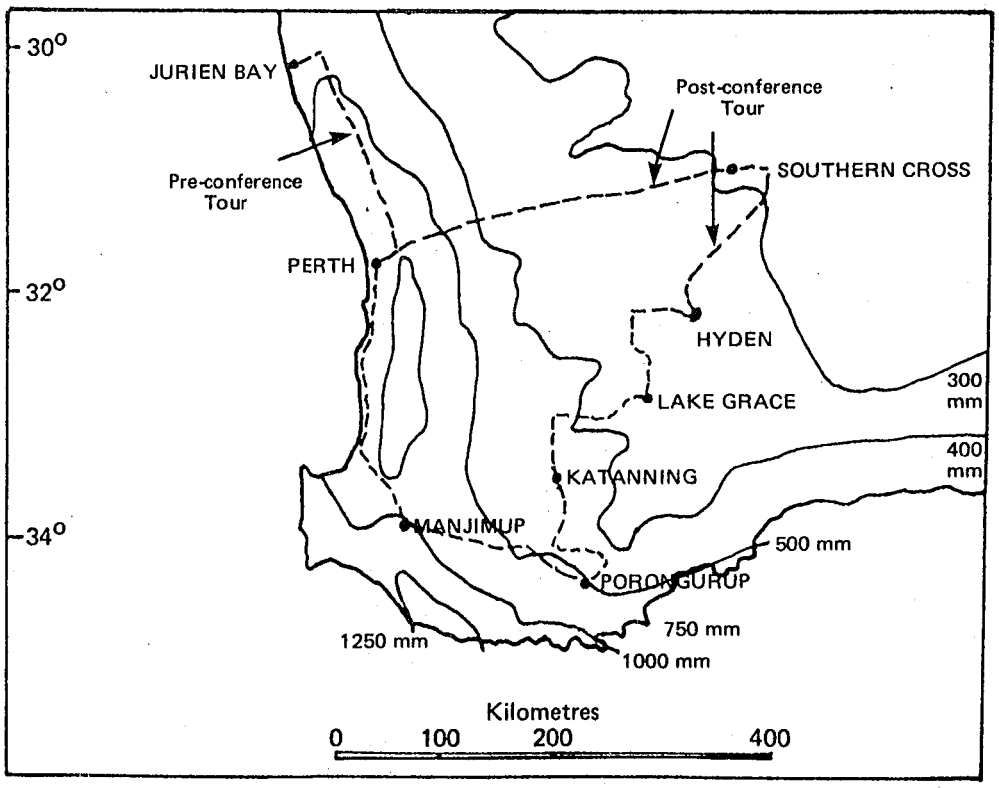
Fourth International Conference on Mediterranean Ecosystems, 1984

MEDECOS

POST-CONFERENCE TOUR:

August 18 to 25 1984



Wharton / Mitchell
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MEDECOS Postconference tour.

DAY 1. August 18th 1984. PERTH to MANJIMUP, 335 km.
The party travels today to the high rainfall area of the lower south-west, and will view on the way the vegetation of the Swan Coastal Plain including coastal dunes and relict mangroves.

8.45 a.m. Leave Perth.
9.15-9.45 a.m. Stop 1. Banksia low woodland on the outskirts of Perth. This formation is very extensive on the leached sands of the Bassendean dune formation, of which a soil profile will be seen in a road cutting. Conspicuous plants at the stop are:-
Trees: *Banksia attenuata, B.menziesii, Eucalyptus marginata*
Grass tree: *Xanthorrhoea preissii*
Cycad: *Macrozamia riedlei*
Shrubs: *Acacia pulchella, Adenanthos cygnorum, Beaufortia sparsa, Casuarina humilis, Conostephium pendulum, Eriostemon spicatus, Hibbertia hypericoides, H.subvaginata, Hypocalymma robustum, Melaleuca thymoides, Stirlingia latifolia.*
There has so far been little invasion of weeds at this site, although it it can be very conspicuous in periurban areas. *Gladiolus caryophyllaceus* has invaded but the "veld grass", *Ehrharta calycina* has got no further than the disturbed road-side strip.

After leaving this site the route heads southwards parallel to the coast, passing the industrial area of Kwinana. Recent dunes and beach ridges generally carry a low vegetation as it does not recover rapidly from fire. Wattles - *Acacia saligna* & *A.lasiocarpa*-are dominant and may be in flower. On older more weathered dunes, woodland of *Eucalyptus gomphocephala* (tuart) will be seen. At the township of Mandurah the road crosses the entrance to the Peel Inlet, one of the large estuary systems of the west coast. Just south of the bridge there is a salt flat on the left with the halophytes *Halosarcia halocnemoides* and *Sarcocornia*, and the salt-tolerant tree *Casuarina obesa* at the edge.
Further down, the bus will turn off along a scenic drive following the shore of the Peel Inlet. Fringing communities will be seen of *Juncus, Melaleuca, Viminaria, Casuarina obesa* and *Eucalyptus rudis*. On returning to the main road we traverse weathered dunes under Eucalypt woodland.

11 a.m. Stop 2, at turn-off for Preston Beach in Yalgorup National Park. Virgin woodland dominated by *Eucalyptus gomphocephala* (tuart) and *E.marginata* (jarrah) with smaller trees of *Agonis flexuosa, Banksia grandis & B.littoralis*
Other conspicuous plants are *Acacia pulchella, A.saligna, Clematis pubescens, Hardenbergia comptoniana, Hibbertia hypericoides, Jacksonia thesioides, Logania vaginalis, Xanthorrhoea.*
11.20 a.m. Stop 3. Coastal heath on calcareous dune sand, which will be viewed 120m up side track. A steep dune of Recent material carries a thicket of numerous species, notably these: *Acacia littorea, Eucalyptus decipiens, Grevillea thelemanniana, Hakea prostrata, H.trifurcata, Melaleuca acerosa, Petrophile serruriae, Trymalium ledifolium.*

11.40 a.m. Stop 4. Lake Preston, a linear salt lake cut off by coastal dunes. Fringing vegetation will be examined. *Hemichroa pentandra* forms mats on the lake flat, fringed by sedges and samphire - *Scirpus nodosus, Halosarcia*. Other plants include *Olearia axillaris, Pelargonium capitatum, Scaevola crassifolia Acacia cyclopis* , and the salt-water paperbark *Melaleuca cuticularis*. An interesting feature is the stand of *Melaleuca lanceolata* on an island, interpreted as a relic of climax vegetation surviving isolated from fire.

12.00 noon. Stop 5, at look-out point at water tank. This commands a view of the beach and coastal dunes where the zonation of vegetation may be witnessed. The sandbinders on the strand here are *Arctotheca populifolia* (introduced) and *Spinifex hirsutus*, followed by *Asphodelus fistulosus* (introd.) and *Acacia cyclopis*. *Olearia axillaris* follows with *Spyridium globulosum* leading to a climax of *Acacia littorea & A. saligna* which is rarely attained since fire sets back the succession. On fire-isolated islands off Perth the eventual climax is known to be low forest of *Callitris preissii*.

12.30 p.m. LUNCH STOP at picnic site. Toilet available. Tuart woodland at this site. The following plants may be seen: *Agonis flexuosa, Acacia littorea, A. cyclopis, A. pulchella, Acanthocarpus preissii, Eremophila glabra, Hardenbergia comptoniana, Leucopogon parviflorus, Olearia axillaris, Thomasia quercifolia.*

1.30 p.m. Leave for Bunbury

2.30 p.m. Stop 6 at Koombana Bay on the Leschenault Inlet, to see small relict population of the mangrove *Avicennia marina*, probably a survivor from the climatic optimum 10-6,000 years BP. Fringing vegetation of *Sarcocornia* , reed beds and salt-water couch grass.

3 p.m. Leave for Manjimup. The route traverses the coastal plain which has been mainly cleared but has relics of original vegetation. Forest and woodland of *Eucalyptus marginata & E. calophylla* was formerly widespread, with paperbarks (*Melaleuca rhaphiophylla*) in the more swampy places. Occasional sand ridges will be seen, marking old shore lines, and these carry Banksia woodland similar to that at Stop 1. On leaving the coastal plain we enter a dissected region of the interior plateau with lateritic soils where a ferruginous duricrust caps the higher ground while yellow and red loam soils occur on the slopes and lower ground. The latter have mostly been cleared for farming, leaving the original forest, now managed as State Forest, on the duricrust.

4 p.m. Stop 7. Warner State Forest, near Kirup.
This forest of *Eucalyptus marginata & E. calophylla* (jarrah and marri) has been logged, see old stumps, and we have a second-growth crop. Understory plants likely to be in flower are *Acacia browniana, Dryandra nivea, Hakea lissocarpha, Hibbertia hypericoides, Mesomelaena tetragona* and other Restionaceae. Other important species are *Bossiaea linophylla, Hakea prostrata, Mirbelia dilatata, Xanthorrhoea preissii.*
5 p.m. Arrive Manjimup Auto Motel.

DAY 2. Sunday August 19th. MANJIMUP DISTRICT, 158 km.

This day is devoted to a tour of the forests of the lower south-west, the most humid portion of the State.

Manjimup is situated at the fringe of an extensive forest region further south, mostly managed today as State Forest. Earlier this century two successive attempts were made to promote agricultural development and failed due to infertility problems. The pockets of cleared farmland which will be seen date from these attempts.

The principal forest species is karri - *Eucalyptus diversicolor* - which rivals the Californian redwoods for height (80m or more) but not for diameter or longevity. Karri grows on deep red loam soils on the middle and lower slopes of the catena. Poorer lateritic soils occur on upper slopes and cappings, characterised by jarrah (*Eucalyptus marginata*). Valley floors are frequently swampy with a shrub or herbaceous vegetation.

8.45 a.m. Leave Manjimup for Pemberton.

As we leave town, note Timber Manufacturing Centre on left, and after a few km, the Woodchip Mill on right. The first karri trees are seen on outskirts of town.

9.20 a.m. Stop 1 at Gloucester Tree. Toilets available. Ramble round nature trail in karri forest.

The Gloucester Tree, which may be climbed by visitors, was originally used as a forest fire lookout. Owing to the difficulty of constructing lookout towers of sufficient height in such forest, outstanding trees on high points were selected and turned into lookouts by being climbed, laddered, lopped and having a cabin built on the top which was manned during the fire season. Aircraft surveillance is now used instead.

The nature trail shows us the understory of the karri forest, containing many soft-leaved plants and others of less marked sclerophylly than is normal in Western Australia. Conspicuous plants are as follows, likely to be in flower *Acacia urophylla, Chorizema quercifolium, Hibbertia cuneiformis, Hovea elliptica, Opercularia ?volubilis.*

Others not in flower include *Albizia lophantha, Casuarina decussata, Clematis pubescens, Eragrostis curvula, Macrozamia riedlei, Persoonia longifolia, Pteridium aquilinum, Stylidium rhynchangium, Trymalium spathulatum.*

10.10 a.m. Stop 2, stunted jarrah beyond Brockman National Park.

A small sandplain occurs on high ground at this point, similar to sandplains which will be seen later in the tour. The sand is highly leached, bleached white, and is winter-wet as it overlies clay. The jarrah trees are stunted. Shrubs include *Acacia browniana, A. extensa, A. myrtifolia, Agonis parviceps, Andersonia caerulea and Persoonia longifolia.*

Herbaceous species include *Anigosanthos flavida* and numerous Restionaceae (*Anarthria*) and Cyperaceae (*Gahnia, Lepidosperma*).

11 a.m. Stop 3, photostop and discussion in Warren National Park. This Park protects some of the finest stands of karri. The understory is much the same as at Stop 1. *Acacia urophylla* is the principal species here and *Oxylobium maculatum* will be seen. After leaving the route continues mainly through karri forest. Observe (1) notice commemorating the artist Marianne North, (2) notice about jarrah dieback disease and quarantine. The scenic "Karri Valley" is traversed.

12 noon. Stop 4, good quality jarrah forest at Benghazi Road. This may be contrasted with yesterday evening's stop at Kirup. As before, *Eucayptus marginata & E. calophylla* are the canopy trees, with smaller trees of *Banksia grandis, Persoonia longifolia & Xylomelum occidentale.*

Shrubs here include *Acacia myrtifolia, Adenanthos obovatus, Bossiaea linophylla, Daviesia sp., Hypocalymma robustum, Leucopogon verticillatus, Macrozamia & Podocarpus drouynianus* and herbaceous species *Anarthria prolifera, Patersonia sp.*

12.20 p.m. Stop 5, swamp. *Beaufortia sparsa* is typically dominant in these swamps with *Adenanthos obovatus, Agonis parviceps, Xanthorrhoea*, dense sedges and restios which include *Anarthria spp., Evandra aristata* plus *Xyris* sp. (Xyridaceae)

12.40 p.m. Stop 6, on Boat Landing Road. Casuarina low forest, characteristic of depositional white sands at low levels in landscape. *Casuarina fraserana* is the principal species with some stunted jarrah, *Agonis flexuosa & Banksia littoralis.* The understory has *Agonis parviceps, Podocarpus drouynianus,* Restios and sedges. The *Podocarpus* is perhaps the last survivor of the early Tertiary rainforest, reduced to a subshrub.

1 p.m. LUNCH STOP at picnic site at end of road by the Donnelly River. No toilets here. The river is lined by the Warren River cedar *Agonis juniperina* and the paperbark *Melaleuca rhaphiophylla*, plus *Oxylobium lanceolatum*. By a short walk to a swamp over the hill it is possible to see the pitcher plant *Cephalotus follicularis.*

2 p.m. Resume journey, by Nannup Road and Coronation Road. *Dasypogon hookeri*, related to *Xanthorrhoea* , will be seen in flower by the road.

2.25 p.m. Stop 7. Photostop on Coronation Road 5 km in. Good quality jarrah forest. The understory is as previously listed with the addition of *Bossiaea aquifolium.*

2.40 p.m. Stop 8. A quarry here shows a deposit of white water-worn gravel. What is such material doing at the highest level in the landscape? It may be a fluviatile deposit of Permian age. The vegetation is similar to that of Stop 2.

3.10 p.m. Resume journey. At transition from open area to forest, *Eucalyptus patens & E. megacarpa* will be seen. The road descends into jarrah forest and then into karri which has been felled and regenerated. The young trees are 14 years old. Meet Pine Creek Road and turn left. Here there is a demonstration plot of karri seed trees. 7-year old young karri will be seen on left.

Stop 9, on crossing logging road. Photo viewpoint for logging operations.

3.50 p.m. Stop 10 at The Four Aces, a group of splendid karri trees serving as a tourist attraction. The understory is as previously inspected at Stop 1.

After leaving, we reach One-Tree Bridge at the foot of the hill. From here, time and weather permitting, it is possible to take a short scenic drive through second-growth karri forest of about 100 years of age, back to the 4 Aces.

4.45 p.m. Return to Manjimup Auto Motel.

8.00 p.m. Dr.J.A.Friend will give a talk on the ecology of the numbat in forest areas.

DAY 3. Monday August 20th. Manjimup to Porongurup, 210 km.

Today we begin the transect to the north-east along the rainfall gradient, but not directly as there is a diversion to the scenic and floristically interesting Porongurup and Stirling Ranges. Today's route runs parallel to the south coast with the country becoming somewhat drier, until we reach the Porongurup Range in the afternoon. On the way we view swamp and lake vegetation, and lunettes.

8.45 a.m. Leave Manjimup by the Muir Highway.

9.30 a.m., 49 km from Manjimup. Stop 1, swampy country with scrub forest and woodland. Trees are *Eucalyptus marginata, E.decipiens, Banksia littoralis & Melaleuca rhaphiophylla. Leptospermum ellipticum* is the most abundant shrub with *Hakea varia, Leucopogon polymorphus* . It will be possible to demonstrate the scented Boronia, *B.megastigma,* in the swamp south of the road. The reed layer consists mainly of *Baumea* sp.

10.15 a.m. Stop 2, Lake Muir, a large intermittent brackish lake lying on a high watershed. It is expected to be full in August. Fringing vegetation includes *Crassula natans* (annual, semi-aquatic), *Juncus maritima & Halosarcia halocnemoides.*

11 a.m. Stop 3, at the Frankland River crossing. The route has been traversing extensive teatree and Banksia swamps, alternating with scrubby jarrah forests. On the better drained soil near the river the forest improves. *Acacia saligna* should be in flower.

11.30 a.m. Pass through settlement of Rocky Gully. Toilets available here on request.

12.15 p.m. Stop 4. Lunch at Lake Poorarecup picnic area. Toilets.

This fresh-water lake was formerly much used by local people for recreation but its level has dropped markedly in recent years. The fringe of reeds and paperbarks will be seen around the original margin. The principal interest of this stop is the lunette, a crescent-shaped dune on the south-east side of the lake. Virtually all lakes in this area have these lunettes. It is believed that the material forming the dune was blown out of the lake bed during the arid phase of the last glacial period, demonstrating strong winds from the WNW and a climate much drier than the present.

The lunette is vegetated with *Eucalyptus decipiens* in mallee form and some trees of *E.occidentalis* at the foot of the dune. Shrubs to be seen are *Acacia cyclopis, A.pulchella, A.saligna, Bossiaea linophylla, Brachysema sericeum, Hakea prostrata, Hybanthus calycinus, Isopogon formosus.*

1.30 p.m. Leave for Porongurup. The country around Lake Poorarecup is swampy and has an irregular tree cover of *Eucalyptus marginata, E.decipiens and E.occidentalis.* After a few km rising ground has a cover of *E.marginata* and *E.wandoo* with *E.occidentalis* in depressions. Quite soon as the rainfall is declining, *E.marginata* drops out and the woodland is composed of *E.wandoo & E.occidentalis.* However after we reach the Albany Highway and turn right towards the coast, we reenter forest of *E.marginata & E.calophylla.*

15 km from Lake Poorarecup the peaks of the Stirling Range come into view in front. We shall be there tomorrow.

At the town of Mount Barker we turn east.
3 p.m. Stop 5. Arrive at Bolganup in the Porongurup Range. Toilets available on way in, at Bolganup Dam. The party will have two hours here for a ramble up the Wansborough Walk, continuing if desired up the rock slopes to the summit of the Devil's Slide, 670m. The range is formed of a series of granite domes 12km long and 3 km wide. It is the most massive granite outcrop in the State. The summits are in many cases quite bare or covered with lichens, herbaceous plants and scattered shrubs. Lower down a belt of *Eucalyptus cornuta & E.megacarpa* leads into extensive karri forest (*E.diversicolor*) on the lower slopes. This species here is an outlier, 100 km east of its main range.

Two species are known to be endemic to the Range, *Hibbertia bracteosa, Villarsia calthifolia* . They tend to occur above 400m altitude, on granite rocks.

5.30 p.m. Arrive Karribank Lodge for the night's stay.

An account of the vegetation of the Range is given on a separate sheet.

DAY 4. Tuesday August 21st. Porongurup to Katanning. 227 km.

We spend most of today in the Stirling Range National Park and in the afternoon press on to our night stop at Katanning.

8.45 a.m. Leave Karribank Lodge. After travelling along the foot of the Porongurup Range we meet the main road from Albany and turn north. Another 5km, and we cross the forest boundary to enter the Kalgan Plains, the extremity of heath-covered plains which extend east from here all along the south coast as far as the Great Australian Bight. The Kalgan Plains have been largely cleared for farming in recent years but we shall see the original vegetation in the National Park.

The Stirling Range, coming into view in front, is a highly eroded remnant of sedimentary rocks of Proterozoic age dated at >1340 m.y. These consist of quartz sandstone at the base overlain by phyllite and muddy sandstone, and are up to 910m thick, dipping gently to the south. Such rocks may once have covered much of the interior plateau.

9.15 Stop 1 on sandplain 2 km inside the Park. The vegetation of the south coast sandplains is classed as "mallee-heath" as it comprises a heath layer overtopped by scattered small mallee eucalypts. *Eucalyptus tetragona* is the most characteristic species and is conspicuous with its glaucous leaves. Other mallees at the stop are *E. angulosa* & *E. pachyloma*.
Conspicuous shrubs at this stop are *Acacia drummondii, Banksia gardneri, Casuarina humilis, C. thuyoides, Chorizema glycinefolium, Dryandra armata, D. brownii* and some miniature species, *Exocarpos, Hakea corymbosa, H. trifurcata, Hibbertia sp., Leucopogon cucullatus, Lysinema ciliatum, Melaleuca suberosa, Petrophile squamata, Xanthorrhoea aff. reflexa*.
The ground layer is mainly of the sedge *Mesomelaena pseudostygia*.

10 a.m. Stop 2 at the Gold Holes picnic area, to view woodland in the Park. A small amount of alluvial gold was discovered and worked here. Trees on the deep valley soil are *Eucalyptus calophylla* & *E. cornuta*.. On more shallow soil opposite there is *E. wandoo* which has a sparse understory mainly *Templetonia retusa* also *Acacia drummondii, A. cyclopis, Dryandra sessilis, Hakea trifurcata* & *Leucopogon revolutus*.
There is also a patch of *Banksia attenuata* low woodland on bleached sand on the west side above the Gold Holes, which merges behind into *E. marginata* low woodland.

10.30 a.m. Stop 3 at foot of Toll's Peak. 2 hours will be alotted here for an ascent of the Peak in order to view the thicket formation and its component species, occurring at the higher levels in the Range. It is unfortunately not possible to see this without some physical effort. The Australian kwongan here adopts its closest resemblance to the South African fynbos.

The ascent begins in low woodland of *E. marginata* & *E. calophylla* with an understory of *Acacia drummondii, Dryandra sessilis, Hakea trifurcata, Isopogon baxteri, Leucopogon revolutus, Lysinema ciliatum, Xanthorrhoea sp.*
As the woodland declines in height, *Hakea marginata* becomes common, with *H. baxteri and H. cucullata*.
The woodland trees decline to the stature of mallee without change of species. The ground layer becomes more sedgy. *Xanthorrhoea* will be seen dying of *Phytophthora* root disease.

As the slope steepens, the mallees *E. doratoxylon* & *E. decurva* take over and the high-level shrub flora comes in, e.g. *Andersonia echinocephala, Banksia solandri, Beaufortia orbifolia, Dryandra formosa, Isopogon latifolius; Oxylobium atropurpureum*.

12.45 p.m. Stop 4, LUNCH at Chester Pass picnic area. Toilets.

A ramble will be taken in the sandplain adjacent, in mallee-heath similar to that at Stop 1, with *E. tetragona, E. angulosa, E. buprestium* & *E. marginata*.
Shrubs not seen at Stop 1 will include *Cryptandra sp., Dryandra sessilis, Gastrolobium spinosum, Hakea nitida, Isopogon formosus, Lambertia inermis, Synaphea polymorpha*.
2 p.m. Resume journey by the Stirling Range scenic drive, which skirts the prominent peak Toolbrunup and leads on to the group of Gog, Magog and Talyuberlup in the centre of the Park. Zonation of vegetation according to slope will be observed.

2.30 p.m. Stop 5, Talyuberlup picnic area. A brief stop will be made here to see some localised species, e.g. *Eucalyptus talyuberlup* (formerly *E.macrocera*), an undescribed *Acacia* and *Darwinia wittwerorum*.

3.00 p.m. Stop 6, a brief stop at the view-point south of Gog.

3.15 p.m. Stop 7, Mondurup parking area. This end of the Park was burnt in 1983 and we may have to content ourselves with a view of the country.

3.30 p.m. Stop 8, Red Gum Springs. West of here the Park escaped the fire, and it should be possible to see *Banksia coccinea & Hakea cucullata* in flower.

4.00 p.m. Stop 9, photo-stop on the last hill before leaving the Park where there is a panorama of the peaks of the Range to the east and of the sandplain and salt lakes north of the Range.

From here we have to drive through to Katanning for our night stop. The road proceeds to Cranbrook, passing Hamilla and Sukey Hills which continue the geological formation of the Stirling Range. We then turn north and at Pootenup we pass through a salt lake complex. The intermittent lakes, normally dry, are surrounded by *Halosarcia*, then *Melaleuca* and *Lawrencia* . Each lake has a lunette or complex of lunettes on the ESE on which there is *Acacia acuminata, Eucalyptus wandoo, E.occidentalis* and paperbarks. Between the lakes woodland is formed by *A.acuminata & E.loxophleba*, an association which we shall see much of further inland.

Around Tambellup there is a depositional sandplain with a heath cover. After passing through Broome Hill, *E.gardneri* becomes plentiful.

5.30 p.m. Arrive Jumbuk Motel, Katanning.

8 p.m. Mr.K.Wallace, Fisheries & Wildlife Dept., will discuss the management of natural areas for conservation.

DAY 5. Wed. August 22nd. Katanning to Lake Grace. 209 km.

We now set off to the north-east into the drier country of the wheatbelt where a change in the landscape will be observed. We shall see woodlands, mallee and heath. Lakes will be salt, at first permanent, then intermittent.

8.45 a.m. Leave Katanning for Dumbleyung.

9 a.m. Stop 1, at typical "mallet ridge". Laterite is now only seen as a capping on isolated ridges. The typical tree is *Eucalyptus astringens* plus *E.wandoo & E.longicornis*, and usually little or no understory.

30 km from Katanning we pass the remains of a heath area along the road, with *Leptospermum erubescens*.

At 33 km we encounter our first salmon gum tree, *Eucalyptus salmonophloia*. The undershrub is *Templetonia aculeata*. At 37 km we cross a laterite ridge, now too dry for tree eucalypts so that the vegetation is kwongan with *Dryandra armata* dominant and the mallee *Eucalyptus drummondii*. Other shrubs are *Gastrolobium tricuspidatum, G.spinosum, Hakea gilbertii*.

10.10 a.m. Stop 2, for salt flats on the Coblinine River. In the wheatbelt, rivers become intermittent and saline. Two species of samphire (*Halosarcia*), *Pelargonium havlasae*, *Avena*. Trees and shrubs have suffered from the increase of salinity since land clearing and many are dead. These include *Melaleuca cuticularis*, *M. lateriflora*, *M. uncinata* and the taller *Casuarina obesa*.

10.30 a.m. Stop3, Sandhills with Banksia low woodland. A sand quarry shows the profile of the deep, structureless aeolian material. Trees are *Banksia attenuata*, *B. prionotes*, *Acacia acuminata*, *Casuarina huegeliana* . Shrubs include *Acacia sp.*, *Eremaea pauciflora*, *Hakea corymbosa*, *H. prostrata*, *Jacksonia furcellata*. We continue the route, passing through the town of Dumbleyung.

11 a.m. Stop 4, at lookout point over Lake Dumbleyung. This lake is salt but permanent, an unusual combination. Until Lake Argyle was filled by the Ord River Dam, in the Kimberley, this was the largest body of permanent water in Western Australia. Sir Donald Campbell broke the World Water Speed Record here on Dec.31st.,1964. The lake level varies very considerably with rainfall cycles, as it has no outlet. At low levels, sandbanks with dead tree stumps are exposed.

We resume our route, passing back through Dumbleyung and heading in a generally northerly direction to the Dongolocking group of reserves.

12.15 p.m. Stop 5, LUNCH. Open country, no toilets. Woodland of *E. wandoo* with *Oxylobium parviflorum* and *Acacia pulchella* opens out to heathland. The principal species to be seen here are *Banksia sphaerocarpa*, *Calothamnus quadrifidus*, *Casuarina microstachya*, *Comesperma scoparium*, *Dryandra armata*, *D. cirsioides*, *Eucalyptus eremophila*, *Hakea lehmannii*, *Isopogon drummondii*, *Leptospermum erubescens*, *Melaleuca subtrigona*, *Petrophile squamata*, *Xanthorrhoea reflexa*. *Mesomelaena stygia* is the principal ground plant.

1.15 p.m. Stop 6, examination of a further range of types in the reserve. The stop is on a small laterite plateau, the soil sand over pisolitic ironstone. Two formations are present, mallee on ironstone, heath on sand.

Mallees are *Eucalyptus oleosa*, *E. sheathiana*, *E. decipiens*, *E. falcata* . *Dryandra nobilis* & *D. cirsioides* form a dense understory to the mallee.

Heath consists of *Beaufortia ?incana*, *Chloanthes coccinea*, *Hakea baxteri*, *Hibbertia sp.*, *Isopogon divergens*, *Lambertia inermis*, *Melaleuca sp.*, *Pimelea ferruginea*, *Urocarpus squamuligerus*, *Xanthorrhoea reflexa*.

After resuming the journey we pass through extensive flat country originally under woodland of *Eucalyptus loxophleba* and *E. salmonophloia* .

3 p.m. Stop 7, near Kukerin, for inspection of mallee formation. Mallee species are *E. gracilis*, *E. redunca*, *E. sheathiana*. There is very little understory here, a few *Daviesia acanthoclona* and *Templetonia aculeata*. ½km further on there is a thick understory of *Melaleuca uncinata*.

3.35 p.m. Stop 8, Tarin Rock Reserve.

The reserve here preserves an extensive remnant of kwongan on sandplain. The kwongan contains scattered small mallee, *Eucalyptus albida*, which only occurs in kwongan; *Grevillea hookerana*, a pioneer species abundant after fire, and the compass bush *Casuarina pinaster* which leans over to the south. Other species at the stop are *Adenanthos argyrea, Banksia sphaerocarpa, Casuarina humilis, Daviesia spp., Dryandra aff. cirsioides, Grevillea armigera, Hakea glabella, H. incrassata, Isopogon drummondii, Jacksonia sp., Synaphea polymorpha.*

2 km further on we shall see *Grevillea insignis* and *Hakea multilineata* by the road side.

After another 15km an extensive view of the salt lakes opens up (Lake Grace North & South). The first gimlet trees appear (*Eucalyptus salubris*), and thickets of *Casuarina campestris* on laterite. Photo stop on request.

4.40 p.m. Stop 9. After crossing the lake by the causeway we stop to examine the vegetation of the adjacent salt flats. Salt-tolerant eucalypts, *E. gracilis & E. kondininensis* are seen on the lunette with chenopodiaceae, e.g. *Enchylaena tomentosa* and *Threlkeldia. Atriplex vesicaria* is dominant on the flats with *Disphyma clavellatum & Frankenia sp.* The lake itself is bordered by *Halosarcia & Lawrencia.*

5 p.m. Arrive Lake Grace township for the night stop. The party will be divided between the Golden Fleece Motel and the Lake Grace Hotel.

DAY 6. Lake Grace to Hyden. 187 km. Thursday August 23rd.

We traverse the outer wheat belt, through mallee, drier woodlands and heaths.

8.45 a.m. Leave Lake Grace, on Kulin road.

The country is very gently undulating with mallee and woodland alongside the road. A number of granite rock outcrops will be observed.

9.30 a.m. Stop 1, Jilakin Rock. An especially prominent granite dome here affords a recreational area and overlooks a small salt lake. The site is of interest for the occurrence of a small population of *Eucalyptus marginata* , an outlier 120 km east of any others. The site receives additional runoff from the rock.

The opportunity will be taken to examine the rock and the plants growing on it in crevices and patches of soil. A number of W.A. species are confined to this habitat, and we shall see *Stypandra grandiflora* ("blind grass") and the floriferous shrub *Kunzea pulchella* which makes a good garden subject. Other plants are *Casuarina huegeliana, Diplolaena microcephala, Dodonaea* sp., the reed *Spartochloa* and the sandalwood *Santalum spicatum*. Clumps of *Borya nitida* form a grass-like cover in parts.

On resuming our journey we pass through the settlement of Kondinin, type locality for *Eucalyptus kondininensis*, and head north for Bendering where we turn east to examine the Bendering Reserves. These were included in the Biological Survey of the Wheatbelt by Muir and are well documented.

Conveniently, the road runs along the west, south and east sides of the West Bendering Reserve, enabling inspection from the bus. There is first woodland of *Eucalyptus salmonophloia-E.salubris*, then mallee, then Casuarina thicket on the laterite at the top of the rise, then down into mallee (note topographic sequence). Along the south side of the reserve we see mallee with scattered trees of *E.salmonophloia & E.salubris*. After turning north along the east side, we again see mallee and woodland, and come eventually to an extensive granite outcrop.

11.30 a.m. Stop 2, at cross-roads.

A laterite quarry shows a profile of the duricrust. It carries a thicket of *Casuarina campestris* with a limited number of associates, e.g. *Acacia ?multispicata, Calothamnus quadrifidus, Dryandra sp., Grevillea armigera, G.excelsior.*

Around the granite rock outcrops we see the run-off community of *Acacia lasiocalyx, Dodonaea viscosa, Leptospermum erubescens* and the sedge *Lepidosperma viscidulum.*

The run-off community merges into mallee - *E.eremophila* - with scattered trees of *E.loxophleba* and undershrubs of *Casuarina acutivalvis, Hakea invaginata, Verticordia acerosa & V.picta.*

We resume the road east towards the main Bendering Reserve, and turn south for 1 km along boundary.

12.05 p.m. Stop 3, *Eucalyptus burracoppinensis* community.

A feature of this area is the occurrence of the small mallee *Eucalyptus burracoppinensis* in kwongan. Muir was unable to identify soil properties to account for this. The kwongan at the stop is essentially Casuarina thicket with a mixture of *Casuarina acutivalvis, C.campestris & C.corniculata* and *Acacia* sp., *Santalum acuminatum* (Quandong). There is only a sparse understory including *Persoonia sp. & Phebalium tuberculatum.*

12.30 p.m. Stop 4, LUNCH. Woodland, no toilets.

We return to the main road and stop for lunch in a grove of mallet trees, *E.falcata & E.gardneri*. These are small eucalypts known as marlocks, which are common in the mallee region. After fire, resprouting species form mallee but non-sprouting species must regenerate from seed and form groves of marlocks. Understory shrubs here are *Beyeria leschenaultii, Callitris roei, Casuarina acutivalvis, Dodonaea bursariifolia, Isopogon buxifolius, Leptomeria sp.*

The mallee formation immediately to the east down slope consists of *E.eremophila, E.flocktoniae, E.loxophleba var.* The understory is mainly of *Melaleuca uncinata & M.undulata.*

2 p.m. Stop 5, for heath in the Reserve.

The kwongan takes the form of scrub-heath, a more mixed and open community, where sand predominates over ironstone gravel in the soil. The patchy nature of the community will be observed, illustrating the highly mosaic character of kwongan. The following are likely to be in flower:-
Adenanthos argyrea, Boronia ternata, Isopogon buxifolius, Lobelia sp., Lysinema ciliatum, Pimelea silvestris, Psammomoya choretroides, Synaphea polymorpha.

2.50 p.m. Stop 6. Deep-weathered profile.
An exposure will be seen at the roadside of the deep-weathered soil profile. A massive lateritic carapace overlies a mottled zone which merges down into a pallid zone of white kaolinised material. The deep weathering is thought to be of early Tertiary age or earlier, the lateritisation Oligocene/Miocene. The water storage potential for tree growth can be appreciated.
A few small *Callitris canescens* occur on the summit.

3.30 p.m. Arrive Hyden. Pass through town.

3.35 p.m. Stop 7. Visit Wave Rock.
This rock, while basically the same as Jilakin Rock visited this morning, is a major tourist attraction due to the wave formation on the north side, which we shall see. The rock above is rather bare of plants but the run-off community can be seen as before at the foot. The rock also serves as a catchment for the town's water supply which is impounded by a small dam.

5 p.m. Arrive Hyden Motel for the night.

DAY 7. Friday August 24th. Hyden to Southern Cross. 187 km.
Continuing to the north-east into still drier country, we pass beyond the outer fringe of cultivation into undisturbed bush without, however, much obvious change in the vegetation. We see communities on a different substrate, greenstone.

8.45 a.m. Leave Hyden.
After 15 km we pass another massive granite outcrop, "The Humps". 14 km more and we come to Stop 1.

9.30 a.m. Stop 1. A population of young gimlet trees - *Eucalyptus salubris* - with *E. flocktoniae* & *E. loxopleba*. These must have started life after a fire a few years ago and will thin themselves with time. Gimlet can become a large tree. The understory is very sparse under this dense stand. Note *Phebalium nude, Eremophila decipiens, Olearia muelleri*. Further on there is a Melaleuca understory.
After another 10 km. we cross a sandplain with kwongan in which *Banksia laevigata* will be seen, then pass a wheat silo on the left. We fork left, signposted for Southern Cross. From this point the road runs absolutely straight to the north-east for 80 km.

10.10 a.m. Stop 2. Vermin-proof fence. We make a brief stop to inspect this. In 1901 the Government of Western Australia, faced with the threat of an advancing plague of rabbits from the east, decided to construct a rabbit-proof fence from Bedford Harbour on the south coast to Cape Keraudren in the north, a distance of some 1500 km. Although two more fences were built behind this one, they failed to stop the rabbits! Today this fence is maintained to prevent emus from migrating into the farming areas. South of this point, the fence marks the limit of agricultural development. Further up the road we shall again meet a few farms but generally speaking this is now the end of settled country.

As this road is so straight it provides an ideal opportunity to observe the catenary sequence of soils and vegetation - red loam on low ground with woodland, more sandy up slope with mallee, and sandplain under kwongan on the summits.

11 a.m. Stop 3. Scrub-heath on deep yellow sand.
Grevillea excelsior now tends to replace *G. hookerana* as the conspicuous pioneer species, but both are present. Other shrubs present are *Acacia hynesiana, Banksia audax, Callitris roei, Casuarina corniculata, Daviesia croniniana, Dryandra sp., Eremaea pauciflora, Hakea incrassata, H. platysperma, Melaleuca undulata, Petrophile ericifolia.* The restionaceous *Ecdeiocolea monostachya* is common and other Ground plants are *Mesomelaena stygia* and a green cushion plant which belongs to an undescribed genus of Cyperaceae.
This is a heterogeneous scrub-heath association. Note that on the next summit 2 km in front, Casuarinas are dominant, owing to proportion of ironstone gravel.

11.50 a.m. Stop 4. This time we stop in a depression where there is a low granite rock surrounded by *Acacia ?resinomarginea* with *Lepidosperma & Spartochloa.* On the far side *Acacia acuminata* and large *Callitris preissii*, indicating a fire-protected habitat. The pond is fresh; no salt lakes here. Note also a sand flat with thickets of *Melaleuca uncinata* and *M. acuminata.*

12.30 p.m. Stop 5, LUNCH. Open country, no toilets.
We stop for lunch in an open clearing in salmon gum woodland with some large *E. salmonophloia & E. salubris.* Smaller trees or mallee are also of these species plus *E. eremophila & E. concinna.* The understory includes *Melaleuca eleutherostachya, M. spp., Microcybe sp., Olearia muelleri.*

1.40 p.m. Stop 6, in kwongan. This time Casuarinas are dominant but the community is open enough to permit a variety of other species. Shrubs to be seen here include *Banksia elderana, Callitris preissii, Calothamnus quadrifidus, Melaleuca undulata, Persoonia saundersiana, Santalum spicatum.* Ground plants include *Borya nitida* and the Restionaceous *Ecdeiocolea monostachya.* A sign that we are entering semi-arid country is provided by the appearance of hummock grass or "spinifex", which is either *Triodia scariosa* or *Plectrachne rigidissima.*
After leaving this stop we see the extraordinary *Acacia rossii* in flower.
At a cross-roads we turn right for the Parker Range.

2.15 p.m. Stop 7. The low hills known as the Parker Range result from the outcrop of metamorphic rocks known as greenstones. These are of Archaean age and originally consisted of layers of shale, greywacke and basalt. Metamorphism has altered the shale and greywacke to slate, phyllite, schist and in some cases to banded ironstone. The volcanics have been altered mainly to amphibolite and there has been some intrusion of serpentine and other ultramafic material. The whole sequence is strongly folded with a strike of NNW-SSE.
The greenstone belts are the seat of gold mineralisation in Western Australia. Their vegetation may differ significantly from that of granite country.

Stop 7 (continued). We stop at a ridge, probably formed of banded ironstone as it has a massive duricrust. The cover is a thicket of *Casuarina campestris & C.acutivalvis* with a *Hakea* and scattered eucalypts. There is very little understory.

On returning to the crossroads we turn right and continue the previous road which follows the greenstone belt in woodlands of *Eucalyptus salmonophloia, E.salubris, E.gracilis & E.longicornis* with an understory of *Melaleuca pauperiflora* and a ground layer frequently of saltbush, *Atriplex vesicaria.* Evidences of mining will be seen in abandoned mine shafts and mullock heaps. On rising ground the woodlands merge into mallee and Casuarina thickets.

3.30 p.m. Stop 8. After leaving the greenstone belt we come once more to wide sandplains. Our stop shows the effect of fire. On the left-hand side of the road we have a well matured thicket of Casuarina - *C.acutivalvis, C.campestris, C.corniculata* - whereas on the right-hand side the vegetation is lower and more open, recovering from fire, with pioneer plants such as *Grevillea excelsior & Acacia rossii.* Other plants here are *Baeckea & Thryptomene spp., Drummondita hasselii & Melaleuca undulata.*

4.30 p.m. Arrive Southern Cross. Inspect abandoned open-cut gold mine.

5 p.m. Southern Cross Motel for night's stop.

DAY 8. Saturday August 25th. Return to Perth, 400 km.

As we have far to go we must make an earlier start and allow ourselves fewer stops along the way.

8.30 a.m. Leave Southern Cross by Great Eastern Highway.

9.15 a.m. Stop 1, in Bodallin sandplain. Quite well matured kwongan, a thicket of the *Acacia-Casuarina-Melaleuca* alliance but with a reasonably rich flora. Plants to be noted are numerous *Acacia* spp., *Casuarina acutivalvis & C.corniculata,* sandplain mallees *Eucalyptus burracoppinensis & E.leptopoda, Drummondita hasselii, Grevillea excelsior, G.paradoxa, Hakea ?falcata, Hakea aff. francisiana, Melaleuca cordata, Persoonia revoluta* and the reed *Ecdeiocolea monostachya.*

Continuing along the main road, one again notices the catenary sequence of woodland, mallee and kwongan. A feature of this area is the frequent occurrence of a fringe of *E.wandoo* and *E.erythronema* at the edge of the sandplain.

10 a.m. Stop 2. Here we inspect a deep exposure of the profile in a railway cutting. The base comprises pallid zone consisting of kaolinite and quartz derived by chemical weathering from the granitic basement rocks. It is overlain by duricrust representing indurated mottled zone. To left and right down slope there is a thickening of transported material, up to 2m of pea ironstone capped by sand.

The route continues through Merredin until at Kellerberrin we turn south off the highway.

12 noon. Stop 3, Mount Caroline.

Mount Caroline is an extremely large granite outcrop protected as a reserve by the Dept. of Fisheries & Wildlife. Research on maintenance of the rock-wallaby population is in progress and Dr.J.E.Kinnear will meet the party here to describe his work.

The rock receives a higher rainfall than other rocks we have visited and a difference in the vegetation will be observed, e.g. far more tree cover, of *Eucalyptus loxophleba, Acacia acuminata & Casuarina huegeliana* . The rock is home to a population of *Eucalyptus caesia*, one of the rare mallees confined to granite rocks as their habitat. We shall see this in some long unburnt senescent low woodland at the foot of the rock containing *Acacia acuminata, A.lasiocalyx, Grevillea petrophiloides*. These species also occur, more sparingly, on the rock itself with the usual mats of *Borya*. The orchid *Thelymitra antennifera* should be in flower.

1 p.m. Stop 4, LUNCH. Open country, no toilets.

We reach the Charles Gardner Flora Reserve, 583 ha., named after a former Government Botanist who was instrumental in its protection, and stop for lunch in a small grove of *Eucalyptus loxophleba & Acacia acuminata.*

The flora of the reserve has been intensively studied by botanists from the State Herbarium, and a list of 328 taxa is available (see separate sheet).

On the way in we pass a yellow sand area on which the most important species are *Xylomelum angustifolium* and *Actinostrobus arenarius*. This is an outlier of a community,the *Banksia-Xylomelum* alliance, which is important further north. Around the picnic area the soil is a grey sand with ironstone gravel on which *Casuarina campestris* is dominant. Scattered small trees of *Acacia lasiocalyx & Casuarina huegeliana* occur. Common shrubs are *Acacia hynesiana, A.pulchella, Calothamnus quadrifidus, Comesperma volubile, Conospermum stoechadis, Daviesia spp., Eremaea pauciflora, Grevillea pilulifera, G.pritzelii, Hakea commutata, H.platysperma, Leptospermum erubescens, Petrophile ericifolia.*Herbaceous *Mesomelaena stygia.* The beautiful, rare and localised *Dryandra speciosa* deserves special mention.

2 p.m. Leave for Perth. We now go straight through to Perth without further stops, as we have still 200 km to go.

After a short distance we see the glaucous mallee *Eucalyptus macrocarpa* by the roadside with the rare and peculiar *Hakea aculeata* . At Cunderdin we rejoin the Great Eastern Highway and pass through the village of Meckering which was destroyed by an earthquake in 1968. The earthquake fault line is marked just beyond the town. Below Meckering the shallow valley we have been following, containing a chain of salt flats, narrows and steepens, forming an active river course. The "Meckering Line" marks the upper limit of the rejuvenation of the river system following the post-Cretaceous uplift.

After passing through Northam the country changes and we reenter the jarrah forest seen at the beginning of the tour. After winding down the coastal escarpment we reach Perth at 5 p.m.

We hope you have enjoyed your tour.