

Introduction to Biological Survey of the Bungle Bungle Area

by
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BACKGROUND

The Bungle Bungle Range is a sandstone outlier in the south-east Kimberley (Fig. 1). In recognition of its outstanding scenery, its significance for Aboriginal culture and the botanical value of the massif and adjacent area, the Western Australian government reserved the massif and its surrounds as Purnululu (Bungle Bungle) National Park (208 723 ha) and Purnululu Conservation Reserve (110 602 ha) in 1986 (Fig. 2). Difference in status between the two areas arises from the prior presence of mining leases within the Conservation Reserve area. The Conservation Reserve will be included in the National Park when these leases have expired (Colreavy *et al.* 1989). Together, they form the only large conservation reserve in the south-east Kimberley, and one of only three (with Prince Regent River Reserve and Drysdale National Park) large reserves in the Kimberley proper.

In considering proposals for the National Park, and subsequently in preparation of a management plan for the Park and Conservation Reserve, it was recognized that no detailed information on the wildlife of the area was available (Anon 1986; Colreavy *et al.* 1989). Such knowledge was considered important to assess the conservation significance of the area, to guide management policies, to assist in the interpretation of the Park for tourists and to provide perspective on biogeographic patterns of the Kimberley in general. This report presents information to this end, and is based on two periods of detailed surveys of wildlife and plants of the Bungle Bungle area during 1989. The area considered includes the National Park, Conservation Reserve and portions of the adjacent Texas Downs, Osmand Valley, Mabel Downs and Sophie Downs Stations considered for possible extensions to the Park (Fig. 2). Together, these three categories of land are referred to generally as the Bungle Bungle area in this report.

LOCATION

The Park lies about 160 km south of Kununurra, 50 km south-east of Turkey Creek in the Shire of Halls Creek. The Park, Conservation Reserve and the rest of the area surveyed lie within the one degree block defined by 17° to 18° S and 128° to 129° E. To the north it is bounded by Osmand Valley Station and Texas Downs, to the west by Mabel Downs and Sophie Downs, by Alice Downs in the

south-west corner, and by the Ord River Regeneration Reserve (including in part the former Turner and Ord River Stations) to the south and east. The Northern Territory border lies about 50 km to the east.

Access to the Park is by the four-wheel-drive Spring Creek track (*c.* 50 km) running off the Great Northern Highway about 50 km south of Turkey Creek. A previous access via Osmand Valley Station has been closed to the public for about three years.

Place names for locations in the Bungle Bungle area which are listed in the text are shown in Figure 2. Some colloquial names used by ranger staff are given in quotation marks. The use of such names may be discontinued in the near future. Throughout we use the name Osmand (rather than Osmond) to refer to the Range, Valley, Plateau and Station.

CLIMATE

Slatyer (1970) presents a detailed description of climate in the general region of the Ord and Victoria River basins, and this description is based mainly on that report. Purnululu lies near the southern (inland) border of the wet-dry tropics. Rainfall at Turkey Creek and at Limbunya Station (*c.* 140 km east of the study area) probably approximates the wettest and driest portions of the study area (Table 1). The 500-700 mm average annual rainfall occurs mainly (*c.* 85 per cent) in the four-month (December to March) wet season. Typical of the wet-dry tropics (Taylor and Tulloch 1985), variability in rainfall between years is pronounced (Robinson 1971). Particularly notable were extensive periods of below-average rainfall between 1927 and 1936, and between 1947 and 1958 (Robinson 1971).

The evaporation rate is very high (greater than 2000 mm per year) and run-off is rapid, resulting in little permanent water in the area. The effectiveness of the rainfall has declined fundamentally over the last century because of deterioration of soils and loss of vegetation (Robinson 1971; Aldrick *et al.* 1978). Extreme rainfall events are likely to further exacerbate erosion (Aldrick *et al.* 1978; de Salis 1982).

Mean maximum temperatures during the dry season average between 30 and 35°C and rise at the approach of the wet season to about 40°C in November and December.

LANDSCAPE

Descriptions of geology, geomorphology and soil of the general region are provided by Traves (1955, 1970 a and b), Dow and Gemuts (1967, 1969), Paterson (1970), Stewart (1970), Robinson (1971) and Aldrick *et al.* (1978). Anon (1986) and Colreavy *et al.* (1989) summarize more specific information for the Bungle Bungle area.

To the north and west of the Bungle Bungle massif, there is a narrow zone of ancient (to Archaean, 2500 million years before present) igneous, metamorphic and sedimentary rocks (the Halls Creek Mobile Zone), with complex geological history of intense faulting, folding and deformation. This rugged and undulating terrain is covered by greywacke, phyllite, conglomerate, limestone and dolomite rocks, with some granite intrusions. Slightly younger (Proterozoic, 1500 million years ago) conglomerate and quartz sandstones form the plateau of the Osmand Range to the north of the study area. There is a narrow band of basalts between the Halls Creek Mobile Zone and the Hardman Basin to its south-east.

Almost all of the National Park lies within the Hardman Basin province. This basin, which extends south and east into the Northern Territory, has an underlying layer of basalts of the Antrim Plateau Volcanics with some Cambrian (500 million years ago) limestone, shale, marl and siltstones superimposed. During the Devonian (370 million years ago), Elder sandstone was deposited, and in eroded form persists today as the Bungle Bungle massif or smaller remnants to the south and east (e.g. Dixon, Hardman and White Mountain Ranges). Gradual erosion of this soft sandstone produced the broad sandplains surrounding the central massif. The massif itself is composed of a series of characteristic domes. The lack of scree slopes and boulders reduces the complexity of this range for animal habitat.

Except for the sandplains of the Ord River valley, the Bungle Bungle area is of high relief. Elevation varies from 180 m to 720 m above sea level. Substantial areas of the Osmand Plateau are above 600 m. The highest point of the Bungle Bungle massif is 640 m.

The soils of the region are highly variable, and for convenience are described below in association with land system units.

LAND SYSTEMS

The variety of geological features underlie a pronounced range of land forms in the Park region. For the general region, these were described as a series of named land systems by Stewart *et al.* (1970), Robinson (1971) and Aldrick *et al.* (1978). A more detailed description and mapping of land system units in the Bungle Bungle area

was given by de Salis (1982), and subsequently by Anon. (1986). This description is summarized here:

ANTRIM: Rugged uplands (Au), Lowlands (Al). Occurring in the area as a narrow band on the north-west edge of the Hardman Basin. Basaltic; rough stony hills, with skeletal lithosol soils on hills and juvenile cracking clays on the narrow plains. The hills support *Eucalyptus* open woodland over spinifex, plains have *Eucalyptus* open forest or woodland over tussock grasses, and stream lines support *Terminalia platyphylla* open forest. The lowland areas suffer extensive sheet and gully erosion, but the uplands remain in good condition.

BUCHANAN: Uplands (Bu), Sand Plain (Bp), Frontage (Bf).

Occupying much of the Bungle Bungle area, this land system is based on Elder sandstone, and consequently has deep red and yellow sands or earths, with fine white sands on frontage river plains. Vegetation consists of *Acacia* and *Grevillea* shrublands over spinifex in the uplands, *Eucalyptus* woodlands over *Acacia* and spinifex on sandplains, and a range of species along riparian margins. There is little degradation in this land system.

DOCKRELL: Rugged Uplands (Do).

This land system occurs along the far western edge of the Bungle Bungle area. It consists of folded hills, with sedimentary and metamorphic Archaean rocks and skeletal gravelly lithosol soils. Hills support *Eucalyptus* open woodland over spinifex, and have undergone little degradation. This system was not sampled during this survey.

ELDER: Uplands (Eu), Cuestas (El), Lower Slopes (Ep).

This land system includes much of the Bungle Bungle area, including the massif itself. It is based on Elder sandstone, with exposed rock or sandy lithosols on upland and cuesta units, and sandy to friable calcareous soils on lower slopes. A *Eucalyptus* low open woodland with scattered *Grevillea* and *Acacia* and understorey of spinifex occurs in the upland and cuesta units. The lower slopes support an open woodland of various *Eucalyptus*, *Acacia* and *Terminalia* species over tussock grasses. The lower slopes have undergone moderate erosion, the cuestas and uplands remain in good condition. The lower slope unit was not sampled in this survey.

HEADLEY: Upper Slopes (Hu), Lower Slopes (Hl).

This system occupies only a little of the Bungle Bungle area, mostly in the south-west adjacent to the Dixon Range. Headley limestone characterizes this system, evident as a series of exposed ridges and cuestas. Soils are skeletal stony calcareous lithosols and loams. Isolated *Ficus platypoda* form a distinctive plant community on outcrops. Lower slopes support woodlands over spinifex or hummock grasses. Upper slopes remain in good

condition, but there has been some erosion of lower slopes. The upper slope unit was not sampled during this survey.

NELSON: Cuestas (Nc), Cuesta Backslopes (Nb), Cracking Clay Plains (Ns), Interfluvial Upper Slopes (Nu), Interfluvial Lower Slopes (Nl), Frontage (Nf), Low Rises (Nr).

This diverse land system is restricted mainly to the valley of the Ord River along the south and east of the Bungle Bungle area. Its geological composition is calcareous limestone and shales. The cuestas, backslopes and lower rises have skeletal, calcareous soils, bearing open woodland over spinifex, tussock grasses and the introduced *Aerva*. Degradation has been moderate. The cracking clay unit is a black soil plain carrying open woodland of *Lysiphyllum* over tussock grasslands, and remains in reasonably good condition. The upper and lower slope units have grey-brown calcareous desert loam and clay soils, and support a low open woodland of a range of woody species over introduced grass species. These units are extensively degraded. The frontage unit has alluvial sands, silts and loam soils, and supports a narrow riparian strip of open forest dominated by *E. camaldulensis* and/or *Melaleuca leucadendra*, the adjacent levees include also *E. papuana*, the understory is very heterogeneous but includes substantial cover of introduced species. This unit is severely eroded and degraded. The Cuesta, Cuesta Backslopes and Interfluvial Upper Slope units were not sampled in this survey, and the Interfluvial Lower Slope unit was sampled by only one quadrat.

WICKHAM: Rugged Uplands (Wk).

This system dominates the north and west of the Bungle Bungle area, covering most of the Osmand Ranges. It should probably be divided into distinct units, as it includes a very variable range of land forms and vegetation. It is based on mostly Proterozoic shales, siltstones, sandstone, conglomerates and dolomites. It consists of rugged plateaux, ridges and cuestas, split by narrow gorges. Soils are variable: dark clays in river valleys, duplex on mid slopes and stony lithosols or exposed rock in uplands. The rocky ranges support *Eucalyptus* open woodlands over spinifex. The more sheltered creek lines support a dense riparian vegetation, including *Melaleuca leucadendra*, with pockets of rain forest species. The rocky ranges remain in good condition, the lowland areas support very high densities of cattle and feral stock (especially donkeys) and are suffering extensive degradation.

ABORIGINAL HISTORY

Aboriginal use of, and association with, the Bungle Bungle area has been long-standing. Much of their traditional activity was centred on the river systems and permanent pools, especially those of the Ord River. The Bungle Bungle massif and surrounding ranges are rich in sites of enduring cultural significance (Kirkby and Williams 1984).

The Aboriginal population declined, and traditional activities were disrupted, following pastoral expansion at the end of the last century. Available food resources declined or were eliminated during the degradation of land associated with grazing (Colreavy *et al.* 1989). Presumably, the reduced role of Aborigines in managing the land over this period was associated with substantial changes in fire regime.

Ongoing links with the Purnululu area were formalized with the creation in 1986 of the Purnululu Aboriginal Corporation which represented the traditional custodians during planning for the establishment of the National Park (Coombs *et al.* 1989). Current management plans provide for permanently inhabited outstations within the Park (one outstation is currently established), Aboriginal rangers, traditional hunting and gathering, and a high priority assigned to the protection of important Aboriginal sites (Anon. 1986; Colreavy *et al.* 1989).

EXPLOITATIVE HISTORY

The first European exploration of the Bungle Bungle area was by Alexander Forrest between 1876 and 1879. His favourable reports of the area led rapidly to the establishment of leaseholds (1880s) and rapid stocking of cattle, especially along the Ord River valley (Bolton 1953; Auty 1964; Perry 1970b). The cattle industry was boosted with the nearby market provided by the Halls Creek gold-rush from the 1880s to the mid 1890s (Stewart 1970a). Stocking rates quickly increased (Perry 1970b), assisted by live cattle export from Wyndham and, from 1918, the establishment of an abattoir there.

Within forty years most of the more productive land along the Ord River was severely degraded and eroding (Medcalf 1944; de Salis 1982), with massive dust-storms providing conspicuous evidence of poor land management and overstocking (Riddett 1988). Little conservation action was taken until it was realized that continuing soil erosion would lead to massive siltation of the proposed Ord River Dam (Lake Argyle). Arising from this concern, 8960 km² of the Ord River catchment (including most of the present Park, and all of Ord River and Turner Stations, and parts of Flora Valley, Elvire Downs and Ruby Plains) was resumed in 1967 as the Ord River Regeneration Reserve, with control vested in the Minister for Agriculture. Rehabilitation measures by the Department of Agriculture included the removal of livestock, mustering and shooting of feral stock (mostly donkeys), fencing and strip contour cultivation and seeding with exotic pioneer species (especially *Cenchrus* spp. and kapok-bush, *Aerva javanica*). The erosion status of this land was surveyed in 1981 by de Salis (1982). There was little restorative work undertaken on degraded lands in the National Park and Conservation Reserve until 1985.

The degradation caused by the pastoral industry has led to extensive loss of soils, change in composition of understorey species (notably the proliferation of *Heteropogon contortus*: Forbes and Kenneally 1986), destruction of much riparian vegetation (e.g. *Typhus* reedbeds around the Ord: Anon. 1986), elimination of many of the herbs and other plants traditionally used as food by the local Aboriginal people (Colreavy *et al.* 1989; Coombs *et al.* 1989) and massive siltation of rivers and waterholes (R. Wallaby in Anon. 1986). These changes have probably been associated with the local extinction of numerous animal species, with the medium-sized mammals being most vulnerable (McKenzie 1981a; Burbidge and McKenzie 1989). Such radical changes in the animal species composition must remain partly conjectural, as the pre-pastoral fauna was never described.

Disturbance and erosion has been very uneven in the Bungle Bungle area, with the water systems and lowland plains adjacent to the Ord River bearing the brunt of livestock pressure (Riddett 1988). The friable soils of these areas proved erosion-prone. The rugged uplands, with their difficult access, relative unpalatability of their grasses and distance from water, have fared much better.

There has been no substantial mining in the Bungle Bungle area. Limited exploration activity has occurred around the periphery of the National Park, and exploration leases are current in the Conservation Reserve. Some of this exploration has further developed a track network in the Conservation Reserve. Our observations in the south-west of the Conservation Reserve indicated that in some cases exploration tracks had been sited without regard to erosion risks, and there had been little attempt made to rehabilitate disturbances associated with exploration activities. The Bungle Bungle massif itself is not considered highly prospective (Anon. 1986).

TOURISM

The Bungle Bungle massif is now a major focus for tourism in the Kimberley region, with visitor numbers escalating dramatically over the last five years (Barrington Partners 1986; Colreavy *et al.* 1989). Numbers are expected to continue increasing, and an airstrip is under construction near Bellburn Creek campsite. The Department of Conservation and Land Management has restrained tourist pressure by (i) encouraging visits by scenic flight from Kununurra or Halls Creek, (ii) keeping the access track at four-wheel-drive standard, (iii) restricting campsites to two locations, (iv) prohibiting campfires, and (v) limiting access, chiefly to Piccaninny and Cathedral

Gorges and Echidna Chasm. Nonetheless, tourist impact has led to some proliferation of tracks and to severe localized degradation where tracks have been inappropriately aligned. Tourist pressure may be expected to increase, with a range of tourist developments being proposed for the Park and surrounding area (e.g. Barrington Partners 1986). The impact and management of visitors will remain a formidable management consideration.

PREVIOUS BIOLOGICAL INFORMATION

There is an extraordinary dearth of information on the fauna of the Bungle Bungle area. It was missed by the extensive collecting expeditions which worked in the Kimberley region over the last 40 years (e.g. Hall 1974; Kitchener and Vicker 1981).

The birds have been best served, with the published list of long-term ranger Mr Bob Taylor (in Colreavy *et al.* 1989) including 115 species from the National Park, and another smaller list based on a short visit (Muir 1983). The bird fauna of the Ord River Station was described by Kilgour in 1904, and this provides an important historical perspective for possible changes in faunal composition. Records from the Bungle Bungle area were also included in the Atlas of Australian Birds (Blakers *et al.* 1984).

Muir (1983) also lists six mammal species identified from bones collected near Bungle Bungle Outcamp. Anon. (1986), McGonigal (1989) and Colreavy *et al.* (1989) give anecdotal records for a few other mammal species, although the identification of some of these is unconfirmed. There is no published information on the reptiles and amphibians of the area, although the Western Australian Museum has undertaken limited collecting of the herpetofauna of the Ord River valley (Smith¹ personal communication).

In contrast, the vegetation of the Bungle Bungle area was described in detail by Forbes and Kenneally (1986), its conservation significance reported by Forbes and Kenneally (1985) and ethnobotanical value given by Rose (1985) and Scarlett (1985). Forbes and Kenneally (1986) provide an extensive annotated list of plant species.

LAYOUT

This report is presented as a series of sections linked by a common introduction, methods and discussion. All references are listed together in the final section. Tables and Figures for individual sections are presented together at the end of the section in which they are cited.

¹ L. Smith - Western Australian Museum, Perth

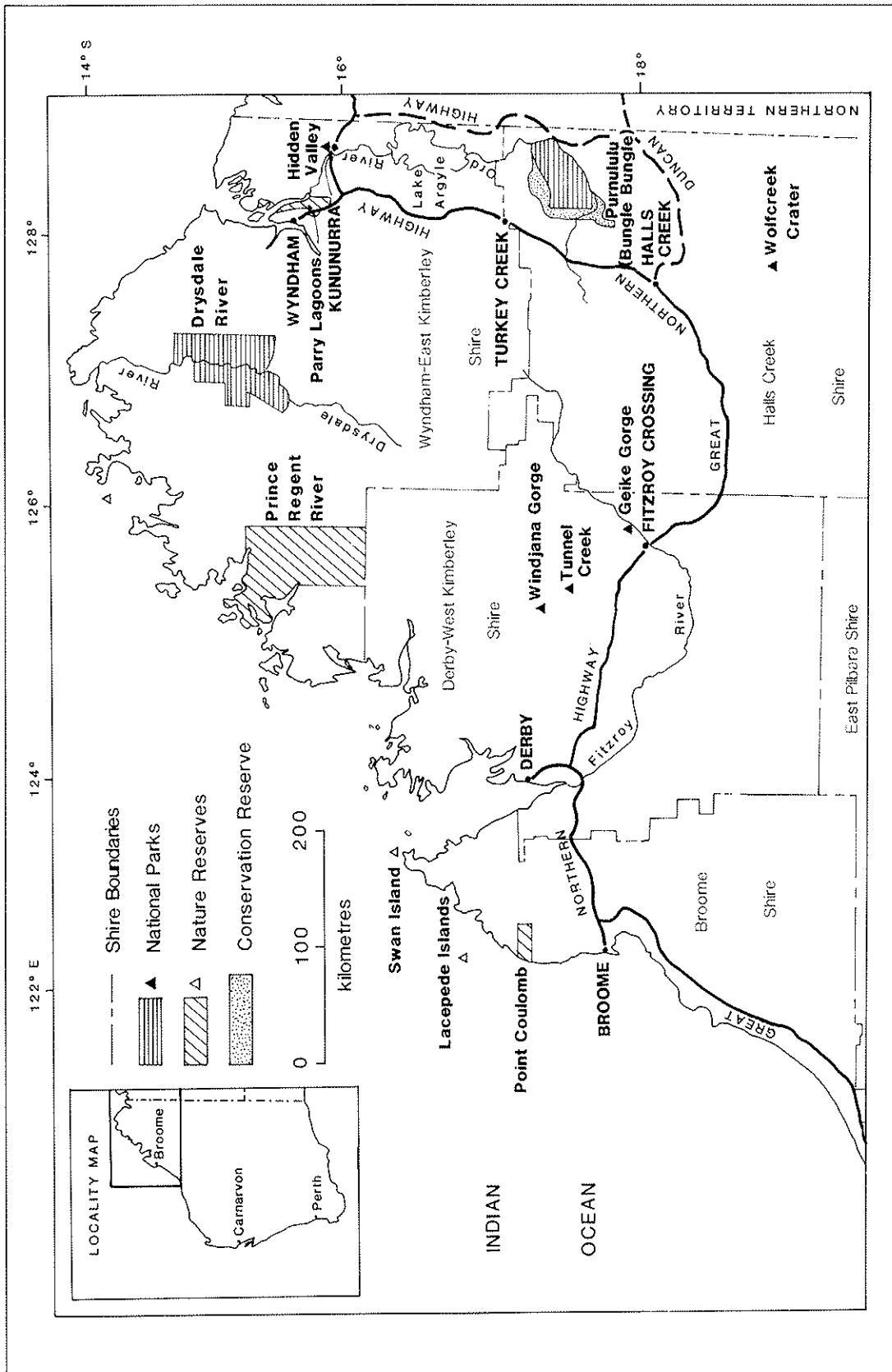


Figure 1
Location of the Bungle Bungle area.

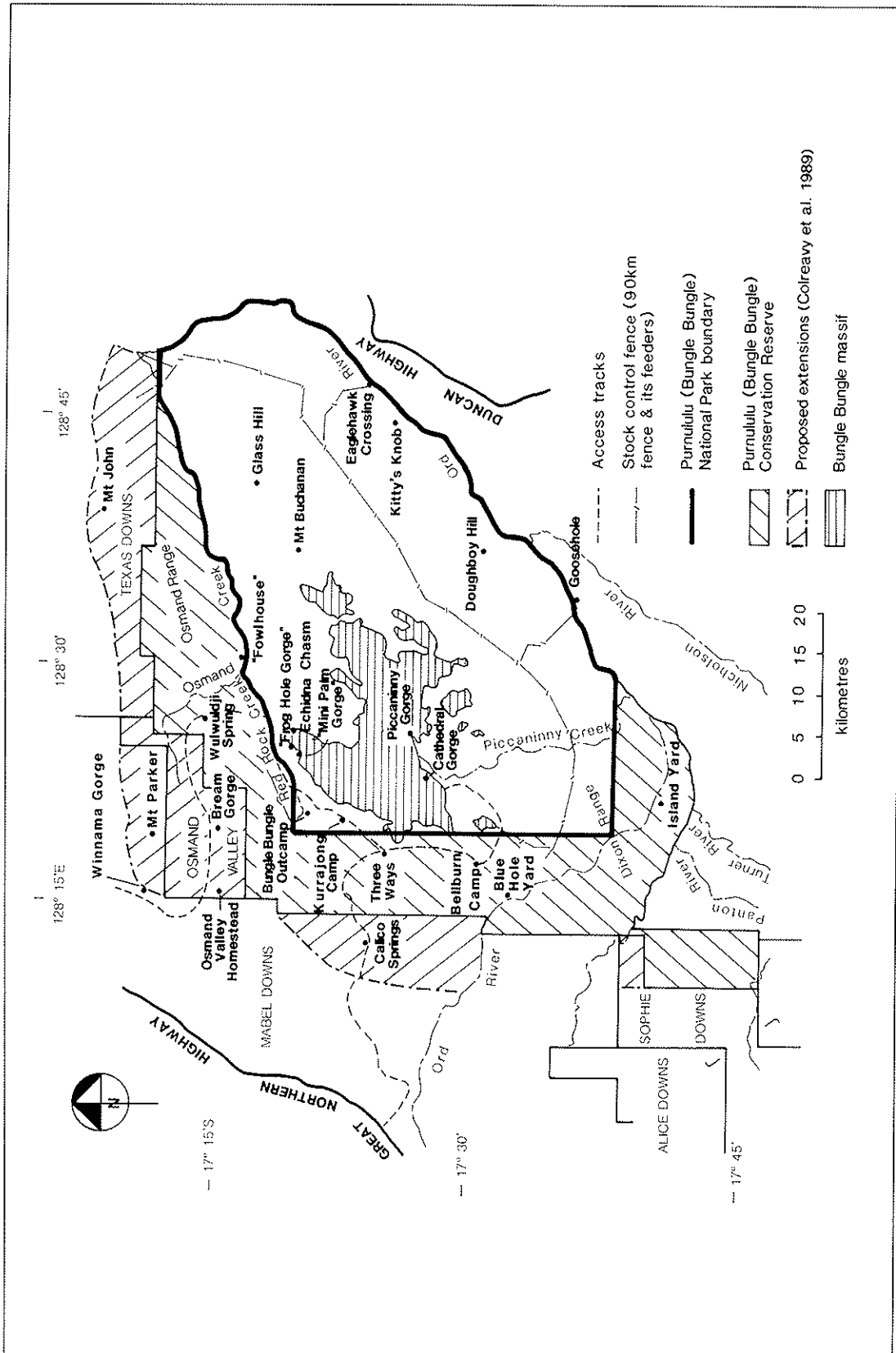


Figure 2
The Bungle Bungle area showing place names mentioned in text.

Table 1

Average rainfall figures (mm) for Turkey Creek (records over 60 years) and Limbunya (records over 44 years).

	<i>Jan</i>	<i>Feb</i>	<i>Mar</i>	<i>Apr</i>	<i>May</i>	<i>Jun</i>	<i>Jul</i>	<i>Aug</i>	<i>Sep</i>	<i>Oct</i>	<i>Nov</i>	<i>Dec</i>	<i>Year</i>
Turkey Creek	170	168	102	26	11	7	6	2	4	18	54	113	681
Limbunya	144	144	79	16	8	5	5	2	2	19	38	91	553