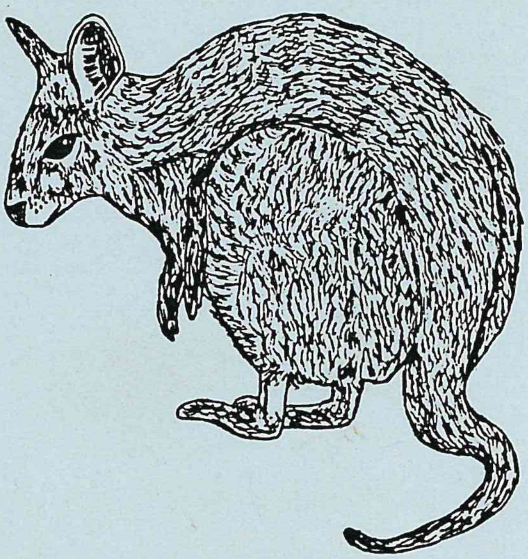
Wally Edgecombe

THE PERUP FOREST ECOLOGY STUDY CENTRE

THE PERUP FOREST AND NOTES ON FIELD STUDY TECHNIQUES



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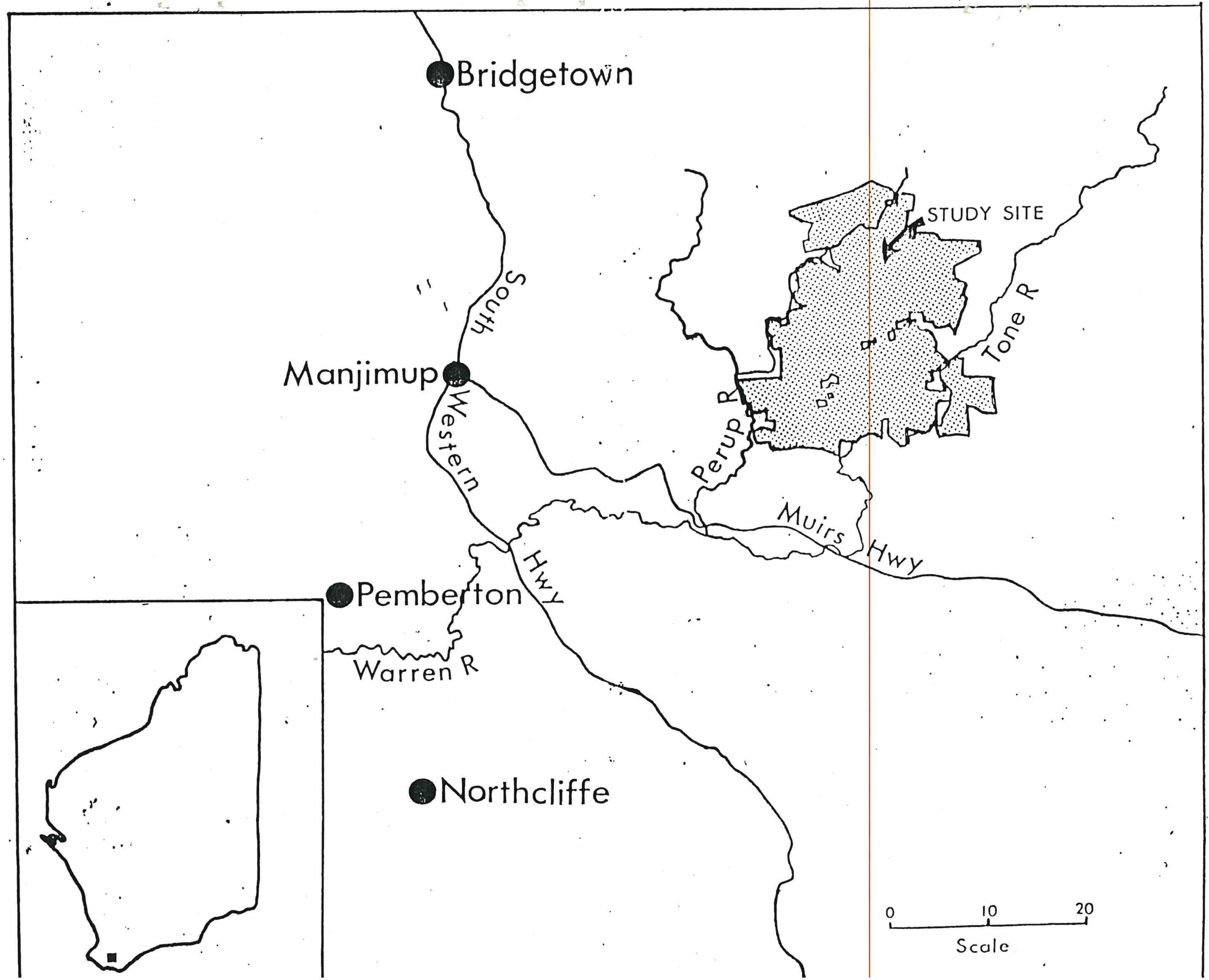
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Manjimup
South Western Hwy
Pemberton
Warren R
Northcliffe
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Muirs Hwy
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STUDY SITE
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Scale

THE PERUP FOREST

INTRODUCTION

The Perup forest contains more species of mammals than any similar sized area in the south-west of Western Australia. Viable populations of no less than five rare and endangered mammals, exist within the area. For this reason the Perup has been designated a Management Priority Area for flora and fauna by the Forests Department of Western Australia.

Management Priority Areas (M.P.A.s) are the means by which the Forests Department carries out its policy of Multiple Use of the Forest. Different areas of forest have been assigned 'priority uses' such as hardwood production, recreation, flora and fauna protection and so on. These uses are not necessarily mutually exclusive, in most cases they may be carried out simultaneously or at different times within the same area. However occasionally there is conflict, consequently priority ranking has been introduced to resolve conflicts in management when these arise.

The forest area is divided into a series of different categories of M.P.A. of varying size and extent. One of these categories has flora and fauna protection as the major priority. There exist at present over seventy flora and fauna M.P.A.s within State Forest. Of these the Perup Forest, some 40,000 hectares in size, is the largest and most important. It is also one of a few in the special category of 'Flora, Fauna and Landscape Management Area' where a range of management systems is employed to improve or sustain the fauna values.

HISTORICAL

The Perup area which was set aside in 1971 was the first of the Management Priority areas. Indeed it was the embryo of the Priority Management concept, the place where it all started. Since that time much research on the fauna of the area has been carried out by the Forests Department. Most of it has centered around the effects of fire on flora and fauna. Though the prime reason for most of this research has been to find out about the effects of prescribed burning practices much of it has been of a more basic nature. Thus the major thrust has been on the fire ecology of species rather than just the effects of cool spring fires.

The main reason for this approach is to gain an understanding of the role that fire plays in the ecology of the populations and communities of animals which occur in the Perup. As well as being able to predict the effects of prescribed fire on plants and animals, this information will enable forest scientists to formulate fire management plans suitable to the species of the area.

Much of the work has been written up and published in the journals, scientific papers and various pamphlets listed under references.

THE PERUP AREA

The area is encompassed between the upper reaches of the Perup and Tone, tributaries of the Warren River. It is undulating country, typical of the upper reaches of the rivers in the south-west, characterised by broad, flat valleys and low ridges. The rainfall is low, less than 800 mm p.a. and streams in the area are seasonal and there are a number of seasonal swamps.

The area is underlain by the precambian basement, largely Archean rocks, a complex of crystaline igneous and metamorphic rock, dominantly granites and gneisses with minor amounts of basic igneous and schistose metasedimentary formations. In places there are younger deposits from the quaternary age.

Yellow podsolic soils occur along the drainage lines while the ridges are sandy gravels with occasional boulders and sheets of lateritic pavement. Sands occur in places around the margins of swamps and there are very few outcrops of granite.

VEGETATION

The predominant vegetation of the area is open forest of jarrah (*Eucalyptus marginata*) and marri (*E. calophylla*). Jarrah tends to be dominant on the ridges and more lateritic soils whereas marri becomes more common in the valleys and on the sandier soils. In many of the valleys, especially on claey soils, in the northern parts of the area wandoo (*E. wandoo*) woodlands occur.

The understorey over the greater part of the Perup is one of low clumped exeric scrub species. Rootstock species such as *Hakea lissocarpa*, *Leucopogon capitellatus* and *Bossiaea ornata* are common on the ridges, in lower lying areas, particularly on sandy soils *Hypocalymma angustifolia* is dominant. In the treeless drainage lines on shallow soils *Hakea prostrata*, *H. varia* and *Acacia saligna* form tall open thickets. In some areas, particularly along the upper parts of the Perup river, *Melaleuca viminea* forms dense thickets. The wandoo woodlands have a sparse understorey with much bare ground between occasional scrubs.

A few restricted habitats occur with a different vegetation. These include granite outcrops with *Casuarina heugeliana*, *C. humilis*, *Hakea cyclocarpa* and *Dryandra ornata*, quartz sands with a dense low understorey of *Melaleuca thymoides* and others and several Cladium swamps. The latter are peaty swamps with reedbeds of *Cladium reticulatum* often surrounded by woodland of *Banksia attenuata*, flooded gum (*E. rudis*) and *Melaleuca preissii*.

Several leguminous species form dense thickets following summer fires, these include *Gastrolobium bilobum* (Heartleaf poison), *G. spinosum* (Prickly poison) and *Acacia pulchella*. Many thickets of Heartleaf originating from the 1951 wildfires exist in the more fertile valleys particularly in the south of the area. Prickly poison thickets occur on shallow soils over granite outcrops in several places and *A. pulchella* form low thickets in many places following summer or autumn fires. These thickets of 'fire weed' species are important for several species of mammals in the area.

A list of plant species collected from within the area is presented in Appendix 1.

ANIMALS

A total of 21 native, and five introduced mammals, 85 birds, 4 snakes, 9 skinks, and 7 frogs have been recorded in the area (Appendix 2). These lists are not considered to be complete and more birds and reptiles in particular are likely to be recorded in future.

The area is outstanding primarily because of its diverse mammal fauna and the high number of rare and endangered species which it contains. Thus the largest existing populations of the woylie (*Bettongia penicillata*) estimated to number less than 5,000 individuals live in the area. The woylie occurs throughout most of the area particularly in the more fertile sandy gravels where the ground cover is comparatively dense. The Numbat (*Myrmecobius fasciatus*) is also widely distributed but far less common and the total population of this species within the area is estimated to number less than one thousand animals. The Western Native Cat (*Dasyurus geoffroii*) is also widely distributed but uncommon although it appears to be holding its own. The tammar wallaby (*Macropus eugenii*) is restricted to the thickets of Heartleaf and *Melaleuca viminea* mentioned previously and is comparatively common in the northern and southern parts of the area where these thickets exist. The Western Ringtail possum (*Pseudocheirus peregrinus*) exists in low numbers over much of the area, in particular in the south and north.

All the above species are now on the rare and endangered species list and are the primary reason for the special status of the area as a flora and fauna M.P.A. In 1973/74 many species of fauna in the area suffered a drastic decline in population e.e. the Numbat, Ringtail, Woylie and others. It is believed that the fox had a major role to play in this decline and since that time detailed research has been carried out on species biology, in particular the rare and endangered species. Some of the details of this research may be found written up in the various papers and journals listed under further reading.

RESEARCH

Since the early 1970s a continuing programme of monitoring and research has been carried out in the Perup. Kangaroo and Brush wallaby (*Macropus irma*) populations and monitored twice yearly along a transect through the area. The Possum populations are monitored also twice yearly along transects using spotlights. Other mammals e.g. the Woylie, Short-nosed Bandicoot (*Isoodon obesulus*) and the Native Cat are trapped on a regular basis as a part of a capture-mark-release programme.

In addition to these monitoring programmes more detailed studies on species biology particularly in relation to fire, have been carried out on the woylie and tammar wallaby. These studies are still in progress and detailed investigations are being carried out into the relationship between 'tammar thickets' and fire. Artificial establishment of these thickets, by planting and sowing, is also being investigated.

Further work on the woylie, establishing new colonies in other areas of State Forest is being undertaken. The role of the fox as a predator in this situation is also receiving attention.

In addition to these studies work has also been done on the biology of the numbat and some work has been done on the fire ecology of possums, on the native cat and on bird communities in the area.

MANAGEMENT OF THE AREA

The research which is being carried out within the area is of value in its own right as basic ecological data. However this is not the main reason for the research. Most of the research which is being done relates to the fire ecology of the Perup and the populations of animals which exist there and this is because fire is considered basic to the management of the area.

Protection of the area and of the surrounding farmland is of prime importance. Wildfires can no longer be allowed to take their course in our forests, too many human values are inextricably bound up with these in the south-west.

No information on the fire history of the area is available prior to 1938. However from that time records indicate that the Perup suffered frequent wildfires during the summer and autumn months. It was common practice for the farmers in the area to burn the perimeter and fires often continued to burn uncontrolled for long periods.

In 1951 an exceptionally severe wildfire burnt the entire area leaving the trees scorched and leafless. The extensive thickets of heartleaf, which are the main home of the tammar, originated as a result of this fire.

Prescribed burning was introduced in the late 1950s and by the mid 1960s the area was under a regular 5-7 year cycle of prescribed spring burning. In the mid 1970s a special burning plan was formulated which took account of the fauna values of the area. This included two large unburnt benchmark areas and one area which was to be burnt during autumn rather than the more customary springtime burning. More recently this plan has been superseded by another more detailed one which allows for alternate spring and autumn burns on a longer cycle and has special protective burning buffer zones.

This present burning plan is a compromise between protection of the area as well as the surrounding farming areas and the results of research findings. Some of the details of this burning plan, the philosophy and research findings upon which it is based are outlined in an article in Forest Focus No. 25.

The aim in the Perup is to integrate the use of the forest for other purposes with the management of the area for flora and fauna. Fire protection plays a major role but other aspects such as wood production and the use of the area for scientific study are also considered important. It is not a 'natural museum' it is a place where active and positive management of the areas biological resources is taking place in a rational and practical manner commensurate with the conditions of the world today and in the future.

FUTHER READING

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The breeding burrow of the banded ant-eater (*Myrmecobius fasicatus*). W.A. Nat. Vol. 13, p. 32.

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LIST OF VERTEBRATE SPECIES

MAMMALS

Grey Kangaroo (*Macropus fuliginosus*)
Brush Wallaby (*Macropus irma*)
* Tammar (*Macropus eugenii*)
* Woylie (*Bettongia penicillata*)
Brush Possum (*Trichosurus vulpecula*)
* Common Ringtail (*Pseudocheirus peregrinus*)
~~Pygmy Possum (*Cercartetus concinnus*)~~
Bandicoot (*Isoodon obesulus*)
* Native Cat (*Dasyurus geoffroii*)
Brush-tail Phascogale (*Phascogale tapoatafa*)
Mardo (*Antechinus flavipes*)
Common Dunnart (*Sminthopsis murina*)
* Numbat (*Myrmecobius fasciatus*)
Southern Bush Rat (*Rattus fuscipes*)
Water Rat (*Hydromys chrysogaster*)
Lesser Long-eared Bat (*Nyctophilus geoffroyi*)
Nyctophilus major
Gould's Long-eared Bat (*Nyctophilus gouldii*)
Gould's Wattled Bat (*Chalinolobus gouldii*)
Chocolate Bat (*Chalinolobus morio*)
Little Bat (*Eptesicus pumulis*)
Tasmanian Pipistrelle (*Pipistrellus tasmaniensis*)
White-striped Bat (*Tadarida australis*)
Little Flat Bat (*Tadarida planiceps*)
Echidna (*Tachyglossus aculeatus*)
Cat (*Felis catus*)
Dingo (*Canis familiaris*)
Mouse (*Mus musculus*)
Rabbit (*Oryctolagus cuniculus*)
Fox (*Vulpes vulpes*)

* Species which is rare, or otherwise in need of special protection.

FROGS

Slender Tree Frog (*Litoria adelaidensis*)
Green & Gold Tree Frog (*Litoria moorei*
Heleioporus inornatus
Moaning Frog (*Heleioporus eyeri*)
Crinia georgiana
Ranidella glauerti
Ranidella insignifera
Humming Frog (*Neobatracus pleobatoides*)

SNAKES

Blind snake (*Typhlina australis*)
Dugite (*Demansia nuchalis affinis*)
Tiger snake (*Notechis scutatus occidentalis*)
Little Whip snake (*Denisonia gouldii*)

LIZARDS

Marbled Gecko (*Phyllodactylus marmoratus*)
Scale Footed Lizard (*Pygopus lepidopodus*)
Bobtail (*Tiliqua rugosa*)
Smith's skink (*Egernia napoleonis*)
Red-legged skink (*Ctenotus labillardieri*)
Slippery skink (*Lerista microtis microtis*)
Burrowing skink (*Hemiergis peronii peronii*)
New Holland skink (*Leiolopisma trilineatum*)
Bungarra (*Varanus gouldii*)

BIRDS

Emu (*Dromaius novaehollandiae*)
Australian Grebe (*Tachybabtus novaehollandiae*)
Darter (*Anhinga melanogaster*)
Little Black Cormorant (*Phalacrocorax sulcirostris*)
Little Pied Cormorant (*Phalacrocorax melanoleucos*)
Pacific Heron (*Ardea pacifica*)
White-faced Heron (*Ardea novaehollandiae*)
Rufous Night Heron (*Nycticorax caladonicus*)
Black Bittern (*Dupetor flavicollis*)
Straw-necked Ibis (*Threskiornis spinicollis*)
Black Swan (*Cygnus atratus*)
Australian Shelduck (*Tadorna tadornoides*)
Pacific Black Duck (*Anas superciliosa*)
Grey Teal (*Anas gibberifrons*)
Maned Duck (*Chenonetta jubata*)
Musk Duck (*Biziura lobata*)
Whistling Kite (*Haliastur sphenurus*)
Brown Goshawk (*Accipiter cirrhocephalus*)
Wedge-tailed Eagle (*Aquila audax*)
Little Eagle (*Hieraaetus morphnoides*)
Australian Hobby (*Falco longipennis*)
Brown Falcon (*Falco berigora*)
Australian Kestrel (*Falco cenchroides*)
Painted Button-Quail (*Turnix varia*)
Eurasian Coot (*Fulica atra*)
Banded Lapwing (*Vanellus tricolor*)
Black-fronted Plover (*Charadrius melanops*)
Common Bronzewing (*Phaps chalcoptera*)
Brush Bronzewing (*Phaps elegans*)
Red-tailed Black-cockatoo (*Calyptorhynchus magnificus*)
White-tailed Black-cockatoo (*Calyptorhynchus baudinii*)
Purple-crowned Lorikeet (*Glossopsitta porphyrocephala*)
Red-capped Parrot (*Purpureicephalus spurius*)
Western Rosella (*Platycercus icterotis*)
Port Lincoln Ringneck (*Barnardius zonarius*)
Elegant Parrot (*Neophema elegans*)
Pallid Cuckoo (*Cuculus pallidus*)
Fan-tailed Cuckoo (*Cuculus pyrrhophanus*)
Shining Bronze-cuckoo (*Chrysococcyx lucidus*)

BIRDS (CONT.)

Southern Boobook (*Ninox novaehollandiae*)
Barn Owl (*Tyto alba*)
Tawny Frogmouth (*Podargus strigoides*)
Australian Owlet-nightjar (*Aegotheles cristatus*)
Laughing Kookaburra (*Dacelo novaeguineae*)
Sacred Kingfisher (*Halcyon sancta*)
Welcome Swallow (*Hirundo neoxena*)
Tree Martin (*Cecropis nigricans*)
Richard's Pipit (*Anthus novaeseelandiae*)
Black-faced Cuckoo-shrike (*Coracina novaehollandiae*)
Scarlet Robin (*Petroica multicolor*)
White-breasted Robin (*Eopsaltria georgiana*)
Western Yellow Robin (*Eopsaltria griseogularis*)
* Crested Shrike-tit (*Falcunculus frontatus*)
Golden Whistler (*Pachycephala pectoralis*)
Rufous Whistler (*Pachycephala rufiventris*)
Grey Shrike-thrush (*Colluricincla harmonica*)
Restless Flycatcher (*Myiagra inquieta*)
Grey Fantail (*Rhipidura fuliginosa*)
Willie Wagtail (*Rhipidura leucophrys*)
Splendid Fairy-wren (*Malurus splendens*)
Red-winged Fairy-wren (*Malurus elegans*)
White-browed Scrub-wren (*Sericornis frontalis*)
Weebill (*Smicrornis brevirostris*)
Western Gerygone (*Western fusca*)
Inland Thornbill (*Acanthiza apicalis*)
Western Thornbill (*Acanthiza inornata*)
Yellow-rumped Thornbill (*Acanthiza chrysorrhoa*)
Varied Sittella (*Daphoenositta chrysoptera*)
Rufous Treecreeper (*Climacteris rufa*)
Red Wattlebird (*Anthochaera carunculata*)
Little Wattlebird (*Anthochaera chrysoptera*)
White-naped Honeyeater (*Melithreptus lunatus*)
Brown Honeyeater (*Lichmera indistincta*)
New Holland Honeyeater (*Phylidonyris novaehollandiae*)
Western Spinebill (*Acanthorhynchus superciliosus*)
Spotted Pardalote (*Pardalotus punctatus*)
Striated Pardalote (*Pardalotus striatus*)
Silvereye (*Zosterops lateralis*)
Australian Magpie-lark (*Grallina cyanoleuca*)

BIRDS (CONT.)

Dusky Woodswallow (*Artamus cyanopterus*)
Australian Magpie (*Gymnorhina tibicen*)
Grey Currawong (*Strepera versicolor*)
Australian Raven (*Corvus coronoides*)
Tawny-crowned Honeyeater (*Phylidonyris melanops*)
Singing Honeyeater (*Lichenostomus virescens*)

FLORA

POLYPODIACEAE

Cheilanthes tenuifolia Swartz.
Lindsaya linearis Swartz.
Pteridium esculentum Nakai.

CYCADACEAE

Macrozamia reidlei C.G.Gardn.

PODOCARPACEAE

Podocarpus drouyniana

GRAMINAE

Danthonia pilosa R.Br.
Poa caespitosa
Vulpia bromoides

CYPERACEAE

Cyathochaete avenacea
Gahnia trifida Labill.
Lepidosperma angustatum R.Br.
Lepidosperma brunoniquum Nees.
Lepidosperma longitudinale
Mesomelaena uncinata
Mesomelaena tetragona R.Br. F.Muell.

RESTIONACEAE

Anarthria prolifera R.Br.
Loxocarya fasciculata (R.Br.) Beth.
Loxocarya flexuosa (R.Br.) Benth.

PHILYDRACEAE

Pritzelia pygmaea (R.Br.) F.Muell.

JUNCACEAE

Juncus pallidus R.Br.

LILIACEAE

Agrostocrinum scabrum (R.Br.) Bail.
Borya nitida Labill.
Burchardia sp.
Johnsonia lupulina R.Br.
Stypandra imbricata R.Br.
Sowerbaea laxiflora Lindl.
Dianella revolutos R.Br.
Chamaescilla corymbosa (R.Br.) F.Muell.

FLORA (CONT.)

XANTHORRHOEACEAE

Dasypogon bromeliaefolius R.Br.
Lomandra endlicheri F.Muell.
Lomandra sp.
Xanthorrhoea gracilis Endl.
Xanthorrhoea preissii Endl.

HAEMODORACEAE

Anigozanthos bicolor Endl.
Anigozanthos flavida Red & D.C.
Anigozanthos manglesii D.Don.
Conostylis setigera R.Br.
Hypoxis occidentalis Benth.
Tribonanthes australis Endl.

IRIDACEAE

Patersonia occidentalis R.Br.
Patersonia juncea Endl.

ORCHIDACEAE

Acianthus reniformis (R.Br.) Schlechter
Acianthus reniformis var. huegelii (Endl.) A.S.George
Caladenia barbarossae Reichb.
Caladenia deformis R.Br.
Caladenia flava R.Br.
Caladenia gemmata Lindl.
Caladenia huegelii Klotsch.
Caladenia latifolia R.Br.
Caladenia macrostylis R.Fitzg.
Caladenia menziesii R.Br.
Caladenia patersonii R.Br.
Caleana migrita Lindl.
Diuris laxiflora Lindl.
Diuris emarginata R.Br.
Drakea glyptodon Fitz.
Corybas dilatatus Rhipp et Nicholls.
Elythranthera brunnonis (Endl.) A.S.George
Elythranthera emarginata (Lindl.) A.S.George
Eriochilus dilatatus Lindl.
Lyperanthus serratus (Lindl.)
Lyperanthus nigricans R.Br.
Microtis alba R.Br.
Prasophyllum fimbria Reichb.
Prasophyllum parviflorum Lindl.
Pterostylis barbata Lindl.
Pterostylis nana R.Br.
Pterostylis recurva Benth.
Thelymitra crinita Lindl.
Thelymitra fuscolutea R.Br.
Thelymitra pauciflora R.Br.
Thelymitra villosa Lindl.

FLORA (CONT.)

CASUARINACEAE

Casuarina humilus Ptto. et Dietr.
Casuarina huegeliana

PROTEACEAE

Ademanthos obovata Labill.
Banksia grandis Willd.
Banksia littoralis R.Br.
Banksia sphaerocarpa R.Br.
Conospermum caeruleum R.Br.
Conospermum flexuosum R.Br.
Dryandra armata R.Br.
Dryandra bipinnatafida R.Br.
Dryandra nivea R.Br.
Dryandra sessilis (R.Br.) Druce.
Grevillea pilulifera (Lindl.) C.A.Gardn.
Grevillea pulchella Meissn.
Grevillea quercifolia R.Br.
Hakea amplexicaulis R.Br.
Hakea incrassata R.Br.
Hakea lissocarpa R.Br.
Hakea oleifolia (Sm.) R.Br.
Hakea prostrata R.Br.
Hakea ruscifolia Labill.
Hakea trifurcata (Sm.) R.Br.
Hakea undulata R.Br.
Hakea varia R.Br.
Persoonia longifolia R.Br.
Petrophile longifolia R.Br.
Petrophile serruriae R.Br.
Synaphea favosa R.Br.
Synaphea petiolaris R.Br.
Synaphea preissii Meissn.
Synaphea reticulata (Sm.) G.A.Gardn.
Stirlingia simplex Lindl.

SANTALACEAE

Leptomeria cunninghamii Miq.

OLEACEAE

Olax benthamii Miq.

POLYGONACEAE

Muehlenbeckia adpressa (Labill.) Meissn.

AMARANTACEAE

Trichinum manglesii Lindl.

AIZOACEAE

Carpobrotus aequilateralis (How.) N.E.Br.

FLORA (CONT.)

RANUNCULACEAE

Clematis pubescens Hueg.
Ranunculus colonorum Sm.

DROSERACEAE

Drosera bulbosa Hook.
Drosera gigantea Lindl.
Drosera stolonifera Endl.
Drosera sulphurea Lehm.

ROSACEAE

Acaena ovina A.Cunn.

PITTOSPORACEAE

Billardiera floribunda (Putterl.) Muell.
Billardiera parviflora D.C.
Billardiera varifolia Trucz.
Sollya fusiformis (Labill.) Briq.

MIMOSACEAE

Acacia browniana
Acacia diptera
Acacia drummondii Lindl.
Acacia extensa Lindl.
Acacia incurva Benth.
Acacia insoliata E.Pritzel.
Acacia latipes Benth.
Acacia microbotrya Benth.
Acacia myrtifolia Wild.
Acacia nervosa D.C.
Acacia pentadenia Lindl.
Acacia pulchella R.Br.
Acacia saligna Wendl.
Acacia stenoptera Benth.
Acacia urophylla Benth.
Acacia wildenowniana

CAESALPINIACEAE

Labichea punctata Benth.

PAPILIONACEAE

Bossiaea eriocarpa Benth.
Bossiaea linophylla R.Br.
Bossiaea ornata (Lindl.) Benth.
Brachysema praemorsum Meissn.
Brachysema sericeum (Sm.) Domin.
Chorizema aciculare (D.C.) C.A.Gardn.
Chorizema ilicifolium Labill.
Chorizema rhombeum R.Br.

FLORA (CONT.)

PAPILIONACEAE cont.

Daviesia cordata S.Moore.
Daviesia incrassata Sm.
Daviesia preissii Meissn.
Daviesia rhombifolia Meissn.
Gastrolobium bilobum R.Br.
Gastrolobium spinosum Benth.
Gastrolobium villosum Benth.
Gompholobium burtonioides Meissn.
Gompholobium knightianum Lindl.
Gompholobium ovatum Meissn.
Goodia latifolia Salisb.
Hardenbergia comptoniana Benth.
Hovea chorizemifolia (Sweet) D.C.
Hovea elliptica (Smith) D.C.
Hovea trisperma Benth.
Isotropis cuneifolia (Sm.) Domin.
Jacksonia furcellata (Bonpl.) D.C.
Kennedya coccinea Vent.
Kennedya prostrata R.Br.
Mirbelia scabra R.Br.
Oxylobium linearfolium (Don.) Domin.
Pultenaea ericifolia Benth.
Pultenaea ochreata Meissn.
Sphaerolobium medium R.Br.
Sphaerolobium sp.
Viminaria juncea Sm.

OXALIDACEAE

Oxalis corniculata

RUTACEAE

Boronia crenulata Sm.
Boronia spathulata Lindl.
Eriostemon modiflorus Lindl.

TREMANDRACEAE

Platytheca verticillata (Hueg.) Baill.
Tetratheca affinis Endl.
Tetratheca setigera Endl.

POLYGALACEAE

Comesperma confertum Labill.
Comesperma volubile Labill.

EUPHORBIACEAE

Beyeria sp.
Phyllanthus calycinus Labill.
Poranthera huegelii Klotzsch.
Ricinocarpus glaucus Endl.

FLORA (CONT.)

LINACEAE

Linum marginale A.Cunn. ex Planch.

RHAMNACEAE

Cryptandra pungens Steud.
Trymalium ledifolium Fenzl.
Trymalium spathulatum (Labill.) Ostf.

STACKHOUSIACEAE

Stackhousia brunonis Benth.
Stackhousia huegelii Endl.

STERCULIACEAE

Thomasia grandiflora Lindl.
Thomasia pauciflora Lindl.
Thomasia purpurea (Ait.) J.Gay.

DILLENIACEAE

Hibbertia amplexicaulis Steud.
Hibbertia cuneiformis Labill.
Hibbertia pulchra Ostf.
Hibbertia quadricolor Domin.
Hibbertia rhadinopoda F.Muell.
Hibbertia stellaris Endl.

VIOLACEAE

Hybanthus floribundus (Walp.) F.Muell.

THYMELAEACEAE

Pimelea nervosa (Walp.) Meissn.
Pimelea rosea R.Br.
Pimelea suaveolens (Endl.) Meissn.
Pimelea sylvestris R.Br.

MYRTACEAE

Actinodium cunninghamii Schau.
Agonis linearifolia (D.C.) Schau.
Agonis parviceps Schau.
Astartea fascicularis (Labill.) D.C.
Calothamus lateralis Lindl.
Calothamus sanguineus Labill.
Calythrix brachyphylla Turcz.
Calythrix flavescens A.Cunn.
Eucalyptus calophylla R.Br.
Eucalyptus cornuta Labill.
Eucalyptus decipiens Endl.
Eucalyptus marginata Sm.

FLORA (CONT.)

MYRTACEAE cont.

Eucalyptus patens Benth.
Eucalyptus rudis Endl.
Eucalyptus wandoo Blakely.
Hypocalymma angustifolium Endl.
Kunzea micrantha Schau.
Kunzea recurva Schau.
Leptospermum ellipticum Endl.
Leptospermum erubescens Schau.
Melaleuca acerosa Schau.
Melaleuca hamulosa Turcz.
Melaleuca incana R.Br.
Melaleuca lateritia Otto.
Melaleuca parviflora Lindl.
Melaleuca polygaloides Schau.
Melaleuca rhaphiophylla Schau.
Melaleuca scabra R.Br.
Melaleuca thymoides Labill.
Melaleuca viminea Lindl.
Verticordia habrantha Schau.
Verticordia pennigera Endl.

HALORRHAGACEAE

Glischrocaryon aureum (Lindl.) Orch.
Glischrocaryon sp.

APIACEAE

Daucus glochidiatus Sieb.
Pentapeltis silvatica (Dick.) Domin.
Platysace compressa (Labill.) Norman.
Platysace tenuissima (Benth.) Norman.
Trachymene pilosa Sm.
Xanthosia atkinsoniana F.Muell.
Xanthosia candida (Benth.) Steud. ex Bung.

EPACRIDACEAE

Andersonia caerulea R.Br.
Astroloma ciliatum (Lindl.) Druce.
Astroloma pallidum R.Br.
Brachyloma preissii Sond.
Leucopogon australis R.Br.
Leucopogon capitellatus D.C.
Leucopogon concinnus Benth.
Leucopogon distans R.Br.
Leucopogon glabellus R.Br.
Leucopogon ovalifolius Sond.
Leucopogon propinquus R.Br.
Leucopogon pulchellus Sond.
Leucopogon verticillatus R.Br.
Lysinema ciliatum R.Br.
Sphenotoma capitatum (R.Br.) Lindl.
Styphelia tenuiflora Lindl.

FLORA (CONT.)

LOGANIACEAE

Logania serpyllifolia R.Br.

GENTIANACEAE

Centaurium australe (R.Br.) Ostf.

LABIATAE

Hemiandra pugens R.Br.
~~Hemigenia incana (Lindl.) Benth.~~
Hemigenia sp.

SCROPHULARIACEAE

Veronica plebeia R.Br.

LOBELIACEAE

Lobelia rhombifolia De Vriese.
Lobelia tenuior R.Br.

GOODENIACEAE

Leschenaultia biloba Lindl.
Leschenaultia formosa R.Br.
Scaevola longifolia De Vriese.
Scaevola striata R.Br.
Vellia trinervis Labill.

STYLIDIACEAE

Levenhookia pusilla R.Br.
Stylidium adnatum R.Br.
Stylidium brunonianum Benth.
Stylidium calcaratum R.Br.
Stylidium caespitosum R.Br.
Stylidium caricifolium Lindl.
Stylidium ciliatum Lindl.
Stylidium emarginatum Sond.
Stylidium rehens
Stylidium schoenoides D.C.
Stylidium sp.

ASTERACEAE

Athrixia sp.
Brachycome iberidifolia Benth.
Craspedia glauca (Labill.) Spreng.
Craspedia uniflora
Gnaphalium lutero-album Linn.
Helichrysum ramosum D.C.
Helichrysum bracteatum (Vent.) Andr.
Helipterum cotula (Benth.) D.C.

FLORA (CONT.)

ASTERACEAE cont.

Lagenophora huegelii Benth.
Olearia cassiniae F.Muell.
Podolepis lessonii (Cass.) Benth.
Senecio lautus Soland.
Senecio minimus Poir.
Waitzia citrina (Benth.) Steetz.

FIELD ECOLOGY TECHNIQUES

INTRODUCTION

Measuring, recording and interpreting the natural environment is a formidable task. More than any other scientist the natural scientist faces a bewildering array of complex things and interrelated processes. Accordingly when he comes to look for methods which he can use to record some of these processes and things in the natural environment he is faced with an almost endless array of sampling techniques.

The textbooks and literature contain almost as many techniques as there have been researchers in the field of Biology but none of them exactly seem to fit what you want! How do we then choose the 'right' ones?

The secret is not to attempt too much. The most effective natural scientist is the one who is able to judge which is of relevance and which is not. Many of the techniques available are basically the same with only slight variations on a theme and often one will do the job as well as the next. That is not to say that the individual should not be prepared to modify techniques to suit his or her own particular needs, but that there exist certain basic methods which can be used in most studies.

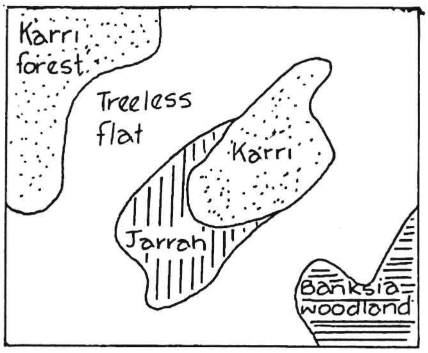
This little booklet is designed to introduce the prospective natural scientist who wishes to undertake some field studies to some of these basic techniques. The techniques presented here are those which we have found to be the most useful in our own field studies.

The material is intended for the use of participants on the Perup Forest ecology field course. Vegetation and animal techniques are kept separate for the sake of simplicity. During the course however the emphasis is on a multidiscipline approach, combining plant and animal studies to the best effect.

TECHNIQUES FOR STUDYING VEGETATION

It does not take a very observant person to realize that the vegetation growing all around us is not all the same. Many different plants of one species (a population) grow together in different places to make up plant communities. Several plant communities may go to make up a forest type e.g. the karri forest, jarrah forest etc.

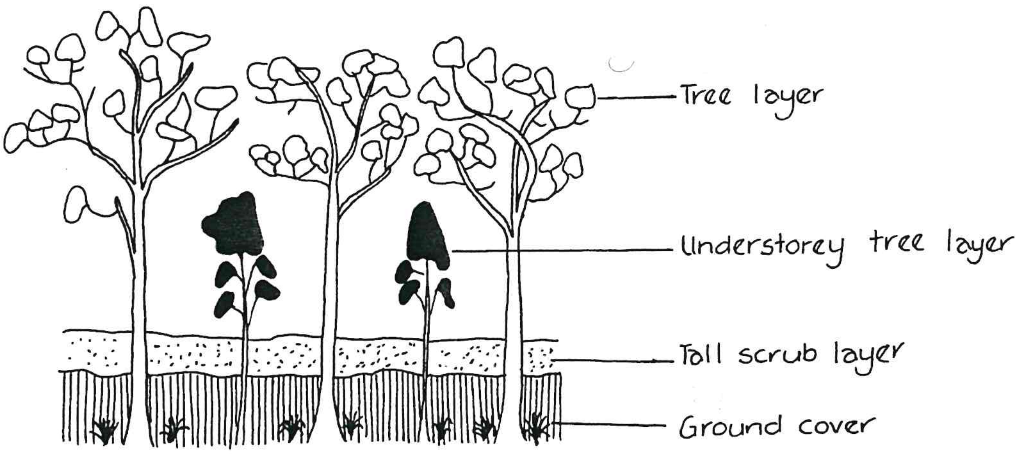
Plant species, populations, communities and forest types all occur together intermingling and overlapping in a complex mozaic.



Within each of these forest types there are several plant communities each comprising populations of many species of plants.

Map of forest types

Forest vegetation may be divided into four main strata or layers.



All of these layers are not necessarily present in all areas of the forest together.

All vegetation has a horizontal as well as a vertical component, in addition it occupies a certain amount of space or volume. Furthermore, vegetation grows so that all these attributes vary with time, an important point to remember.

Because of the complexity of vegetation we should be quite sure that any vegetation study has quite specific and precise objectives. For example it is not enough to have as an objective 'the study of changes with time (succession) following fire'? We need to specify the forest type and maybe also the plant community which we intend to study. In addition we should consider which layers or strata of the forest should be concentrated on, i.e. If the ultimate object is to examine the effect of the plant succession on small ground living animals then most of the attention should be directed to the ground layer. If canopy birds are being studied then the tree layer may be of more importance to us.

This is not to say that strata are irrelevant, rather that you cannot possibly study everything at once and so you should choose those aspects which appear to be most likely to be of importance.

Having made the decision which forest type to work in and what part of the vegetation you wish to study it is now necessary to decide which attributes of the vegetation are most likely to be relevant to the study and how to measure them. The most commonly recorded attributes are:

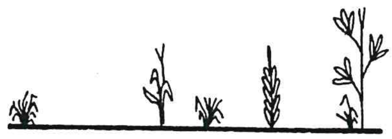
Species composition	-	The kinds of plants growing in the area.
No.'s of each species	-	Counts of plant numbers.
Height	-	Height of the vegetation or of individual plants. Actual measurements or estimates.
Visibility	-	A measure of the 'denseness' of the vegetation. This may be measured using a sighting board or by 'eyeballing'.
Structure	-	A measure of the structural composition of the vegetation i.e. the proportion of leaves, branches, twigs etc. at different levels. This is often used in fire behaviour studies, where it is important to know the amount of 'fuel' at various levels.
Weight	-	The dry weight of vegetation or of individual plants. Obtained by clipping, drying and weighing. Often used in grazing studies.

Information on these attributes of the vegetation is most often obtained by measuring a sample of the total vegetation of an area. It is seldom possible or necessary to measure and record each and every plant. Sampling techniques are therefore all based on obtaining reliable estimates of the vegetation on small sample plots.

There are almost as many techniques for studying vegetation as there are scientists and researchers studying it. This is because botany is an 'inexact' science, there are no known methods by which some vegetation attributes such as, cover, visibility or structure may be measured with absolute accuracy. Even the most careful measurements can only ever be an estimate. There are no 'right' or 'wrong' methods, some are merely more suitable than others in certain circumstances. We should therefore choose techniques which best suit our particular requirements, taking into consideration such factors as time and expense, the objectives of the study and the level of accuracy required.

Vegetation is most frequently studied using sample plots. There are two types of sample plot.

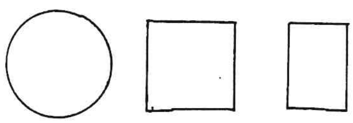
A. LINE TRANSECT



Plants are recorded and measured along a transect through the area. Information which may be obtained includes, species composition, height, numbers, relative density, percent cover. A useful technique to record differences across a vegetation gradient such as across a valley and up a hill.

A variant is the belt transect which is a line of quadrats (see below) laid end to end.

B. QUADRATS

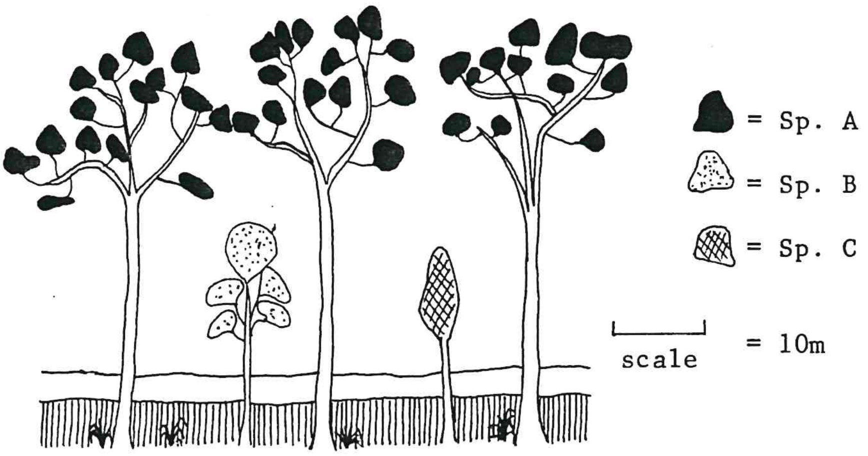


These may be round, square or any other shape and any convenient size. The most common in use is the m^2 quadrat. Quadrats may be located at random through an area or they may be placed on a grid if the results are to be used for mapping an area as well as to record vegetation parameters. Permanent, well demarcated, quadrats are often used in long term studies of vegetation succession.

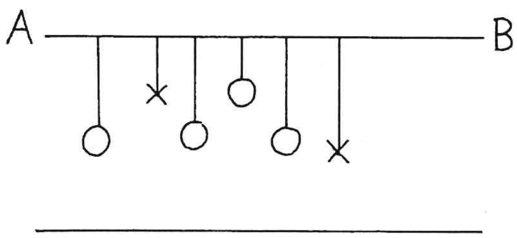
Quadrats are most often used to obtain information on plant parameters such as numbers, species, height etc. in relation to area e.g. you can calculate the number of plant species per hectare of forest.

The following techniques for measuring vegetation have been found to be most useful by us.

PROFILE DIAGRAM



Profile diagrams give information about the total forest structure in a vertical plane. They may be constructed from data derived from a belt transect.



Your should record:

a. Distance along base line.

b. Distance in from base line.

c. Height of individual, also to 1st branch and canopy.

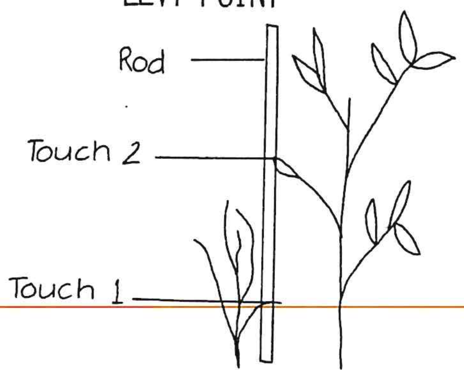
d. Draw outlines of the canopy of each tree.

This is a good method to use in studies of fairly large blocks of forest where information on the forest structure is important. It is useful to give a visual impression of forest structure. Photography may also be used in support of profile diagrams.

Other information which may be collected in these transects include: (i) Tree height, (ii) Basal area (B.A.), a forestry term = the area of wood (tree), calculated from tree diameter measurements at breast height (1.3m) per unit area. A basal area prism may be used for this.

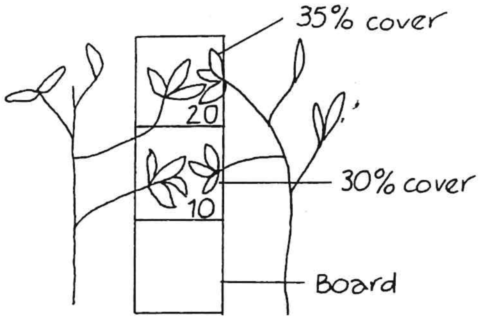
(iii) Canopy density (use a densiometer), (iv) Trees/hectare.

LEVY POINT



A point quadrat method. A slender rod is used to record touches of the vegetation at various heights or levels in the scrub. This gives density and frequency (see later) of the species present at different levels. It is a good method to use for accurate measurements on small plots in dense tall vegetation.

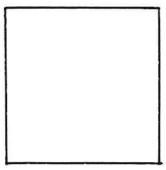
DENSITY BOARD



A white-board, marked at different heights, is used to estimate the percentage cover at various levels in the scrub. Useful in tall dense scrub but may also be used in low scrub types. Cover density by species is obtained.

e.g. 30% cover at 10-20cm height.
35% cover at 20-30cm height.

QUADRATS



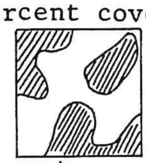
We have found the m^2 quadrat most useful especially in open forest types. Larger quadrats may also be used on occasion, it depends largely on what you are trying to record.

The following data may be recorded from quadrats:

a. A list of species.

b. A count of species numbers - sometimes it is useful to divide plants into life stage types e.g. seedlings, rootstocks etc.

c. Percent cover - an estimate of the percentage of the quadrat which is covered by vegetation. This may be done by species also.



d. Cover/abundance - an estimate on a 0-5 point scale of the relative abundance of a species.

e. Clip quadrat - vegetation is harvested by clipping and weighed by species or 'en masse'.

When doing quadrat work it is often worthwhile recording other things of interest to the study such as;

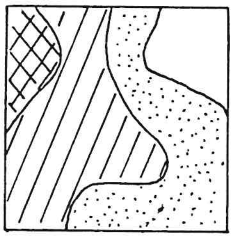
(i) Fuel - weight of dead leaves and twigs (can also include live material).

(ii) Log material.

(iii) Rocks.

(iv) Animal diggings, scats etc.

MAPPING



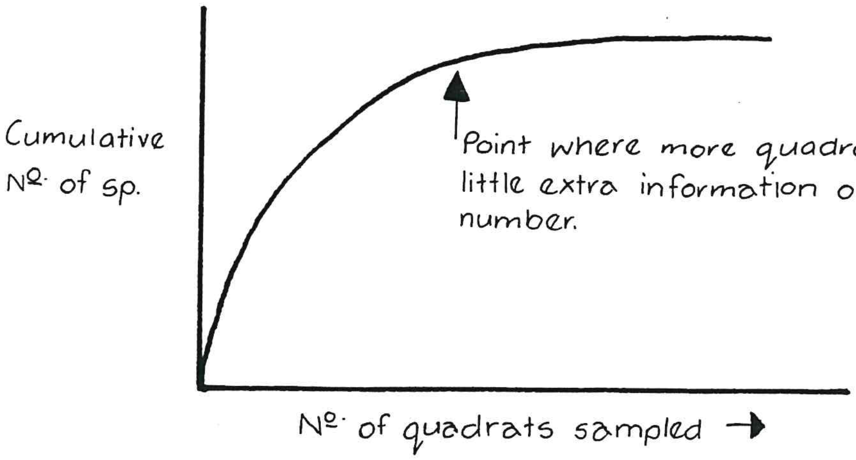
Plant communities may be mapped using transects to grid the area recording changes in the vegetation as it occurs and mapping them.

The size and shape of the quadrats used is somewhat arbitrary but depends largely on the size and number of the things being recorded e.g. larger quadrats (normally termed sample plots) are used for trees and smaller ones for understorey plants. The lower limit being the point quadrat where the quadrat is reduced to the size of a single point e.g. the Levy Point method, where the rod has been used to extend the sample vertically to measure vertical distribution.

It is necessary to obtain some indication of the number of quadrats needed to achieve a reasonable sample of the vegetation.

There are two basic ways of doing this;

a. Species area curve. Plot the number of 'new' plant species recorded in each quadrat as below.



b. Calculation of sampling intensity (i.e. the no. of quadrats) necessary to achieve a certain level of accuracy. This is for quantitative data, for example the total number of species A per hectare, mean percentage cover etc.

Some preliminary sampling is necessary first of all to obtain a mean value as well as the Standard Deviation from the mean. Then the following formula is applied:

$$n = \frac{s^2 \times t^2}{d^2}$$

s = standard deviation

t = normal deviate at confidence limit level and given degrees of freedom (see table of t)

d = designated accuracy $\bar{x}$ x designated accuracy

$\bar{x}$ = arithmetic mean

Example:

Sample the cover of an area to within 10% accuracy with 95% confidence.

10 random plots give $\bar{x}$ 42.3

Then $n = \frac{(5.6)^2 \, (2.26)^2}{(42.3 \times 0.10)^2}$

s = 5.6

t = 2.26 (9 degrees of freedom n - 1 @ 0.5 confidence level. See table of t)

n = 8.9 ∴ 10 plots is considered adequate.

INFORMATION WHICH CAN BE OBTAINED FROM QUADRATS

Basic data on species; Record total number of each species of plant per quadrat.

SPECIES	QUADRAT NO.				
	1	2	3	4	5
a	5	1	6	7	4
b	1	-	2	1	-
c	3	7	1	-	-
d					

Three basic attributes of plant species which give some indication of their importance in the community may be obtained from the above information.

$$\% \text{ Frequency} = \frac{\text{No. of quadrats in which sp. A occurs} \times 100}{\text{Total no. of quadrats}}$$

$$\text{Abundance} = \frac{\text{Total no. of individuals of sp. A}}{\text{No. of quadrats found in}}$$

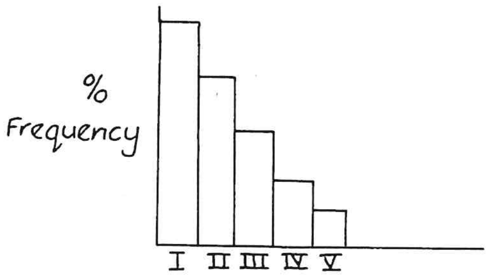
$$\text{Relative density} = \frac{\text{Total no. of individuals of sp. A} \times 100}{\text{Total no. of all sp.}}$$

Each of these gives us different information about a species, thus a species scoring high abundance and low frequency is likely to occur in a clumped distribution, low abundance and high frequency is an indication of a common widespread species.

FREQUENCY DISTRIBUTION

Calculate % frequency for each species, then group as follows.

Group	I	0- 20%	frequency
Group	II	21- 40%	"
Group	III	41- 60%	"
Group	IV	61- 80%	"
Group	V	81-100%	"



Typical species frequency distribution

This illustrates that most species in the community occur at low frequency i.e. are relatively uncommon, few species only are very common.

Quadrats may be used to study the effect of different forest practices on the vegetation. Thus differences between the numbers of plants on areas given different treatments e.g. burnt and unburnt areas may be compared using CHI square (χ^2) test. Make a 2 x 2 Contingency table.

	PRESENT	ABSENT	
BURNT	24(A)	116(B)	140
UNBURNT	5(C)	135(D)	140
	29	251	280

$$\chi^2 = \frac{(ad - bc)^2 N}{(a+b)\ (a+c)\ (b+d)\ (c+d)}$$

$$= \frac{(24 \times 135 - 116 \times 5)^2\ 24+116+5+135}{140 \times 29 \times 251 \times 140}$$

$$= \chi^2 = 13.89$$

Look up in CHI sq. tables 1 degree of freedom = 3.84 ∴ difference between the burnt and unburnt is significant @ 0.05 level of probability.

TECHNIQUES USED FOR STUDYING ANIMALS

As with plants it is not possible to record and measure every animal in a population let alone a community. The zoologist like the botanist must rely on samples of the total population to make predictions about actual population, size, composition etc. In addition to the sampling difficulties encountered by the botanist, the zoologist faces another problem, the mobility of his study subjects. On occasion, in particular when dealing with birds it may be possible to obtain data by direct observation but most often the zoologist must resort to catching or trapping to obtain his information.

A wide variety of techniques are available depending on the species being studied, the objectives of the study, the time available and other factors. Those listed below have been chosen as some of the more useful for local conditions.

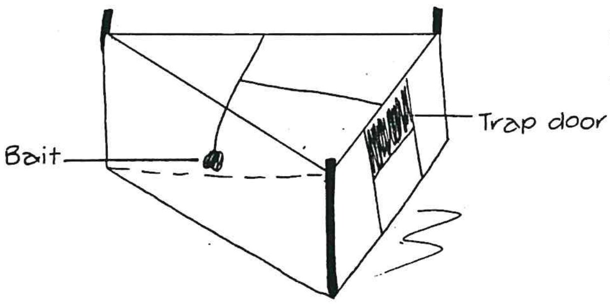
TRAPPING

Trapping may be used to obtain specimens for scientific study, to record movements, breeding condition and data on population structure etc. or simply to record what is in an area.

TRAP TYPES USED

LIVE TRAPPING

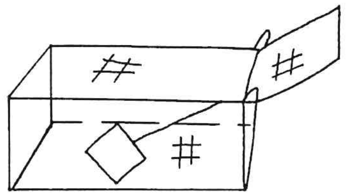
A. TAMMAR OR WALLABY TRAP



Used to catch tammars, quokkas or brush-wallaby.

Three cornered 'chicken wire' pen with a drop gate set off by a trigger mechanism.

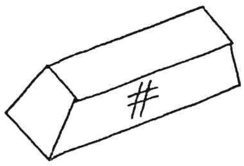
B. BOX OR 'POSSUM TRAP'



Used for woylies, bandicoot, brush-possum, native cat.

Wire cage with trip plate.

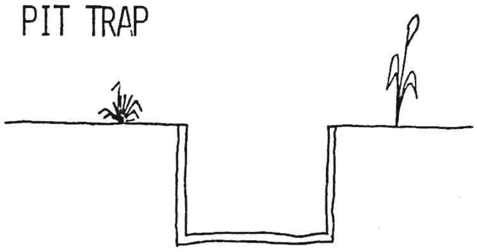
C.



Used for rats, mice, marsupial mice, lizards, snakes and frogs.

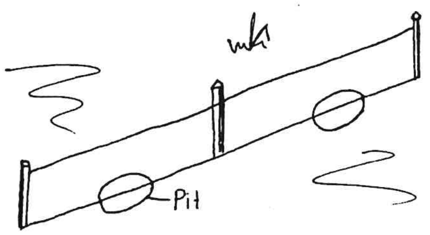
Metal box with trip plate.

D. PIT TRAP



Used for pigmy possum, honey possum, marsupial mice, lizards, snakes and frogs.

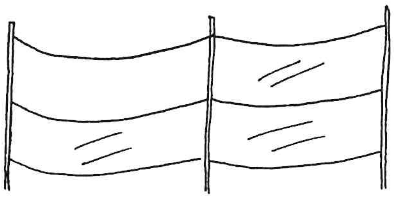
Pit lined with plastic or metal tube sunk in flush with soil surface.



This trap is usually used with a 'drift fence'.

Fence 20cm high, plastic or other material.

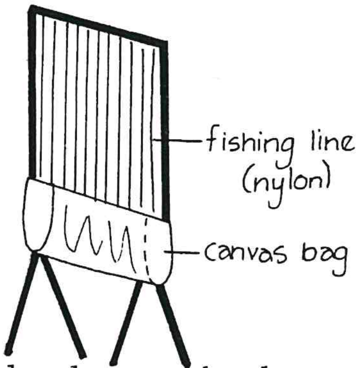
E. MIST NET



Used for small birds and bats.

Fine meshed nylon net.

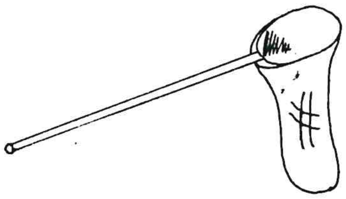
F. BAT TRAP



Used for bats.

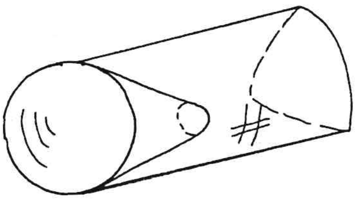
Frame with closely spaced nylon fishing line with holding bag.

G. SCOOP NET



Fine mesh nylon net for catching small fish in small ponds and creeks.

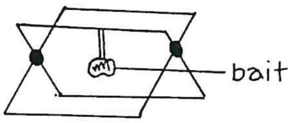
FISH TRAP



Fish trap used for fish in larger lakes, rivers and streams.

COLLECTING SPECIMENS

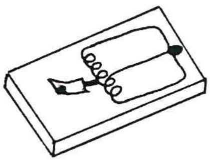
A. CONI-BEAR TRAP



Used for bandicoots, water rats and similar sp.

Spring loaded wire frame.

B. BREAK-BACK



Used for small mammals e.g. rats and mice.

Rat trap.

The location of traps and the bait used is critical for success. For example small mammals are seldom caught in open areas with sparse ground cover. Bat traps are especially difficult to locate successfully. Those things are only learned with experience.

TRAP LAYOUTS

Trapping may be done in one of several ways depending on what information you wish to obtain.

a. Single traps set at one or two points only. Mostly restricted to mist netting and bat trap. Information on the presence of species and some information on, age and sex structure of the population may be obtained, as well as weights and size measurements. No information on movement.

   Usually used to collect specimens only.

b. Trap lines. Lines of traps are set through an area. The same information as with single traps can be collected. In addition comparisons between habitats, total numbers per area and other information can be obtained.

   Usually used on surveys when an inventory of species is required together with some information on habitat requirements. Mostly a range of trap types are used to catch different species.

c. Grid trapping. Traps are set in a grid pattern. Most commonly used in long term detailed studies of animal populations where data on movement and habitat use is required. In such studies animals are almost always 'tagged' with numbered metal ear tags for identification.

OTHER TECHNIQUES

Certain species are not easily captured in traps e.g. Numbat, Native Squirrel and Ringtail Possum. In addition only certain data can be collected whatever trapping methods are used. For these reasons techniques other than trapping are frequently used to study animal populations either separately or in combination with trapping. Such techniques include the following:

a. <u>Radio tracking</u>. The subject animal is captured and fitted with a small transmitter. There are a number of different ways in which it can then be studied.

(i) Using triangulation (cross bearings) on a grid system to obtain data on movement. Similar to trapping but superior in some aspects especially in the numbers of observations which can be made. Many animals may be tracked at once.

(ii) Following individual animals continuously to obtain detailed data on their movements.

(iii) Using activity recorder to record comings and goings from a nest or feeding grounds etc.

b. <u>Bird census</u>. Requires no equipment other than a pair of binoculars, paper and pencil. A knowledge of bird identification is not essential as the keen observer will quickly learn with the aid of any one of the available books. A light pair of 8 x 30 or 8 x 40 binoculars are most suitable.

Methods include:

(i) Individual observations - casual observations only - used to record a species list.

(ii) Point or transect observations. Can be used to record detailed information and to obtain estimates of population density.

(iii) Spot mapping on a grid either from points or with the aid of colour banding. Can be used to obtain an absolute population density.

For all the above, sound or sight records, distance from the observer or information on bird activity and position in the forest profile may be recorded.

c. <u>Spotlight census</u>. These may be done on foot carrying a light and power source or from a vehicle. Vehicles do not normally disturb most animals.

Used to record nocturnal animals otherwise not readily observed e.g. Ringtail Possum, Owls, Owlet Nightjar. Normally used on biological surveys to record species presence but can be used to monitor long term population fluctuations if carried out regularly along the same route.

d. Scat analysis. The scats of predators especially the fox can be collected and the contents examined and identified. Teeth of small mammals and hairs (which can be identified to species level) are often found to be present in scats.

Used particularly on biological surveys but can also be used to obtain information in long term studies with regular collections being made from an area.

Scat analysis of herbivores may also give information on food plants but this is a time consuming process and a reference collection of plant epidermis needs to be built up first.

e. Scat or pellet counts. May be used to obtain information on animal densities, especially herbivores e.g. kangaroos. Counts are usually made in quadrats on a regular basis.

f. Tracks. Small patches or belts of fine sand, regularly swept, may be used to record footprints of animals. Used on surveys and long term studies to monitor population levels and presence of species. This technique has its problems in winter when rain obliterates tracks.

g. Nest boxes. Nest boxes may be fastened to trees in the forest. These are used by a variety of animals including birds, bats and mammals such as marsupial mice and much useful data can be obtained from them.

h. Searching. Searching for animals, their nests or other signs of their presence. Mostly used on surveys, data can be quantified by recording the number of man/hours of searching spent in different habitats. This is one of the most effective techniques for collecting small vertebrates especially when trained observers are used.

INFORMATION FROM TRAPPING

A variety of data may be collected using the above techniques. These data can be interpreted and used in almost unlimited ways. Some of the more common types of data are listed below.

1. Species presence - species list. This may also be used for comparison between habitats to see which species occupy different forest types.

2. Population parameters. These include the following:
   a. Sex ratio - often an indicator of population stability, for example males tend to predominate in colonizing populations.

   b. Age structure of the population - it is frequently possible to age individuals. This may be done by a variety of means e.g. weight, tooth eruption, length of head, pes etc. Sometimes graphs relating age to one or more of these factors are available, for some species it may be necessary to construct them yourself when you have collected the relevant data. Age can indicate breeding season stability of population etc., for example a population with many young animals and few old ones may suggest a colonizing population.

   c. Weight - can give information on age and condition of animals. Seasonal data is useful to determine critical months where there may be a food shortage.

   d. Re-captures - tagged animals which have been caught before. When examined as a function of sex and age i.e. mature or immature animals, the number of re-captures can give information of different age groups and sexes etc. For example few re-captures, especially of young animals, may indicate a high emmigration rate or low survival.

   When re-captures are plotted on a map (grid trapping only) information on range of movements, home range, territoriality and other things can be obtained. The size and stability of home ranges may be indications of the stability of the population.

e. Breeding condition - testicle size, young in pouch, indication of lactating etc. - establishes whether or not a species has a defined breeding season and when it is.

Birds may be captured in mist nets and data on weight, condition and age can be obtained as with trapping for mammals. Birds can also be colour banded as an aid to spot mapping of bird territories to obtain an absolute measure of bird density (number per hectare of each species). For this it is necessary to identify birds, using binoculars, in a grid system over a period of time.

Bird data may be treated in the same way as normal data.

PRESENTATION OF DATA

The following are examples of a few of the ways in which the data collected may be presented.

SUMMARY OF TRAP RESULTS

TRAP TYPE	SPECIES CAPTURED			
	SP. A	SP. B	SP. C	SP. D
TAMMAR TRAP (400 TRAP NIGHTS*)	20 (5)	40 (10)	4 (1)	- -
BOX TRAP (800 TRAP NIGHTS)		80 (10)	8 (1)	20 (2.5)

( ) = percentage capture

* 1 trap night = 1 trap set for 1 night

Comments: Sp. B appears to be the most common of those trapped in the area. Sp. A and D have a trap 'preference, each being caught only in one of the traps.

CAPTURES AS RELATED TO VEGETATION TYPES

SPECIES	VEGETATION TYPE			
	JARRAH FOREST	WANDOO	SWAMP	GRANITE OUTCROP
A	10	2	-	8
B			11	
C				7
TOTAL	10	2	11	15

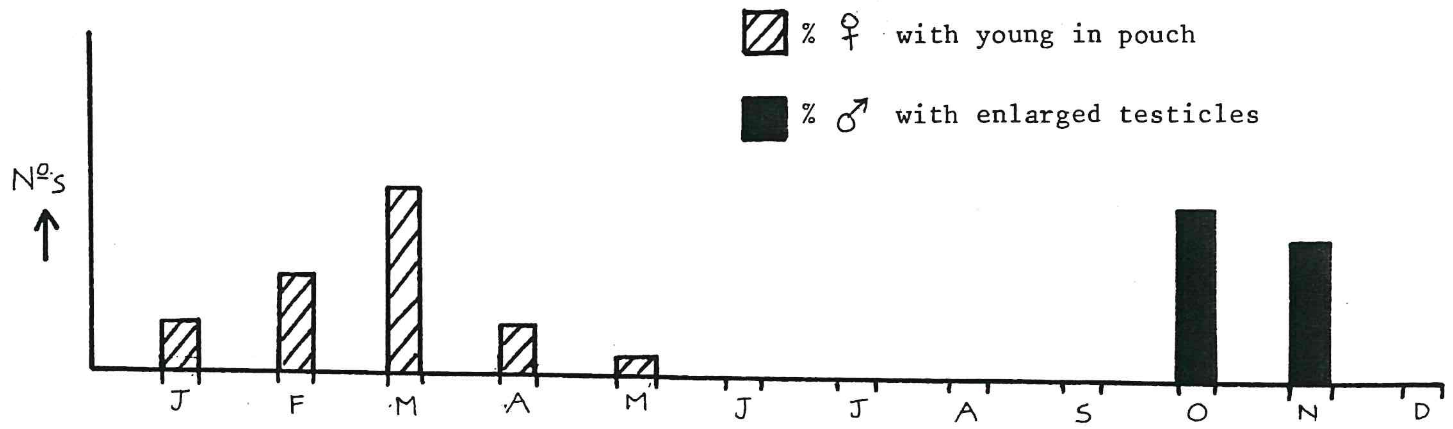
Comments: Granite outcrop appear to be richest in species. Sp. A is widespread, Sp. B may be restricted to swamps and Sp. C may be restricted to granite outcrops.

POPULATION STRUCTURE - SPECIES A

		SPRING	SUMMER	AUTUMN	WINTER
MALES	MATURE	20	10	25	20
	IMMATURE	-	30	10	-
FEMALES	MATURE	15	10	20	20
	IMMATURE	-	25	5	-

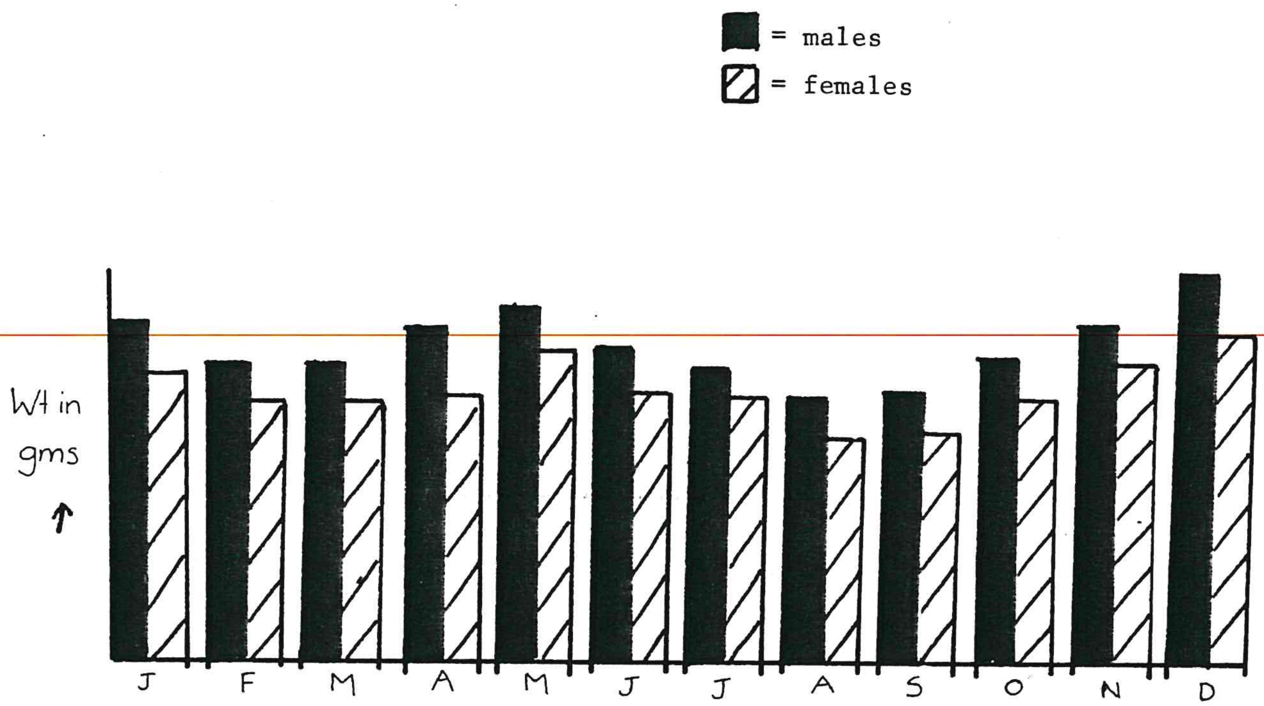
Comments: ♂/♀ ratio approximately 1:1. The presence of immature animals in summer and autumn only indicates a definite breeding season.

BREEDING DATA - SPECIES A



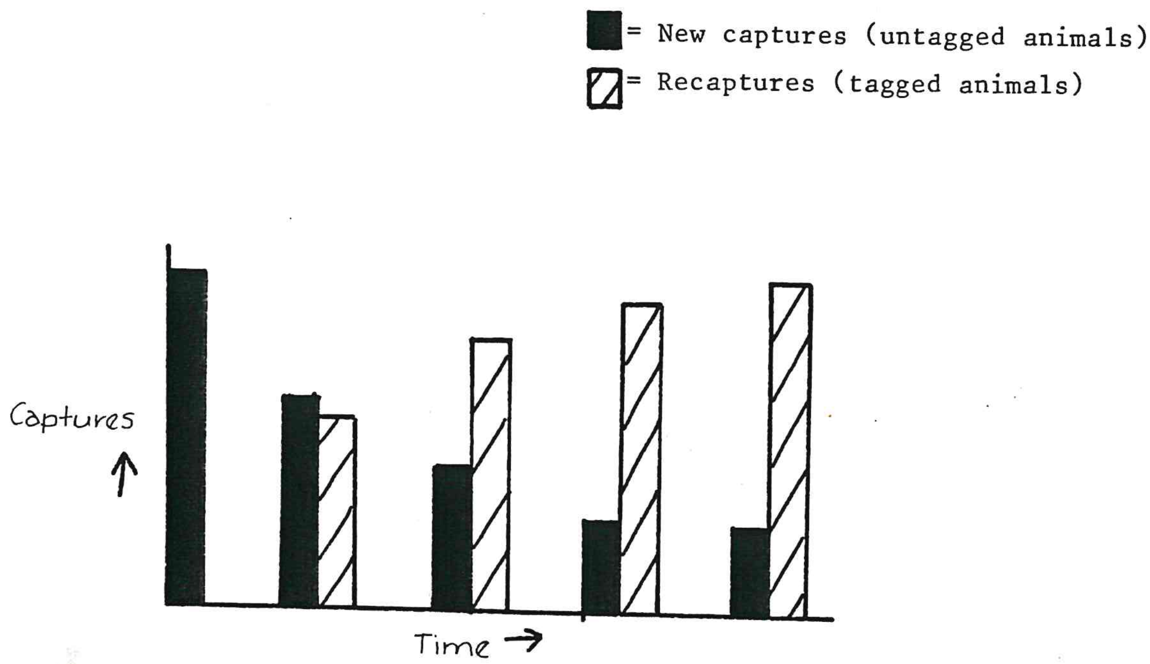
Comments: Breeding season Oct.-Nov., young animals emerge from pouch April - May.

WEIGHT OF MATURE INDIVIDUALS - SPECIES A



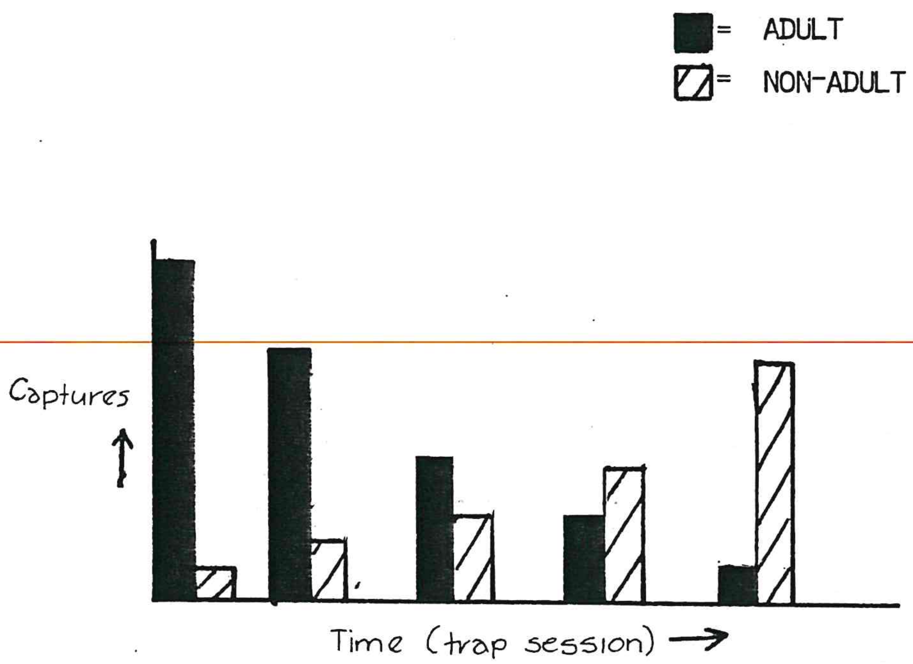
Comments: There is a seasonal weight loss in both sexes towards the end of winter.

COMPARISON OF TAGGED ANIMALS AND NEW CAPTURES (UNTAGGED)



Comments: Resident population probably all tagged, new captures likely to be immature individuals. The data needs to be checked for this.

COMPARISON OF NEW CAPTURES ADULT - NON-ADULT ANIMALS.



Comments: It appears that the assumption made in the previous graph may be correct, i.e. most new captures are young animals.

Estimates of population - Lincoln Index:

Recapture data obtained from periodic trapping may be used to obtain an estimate of the number of animals in an area. The success of the method depends upon a number of assumptions which are not usually fulfilled in natural populations and estimates are therefore likely to be approximate at best.

Using the formula $N = nM/x$

- N = estimated no. of individuals
- M = the no. of these individuals marked with a tag
- n = total no. of animals captured, tagged and untagged (this trap session)
- x = no. of tagged animals (this trap session)

e.g. $M = 100$, $n = 150$, $x = 40$

then $N = \frac{100\ (150)}{40} = 375$

There is a method of calculating the confidence limits of this estimate using a set of tables adapted from Chapman (1948) (see Giles, R. (1971) Wildlife Management Techniques ed. Wildl. Soc. Washington).

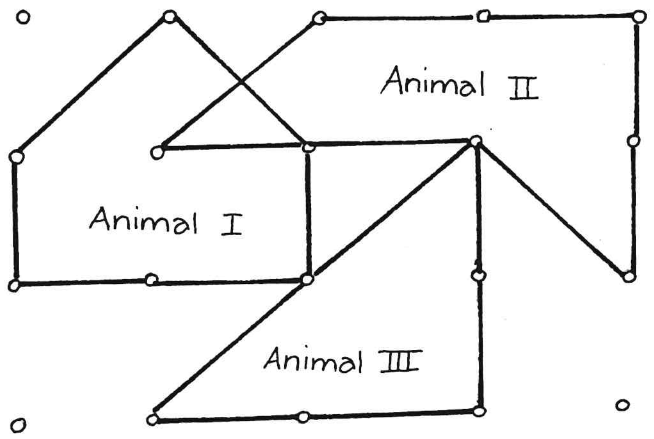
If this is done we have a lower estimate of 265 animals and an upper estimate of 510 animals. The estimate is then seen to be approximate only.

SURVIVAL OF ANIMALS BETWEEN CAPTURE SESSIONS

TRAP SESSION	PERCENTAGE OF ANIMALS PER CAPTURE CLASS			
	1 CAPTURE	2 CAPTURES	3 CAPTURES	4 CAPTURES
2	75	20	5	-
3	70	25	5	-
4	40	40	15	5

Comments: Animals with few captures are a low percentage of the total population at the 4th trap session. This may indicate a short life span depending on the time between trap sessions.

HOME RANGES OF SELECTED STUDY ANIMALS



Capture points where animals are caught on a grid are joined by lines to indicate approximate 'home range'.

Home range sizes may be estimated by calculating the area within the lines for each animal. The same can be done for radio tracking data. A comparison of home range areas by the two methods rarely comes up with the same answer. Home ranges calculated from trap data are generally larger probably because longer time intervals are usually involved.

BIRDS

All of the above information can be obtained also for birds when using mist nets at fixed points and several trap sessions.

The more important information when examining the effects of forest practises is the information on density (re numbers of birds per hectare).

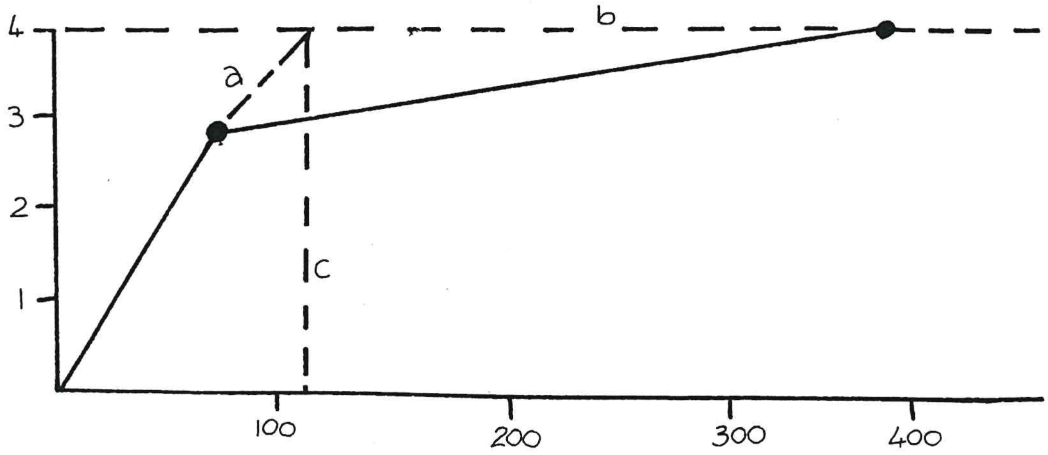
This information is derived from several techniques (including mist netting). The table below shows raw data obtained from ten point counts in vegetation type x.

BIRD TRANSECT DATA, SUMARIZED FOR 10 POINTS

SPECIES	DISTANCE FROM OBSERVER (AREA*)				
	($78.5M^2$) 0-5	($235.6M^2$) 5-10	($942.5M^2$) 10-20	($1570.8M^2$) 20-30	($8482.3M^2$) 30-60
X	3	5	1		
Y	1	5	5	2	1
Z	3	1			

*Area calculated as area of a circle with a radius of the given distance.

This data can be used to calculate densities in the following step wise procedure cumulative area is graphed against cumulative number of birds recorded e.g. for species z;



The effective area surveyed (EAS) is then derived by following the steepest part of the curve (a) to its intersection with the projection from the total cumulative number of birds detected (b). In this case the EAS = 100 square metres (c).

Bird density is calculated as follows;

e.g. for species z -

$$\text{Density (birds/ha)} = \frac{\text{No. birds}}{\text{EAS}} \times \frac{10{,}000}{\text{No. of counts}}$$

$$\text{Density} = \frac{4}{100} \times \frac{10{,}000}{10}$$

$$\text{Density} = 40 \text{ birds per hectare}$$

An independent measure of density can be obtained from several points and compared using for example a chi square formulae.

In this way bird densities can be compared in different forest types and in different successional stages following for example forest operations. The calculations of EAS enables the differential visibility of birds in different sites to be accounted for.

DIVERSITY

Diversity is a measure of the species richness and the spread or evenness within a community.

As a rule the more species there are and the more nearly even their distribution the greater the diversity. Tropical rainforest usually has a very high diversity. A community with five equally abundant species has greater diversity than another of five species one of which comprises 95% of the individuals.

There are a number of measures of diversity each providing an objective measure of the variety within an area. A measure of diversity enables objective comparisons between areas containing different species.

We use the following formula:

$$H^1 = \sum_{j=1}^{n} \left[\left(\frac{ni}{N}\right) \left(\text{Log } \frac{ni}{N}\right) \right]$$

where H^1 is the diversity index, ni is the number of individuals of species i and N is the total number of individuals.

BIRD TERRITORY MAPPING

A map of the grid area is prepared showing all the groups of each species detected in one counting session. Colour banding is often used where many individuals of a few species occur together. An absolute density is thus obtained (provided that the observer is certain that he/she detected all birds of that species in the grid). Areas may be calculated in a similar way to that used for mammals.

GENERAL POINTS

Precisely how you set up and organize ecological studies depends on your skill, knowledge and experience. No two individuals are likely to approach the same study in exactly the same way. The following points are worth bearing in mind when planning field studies.

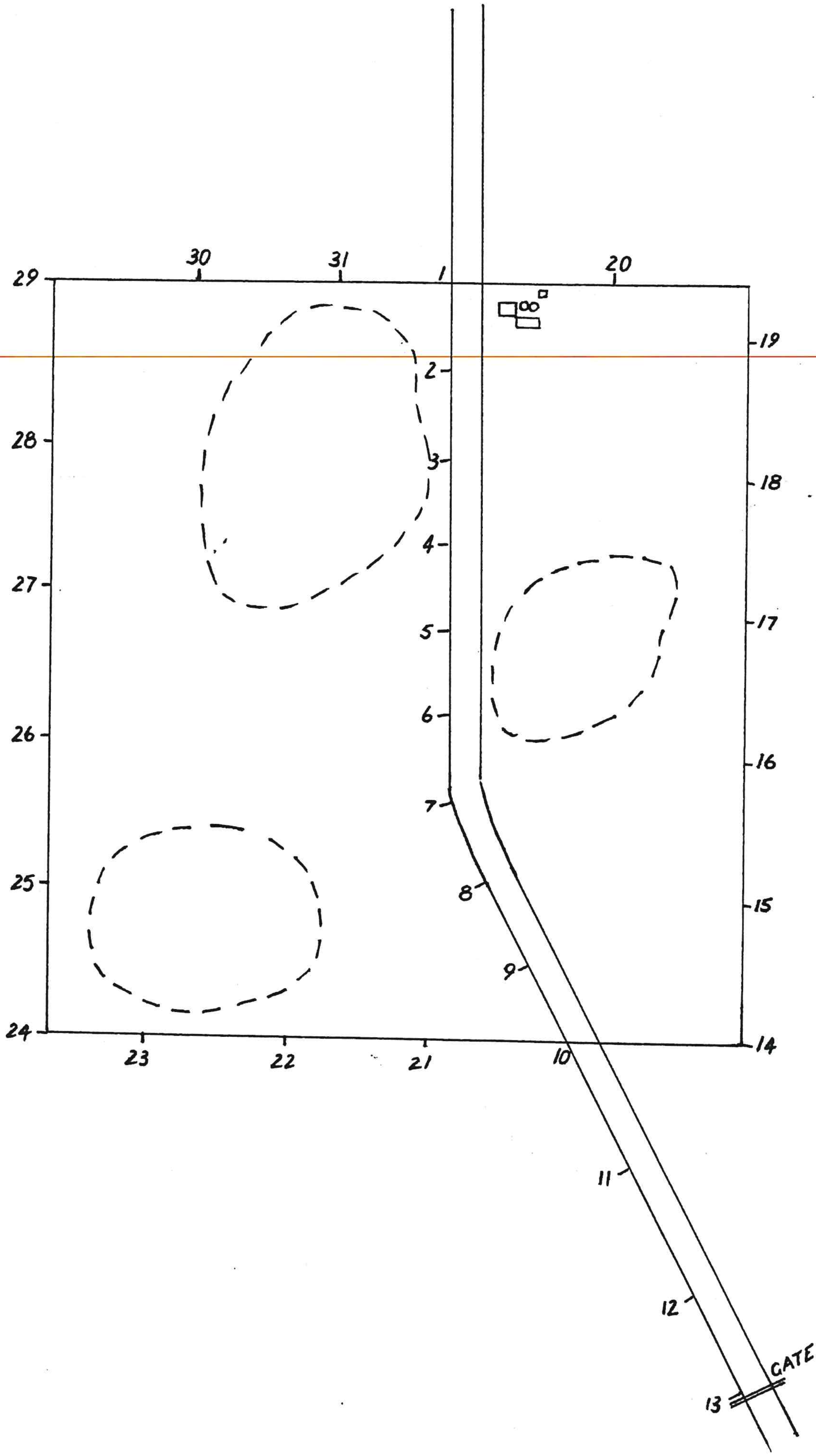
1. Set definite objectives for the study. One method most often used by scientists is to propose a hypothesis i.e. a statement of what you think is the likely answer to a question e.g. There are higher numbers of scrub bird species in an area of forest during the first two years following a fire. You then set out to test the hypothesis by proving or disproving it to the satisfaction of yourself and your scientific colleagues.

2. Having set your objectives try to concentrate most of your effort on aspects which are most likely to affect the hypothesis you have set up. Do not be sidetracked by 'interesting' things, keep these in mind, record them for possible later action. It's amazing how few of these 'interesting' things stand the test of time, at a later date many of them will seem unimportant.

Notwithstanding this always be on the look out for bona fide information, clues which may help further your study, and be prepared to make changes in your programme to accommodate important new aspects which turn up. Every study should allow for extra expansion to cater for such contingencies.

3. Select your study methods and techniques carefully. Use the techniques most relevant to your requirements, do not select complicated techniques when simpler ones will accomplish the job and use a series of different techniques wherever you can to obtain information on each aspect of your study. This last one is important because so single techniques is 'foolproof' and a more complete answer is usually obtained by using a variety of techniques.

PEG	TIME	BEARING	DATE/COMMENT	PEG	TIME	BEARING	DATE/COMMENT



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GATE
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SURVEY

DATE: .... DIVISION: ....

WEATHER: .... BLOCK: ....

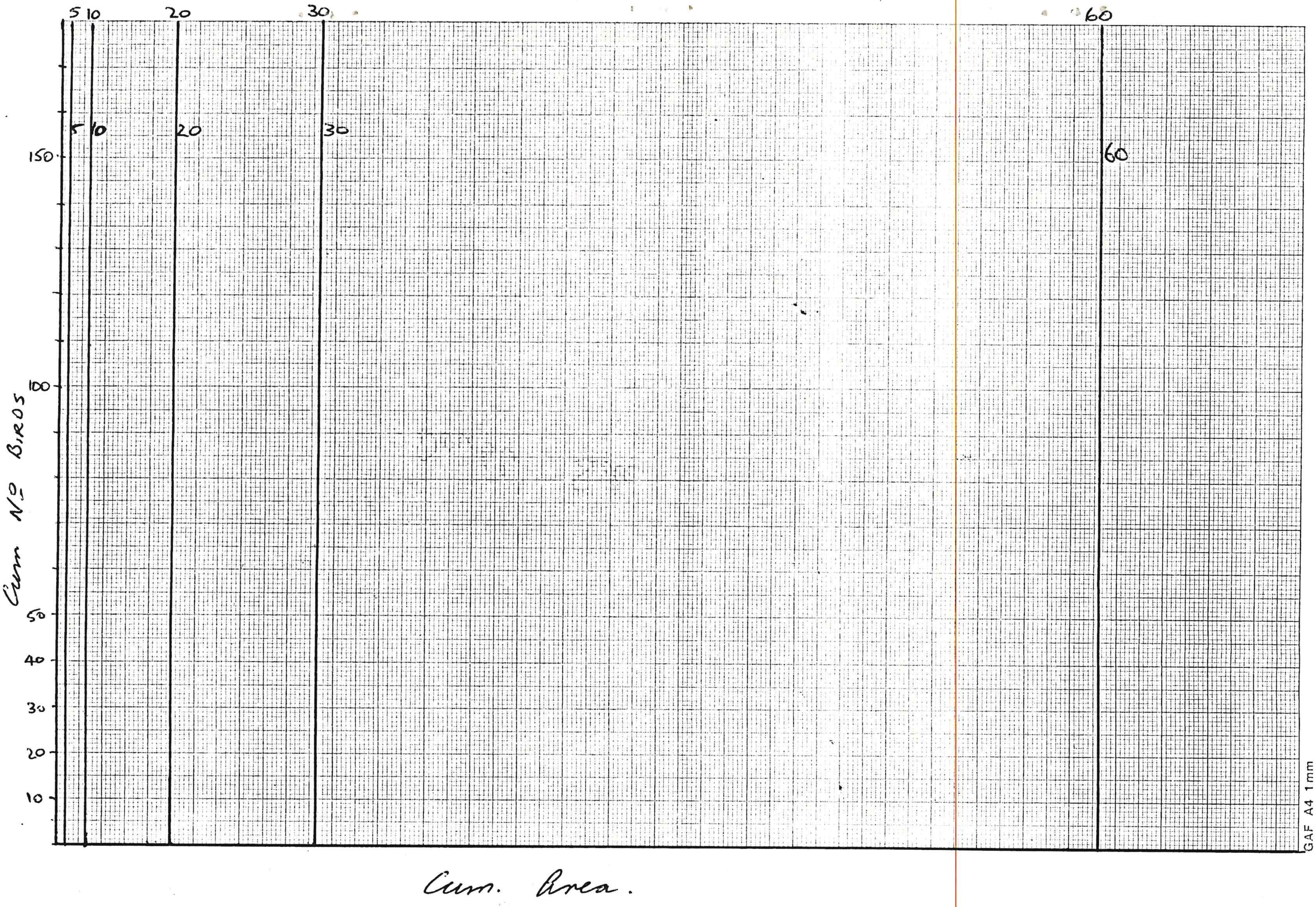
ROUTE: .... OBSERVERS: ....

OBS. NO.	TIME	MILEAGE	SPECIES	NO.	ROAD		COMMENTS
					LH	RH	

SPECIES	0 - 5	5 - 10	10 - 20	20 - 30	30 - 60	60+

BLOCK :

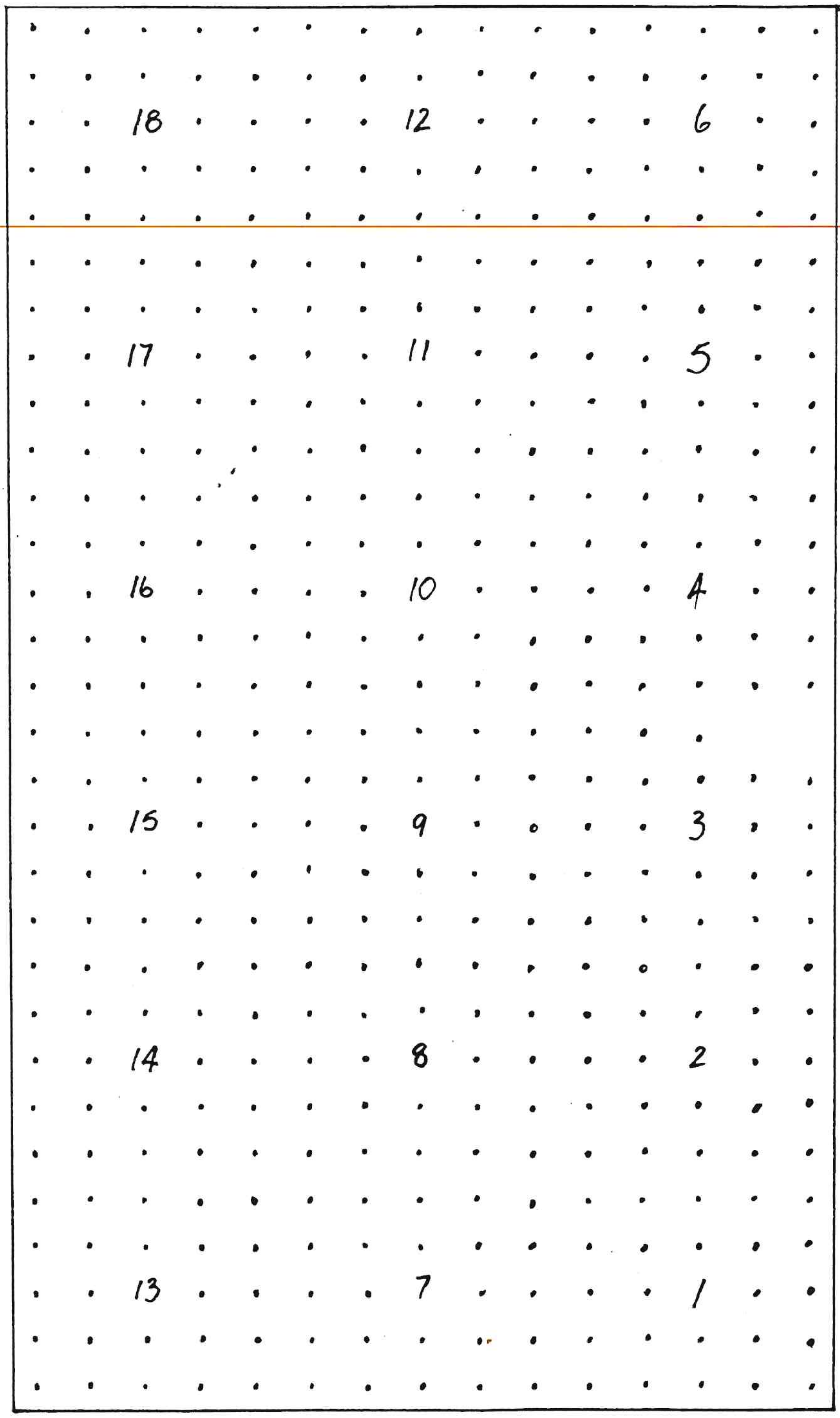
DATE	LOCATION	SPECIES	TAG. NO.	SEX	WEIGHT	TEETH	PES LENGTH	COMMENTS


5
10
20
30
60
150
100
50
40
30
20
10
Cum No Birds
Cum. Area.
GAF A4 1mm

PERUP BIRD STUDY

Date: ....   burn/control

Weather: ....



SPECIES LIST

NOTES.