Wilson
Maireana appressa (J.M.Black)Paul G.Wilson
Maireana brevifolia (R.Br.)Paul G.Wilson
Maireana carnosa (Moq.)Paul G.Wilson
Maireana georgei (Diels)Paul G.Wilson
Maireana oppositifolia (F.Muell.)Paul G.Wilson
Maireana planifolia (F.Muell.)Paul G.Wilson
Maireana pyramidata (Benth.)Paul G.Wilson
Maireana tomentosa Moq.
Maireana trichoptera (J.M.Black)Paul G.Wilson
Maireana triptera (Benth.)Paul G.Wilson
Malleostemon roseus (E.Pritz.)J.W.Green
Malleostemon tuberculatus (E.Pritz.)J.W.Green
Mallophora globiflora Endl.
Marsilea hirsuta R.Br.
Marsilea sp.
Melaleuca calyptroides Craven
Melaleuca cf. calyptroides
Melaleuca cf. leptospermoides
Melaleuca concreta F.Muell.
Melaleuca conothamnoides C.A.Gardner
Melaleuca cordata Turcz.
Melaleuca eleuterostachya F.Muell.
Melaleuca fabri Craven
Melaleuca fulgens R.Br. subsp. fulgens
Melaleuca hamata Fielding & Gardner
Melaleuca leiocarpa F.Muell.
Melaleuca nematophylla F.Muell.
Melaleuca radula Lindl.
Melaleuca stereophloia Craven
Melaleuca thyoides Turcz.
Melaleuca uncinata R.Br.
Microcorys sp.Mt Gibson(S.Patrick 2098) PN
Micromyrtus clavata J.W.Green ms
Micromyrtus cuensis J.W.Green ms P1
Micromyrtus ninghanensis Rye P1
Micromyrtus racemosa var. mucronata J.W.Green ms P1
Micromyrtus racemosa Benth.
Micromyrtus racemosa Benth. var. mucronata J.W.Green ms P1
Micromyrtus racemosa Benth. var. racemosa ms
Micromyrtus sp.Warriedar(S.Patrick 1879A) PN P1

Micromyrtus sulphurea W.Fitzg.
Microtis eremaea R.J.Bates
Millotia myosotidifolia (Benth.)Steetz
Millotia perpusilla (Turcz.)P.S.Short
Mirbelia bursarioides A.M.Monro & Crisp ms
Mirbelia depressa E.Pritz.
Mirbelia microphylla (Turcz.)Benth.
Mirbelia ramulosa (Benth.)C.A.Gardner
Mirbelia rhagodioides Crisp & J.M.Taylor
Mirbelia sp.
Mirbelia sp.4
Monotaxis bracteata Nees
Montagnea arenarius
Myriocephalus guerinae F.Muell.
Myriocephalus occidentalis (F.Muell.)P.S.Short
Myriocephalus oldfieldii (F.Muell.)Paul G.Wilson
Myriocephalus pygmaeus (A.Gray)P.S.Short
Neofuscelia loxodella (Essl.)Essl.
Neofuscelia verrucella (Essl.)Essl.
Nicotiana cavicola N.T.Burb.
Nicotiana rosulata (S.Moore)Domin subsp. rosulata
Ochrolechia parella
Olearia axillaris var. eremicola
Olearia humilis Lander
Olearia muelleri (Sond.)Benth.
Olearia pimeleoides (DC.)Benth.
Olearia stuartii (F.Muell.)Benth.
Opercularia vaginata Juss.
Ophioglossum lusitanicum L.
Osteocarpum salsuginosum F.Muell. Thompson.
Pachycornia triandra (F.Muell.)J.M.Black
Parietaria debilis G.Forst.
Paspalum dilatatum Poir.
Persoonia pentasticha P.H.Weston P2
Persoonia sp.
Petalostylis cassioides (F.Muell.)Symon
Phebalium tuberculosum (F.Muell.)Benth.
Pheladenia deformis (R.Br.)D.L.Jones & M.A.Clem.
Philotheca brucei (F.Muell.)Paul G.Wilson
Philotheca brucei (F.Muell.)Paul G.Wilson subsp. brevifolia (Paul G.Wilson)Paul G.Wilson
Philotheca brucei (F.Muell.)Paul G.Wilson subsp. brucei
Philotheca deserti (E.Pritz.)Paul G.Wilson
Philotheca glabra (Paul G.Wilson)Paul G.Wilson
Philotheca nodiflora (Lindl.)Paul G.Wilson subsp. lasiocalyx (Domin)Paul G.Wilson
Philotheca nutans (Paul G.Wilson)Paul G.Wilson P1
Philotheca sericea (Paul G.Wilson)Paul G.Wilson
Philotheca tomentella (Diels)Paul G.Wilson
Phyllota luehmannii F.Muell.
Physcia cf. jackii
Physcia jackii Moberg
Pimelea avonensis Rye
Pimelea forrestiana F.Muell.
Pimelea microcephala R.Br. subsp. microcephala
Pimelea spiculigera F.Muell. var. thesioides (S.Moore)Rye
Pimelea subvillifera (Threlfall)Rye
Pittosporum angustifolium Lodd.
Pityrodia axillaris (Endl.)Druce P1
Pityrodia terminalis (Endl.)A.S.George
Plagiochasma rupestre
Plantago coronopus L. subsp. commutata (Guss.)Pilger
Platysace cirrosa Bunge
Podolepis canescens DC.
Podolepis capillaris (Steetz)Diels

Podolepis kendallii (F.Muell.)F.Muell.
Podolepis lessonii (Cass.)Benth.
Podotheca gnaphalioides Graham
Pogonolepis muelleriana (Sond.)P.S.Short
Pogonolepis stricta Steetz
Porana sericea (Gaudich.)F.Muell.
Prasophyllum gracile Lindl.
Prostanthera althoferi B.J.Conn subsp. althoferi
Prostanthera campbellii F.Muell.
Prostanthera eckersleyana F.Muell.
Prostanthera magnifica C.A.Gardner
Prostanthera patens B.J.Conn
Prostanthera serpyllifolia (R.Br.)Briq. subsp. microphylla (R.Br.)B.J.Conn
Psammomoya grandiflora Keighery
Psammomoya implexa Keighery P3
Psora sp.
Pterostylis sp.crinkled leaf(G.J.Keighery 13426) PN
Pterostylis sp.scooped sepals(G.Brockman GBB386) PN
Ptilotus aervoides (F.Muell.)F.Muell.
Ptilotus divaricatus (Gaudich.)F.Muell. var. divaricatus
Ptilotus drummondii (Moq.)F.Muell. var. drummondii
Ptilotus drummondii (Moq.)F.Muell. var. minor (Nees)Benl
Ptilotus exaltatus Nees var. exaltatus
Ptilotus exaltatus Nees var. villosus Benl
Ptilotus gaudichaudii (Steud.)J.M.Black var. parviflorus (Benth.)Benl
Ptilotus helipteroides (F.Muell.)F.Muell.
Ptilotus helipteroides (F.Muell.)F.Muell. var. helipteroides
Ptilotus holosericeus (Moq.)F.Muell.
Ptilotus obovatus (Gaudich.)F.Muell.
Ptilotus obovatus (Gaudich.)F.Muell. var. obovatus
Ptilotus schwartzii Tate
Quinetia urvillei Cass.
Quinqueremulus linearis Paul G.Wilson
Radyera farragei (F.Muell.)Fryxell & S.H.Hashmi
Rhodanthe battii (F.Muell.)Paul G.Wilson
Rhodanthe chlorocephala subsp. rosea (Hook.)Paul G.Wilson
Rhodanthe chlorocephala (Turcz.)Paul G.Wilson subsp. splendida (Hemsl.)Paul G.Wilson
Rhodanthe collina Paul G.Wilson P1
Rhodanthe manglesii Lindl.
Rhodanthe maryonii (S.Moore)Paul G.Wilson
Rhodanthe polycephala (A.Gray)Paul G.Wilson
Rhodanthe pygmaea (DC.)Paul G.Wilson
Rhodanthe spicata (Steetz)Paul G.Wilson
Rhyncharrhena linearis (Decne.)K.L.Wilson
Riccia bifurca
Riccia crystallina
Riccia limbata
Ricinocarpos velutinus F.Muell.
Rostraria pumila (L.)Tzvelev
Rosulabryum campylothecium
Rulingia kempeana (F.Muell.)J.M.Black
Rulingia luteiflora E.Pritz.
Ruppia sp.
Santalum acuminatum (R.Br.)A.DC.
Santalum spicatum (R.Br.)A.DC.
Sarcozona praecox (F.Muell.)S.T.Blake
Scaevola hamiltonii K.Krause
Scaevola parvifolia Benth.
Scaevola spinescens R.Br.
Schoenia cassiniana (Gaudich.)Steetz
Schoenia filifolia (Turcz.)Paul G.Wilson
Schoenus variicellae Rye
Sclerolaena alata Paul G.Wilson

Sclerolaena diacantha (Nees)Benth.
Sclerolaena eurotioides (F.Muell.)A.J.Scott
Sclerostegia disarticulata Paul G.Wilson
Sclerostegia tenuis (Benth.)Paul G.Wilson
Senecio glossanthus (Sond.)Belcher
Senecio lautus Willd. subsp. dissectifolius Ali
Senna artemisioides (DC.)Randell
Senna artemisioides (DC.)Randell subsp. filifolia Randell
Senna artemisioides (DC.)Randell subsp. x artemisioides
Senna artemisioides (DC.)Randell subsp. x sturtii (R.Br.)Randell
Senna charlesiana (Symon)Randell
Senna flexuosa (Randell)Randell
Senna glaucifolia (Randell)Randell
Senna glutinosa subsp. aff. chatelainiana
Senna glutinosa subsp. chatelainiana (Gaudich.)Randell
Senna glutinosa (DC.)Randell subsp. chatelainiana (Gaudich.)Randell
Senna pleurocarpa (F.Muell.)Randell
Senna pleurocarpa (F.Muell.)Randell var. angustifolia (Symon)Randell
Senna sp.
Senna sp.Austin(A.Strid 20210) PN
Senna sp.Billabong(J.D.Alonzo 721) PN
Senna stowardii (S.Moore)Randell
Sida calyxhymenia DC.
Sida sp.
Siloxerus multiflorus (Nees)P.S.Short
Sisymbrium erysimoides Desf.
Solanum coactiliferum J.M.Black
Solanum lasiophyllum Poir.
Solanum nummularium S.Moore
Solanum oldfieldii F.Muell.
Solanum orbiculatum Poir. subsp. orbiculatum
Sondottia connata (W.Fitzg.)P.S.Short
Stachystemon intricatus Halford & R.J.F.Hend.
Stackhousia monogyna Labill.
Stackhousia muricata Lindl.
Stenanthemum complicatum (F.Muell.)Rye
Stenanthemum poicilum Rye P2
Stenopetalum anfractum E.A.Shaw
Stenopetalum filifolium Benth.
Stenopetalum sp.
Stipa blackii C.E.Hubb.
Stylidium confluens Banyard & S.H.James
Stylidium induratum M.B.Scott
Stylidium leptophyllum DC.
Stylidium longibracteatum Carlquist
Stylidium warriedarense Lowrie,A.H.Burb.& Kenneally
Stylidium yilgarnense E.Pritz.
Swainsona aff. halophila
Swainsona affinis (A.T.Lee)Joy Thomps.
Swainsona beasleyana F.Muell.
Swainsona elegantoides (A.T.Lee)Joy Thomps.
Swainsona gracilis Benth.
Swainsona kingii F.Muell.
Swainsona perlonga Joy Thomps.
Swainsona sp.
Templetonia sulcata (Meisn.)Benth.
Thelymitra aff. antennifera x macrophylla
Thelymitra aff. macrophylla
Thelymitra antennifera (Lindl.)Hook.f.
Thelymitra macrophylla Lindl.
Thelymitra sargentii R.S.Rogers
Thryptomene costata Rye & Trudgen
Thryptomene ninghanensis J.W.Green ms P1

Thysanotus manglesianus Kunth
Thysanotus pyramidalis Brittan
Thysanotus ramulosus Brittan
Thysanotus sp.
Trachymene cyanopetala (F.Muell.)Benth.
Trachymene ornata (Endl.)Druce
Trichanthodium exile (W.Fitz g.)P.S.Short
Trichodesma zeylanicum (Burm.f.)R.Br.
Triglochin centrocarpa Hook.
Triglochin minutissima F.Muell.
Triglochin mucronata R.Br.
Triglochin sp.A Flora of Australia(G.J.Keighery 2477) PN
Triglochin sp.B Flora of Australia(P.G.Wilson 4294) PN
Triodia rigidissima (Pilg.)Lazarides
Triodia scariosa N.T.Burb.
Triodia tomentosa S.W.L.Jacobs
Tripogon loliiformis (F.Muell.)C.E.Hubb.
Tripteris clandestina Less.
Triptilodiscus pygmaeus Turcz
Uromyces vesiculosus
Urospermum picroides (L.)F.W.Schmidt False Hawkbit
Velleia cycnopotamica F.Muell.
Velleia rosea S.Moore
Verreauxia reinwardtii (de Vriese)Benth.
Verticordia chrysantha Endl.
Verticordia helmsii S.Moore
Verticordia interioris A.S.George
Verticordia rennieana F.Muell.& Tate
Verticordia venusta A.S.George P3
Vittadinia humerata N.T.Burb.
Wahlenbergia sp.
Waitzia acuminata Steetz var. acuminata
Waitzia nitida (Lindl.)Paul G.Wilson
Westringia cephalantha F.Muell.
Wrixonia prostantheroides F.Muell.
Wurmbea densiflora (Benth.)T.Macfarlane
Wurmbea tenella (Endl.)Benth.
Xanthoparmelia callifolia
Xanthoparmelia gongylodes
Xanthoparmelia gongylodes Elix & J.Johnst.
Xanthoparmelia incrustata
Xanthoparmelia parvoincerta
Xanthoparmelia reptans
Xanthoparmelia scabrosa
Xanthoparmelia sp.
Xanthoria ligulata
Xanthosia bungei Keighery
Xerolirion divaricata A.S.George
Zygophyllum aff. fruticulosum
Zygophyllum angustifolium H.Eichler
Zygophyllum eremaeum (Diels)Ostenf.
Zygophyllum fruticulosum DC.
? Perichaena sp.