Chapter 1

THE LITTLE SANDY DESERT

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ABSTRACT

The Little Sandy Desert is biologically a poorly known natural region in north-western Australia. The Desert experiences an arid tropical climate typified by hot summers and cool winters with mostly summer rainfall which averages 200 mm to 250 mm per annum. The salient characters of the Desert are resistant sedimentary uplands of mostly sandstone rising above extensive rolling eolian red sand dunes and sand plains. Significant uplands, typified by the Carnarvon Range are present, however relief is generally subdued. Drainage is mostly internal, easterly to north-easterly trending and along paleodrainage channels. The Desert is situated upon several geological structures most of which are Precambrian sedimentary basins. The Savory Basin is the most important of these sedimentary features and is completely encompassed within the Desert. Overlaying these sediments are Cainozoic deposits dominated by eolian sands although numerous examples of calcariferous, gypsiferous and lateritic deposits are also present. The Desert is mainly vegetated by Acacia, Grevillea *and ericoid shrubs over hummock grasses although not insignificant woodlands of* Eucalyptus, Allocasuarina *and* Acacia *persist.* Melaleuca *and samphire heaths dominate most of the drainage features. The majority of the region is Unallocated Crown Land, although some parts of the Desert are within well-known reserves such as the Rudall River National Park and Canning Stock Route. At this time the region has limited financial prowess although the potential for hydrocarbons in the Savory Basin and the significant mineralisation associated with the Paterson Orogen in the Rudall River area may alter this situation in the future.*

Biological investigations in the Little Sandy Desert have been limited, mainly being confined to the Canning Stock Route and Rudall River areas. This situation was exemplified by the rediscovery of the only presumed extinct Eucalyptus (E. rameliana) *in the southern portion of the Desert in 1991. This survey aims to address this knowledge deficiency by systematically documenting and reporting the flora and fauna of the south-western Little Sandy Desert. Management recommendations designed to ensure that the flora and fauna of the Desert are adequately conserved on reserve land and protected from threatening processes are tendered.*

INTRODUCTION

The Little Sandy Desert (24° 46' S, 122° 09' E) is located to the east and south of Newman in the Pilbara region of Western Australia. The Desert lies between latitudes 21° 30' S and 26° 00' S and longitudes 119° 50' E and 124° 30' E and occupies an area of 111 137 km^2.

(Figure 1.1). This desert region is one of the most inaccessible and biologically poorly known areas within Western Australia.

The Desert was first identified as a distinct biogeographical (natural) region in 1969 (Beard 1970) and officially recognised as a distinct region in 1987 (Department of Land Administration 1987). Prior to 1969 the desert was considered part of the much larger Great Sandy Desert (Pianka 1969, Jennings and Mabbutt 1986). The Little Sandy Desert was principally differentiated from the Great Sandy Desert on the grounds of underlying geology (Precambrian *vs* Mesozoic) and sand dune physiography with the dunes of the Little Sandy Desert differencing in both morphology and provenance from those of the Great Sandy Desert (Williams 1992). Inherently these geological and edaphic differences, together with the more southerly position of the Little Sandy Desert, confer significant floristic differences between the two desert (Beard 1975). Beard (1970, 1980) named the biogeographical region the Keartland Botanical District after George Keartland a naturalist with the ill-fated Wells (Calvert Scientific Exploring Expedition) expedition of 1896. Subsequently, following the Biogeographical Regionalisation of Australia (Thackway and Cresswell 1995) the contemporary name applied to the region is Little Sandy Desert. At present the region is partitioned into two sub-regions. The northern (LSD1) encompasses the highly mineralised Throssell and Broadhurst Ranges in the Rudall River area and comprise approximately 9% of the Desert. The remainder of the Desert is within the LSD2 sub-region.

The principal characters defining the Little Sandy Desert are the sand plains and sand dunes covering approximately 90% of the region, which have evolved *in situ* and are derived from the breakdown of Late Proterozoic sandstones (Williams 1992). To the north the Desert is demarcated from the sands of the Great Sandy Desert by the Throssell, Broadhurst and McKay Ranges while to the east the demarcation occurs where the sands give way to the lateritic plains of the Gibson Desert. To the south the Desert is defined by the acquiescence of the dunes and the replacement of spinifex (*Triodia*) hummock grass by the wattle (*Acacia*) dominated scrub of the Gascoyne Biogeographical Region. In this south-east this transition coincides with the Carnegie Salient while in the south-west the transition coincides with the Gascoyne Ranges (Williams 1995). In the west the demarcation is associated with the replacement of sands by the rocky pediments of the Pilbara and Gascoyne Biogeographical Region as exemplified by the Kumarina Hills.

The climate of the Little Sandy Desert can be described as arid tropical with principally summer rainfall (Beard 1975). No meteorological stations are located within the Desert so climatic averages have been interpreted from the nearby stations at Telfer, Mundiwindi, and Earaheedy (Bureau of Meteorology 2002a). Average annual maximum temperatures range from 34° C in the north to 30° C in the south while over the same latitudinal extent average annual minima range from 19° C to 15° C. Typically the summers are hot, varying between 37° and 41° C while winters are mild to cool varying from 5° C to 10° C. Temperature extremes likely to be experienced in the Desert range from –5° C to 48° C. Frosts are common, occurring from June to early September.

Rainfall across the Desert is erratic and highly variable (Beard 1975). As demonstrated by the isohyets in Figure 1.2, the annual average varies from 200 mm or below in the east to about 250 mm in the west (Waters and Rivers Commission, 2002) although the accuracy of these isopleths is questionable as Telfer on the northern edge of the Desert receives an annual average of 312 mm (Bureau of Meteorology 2002a). Typically most rainfall occurs in summer (49%) and is undoubtedly associated with the dissipation of tropical depressions and

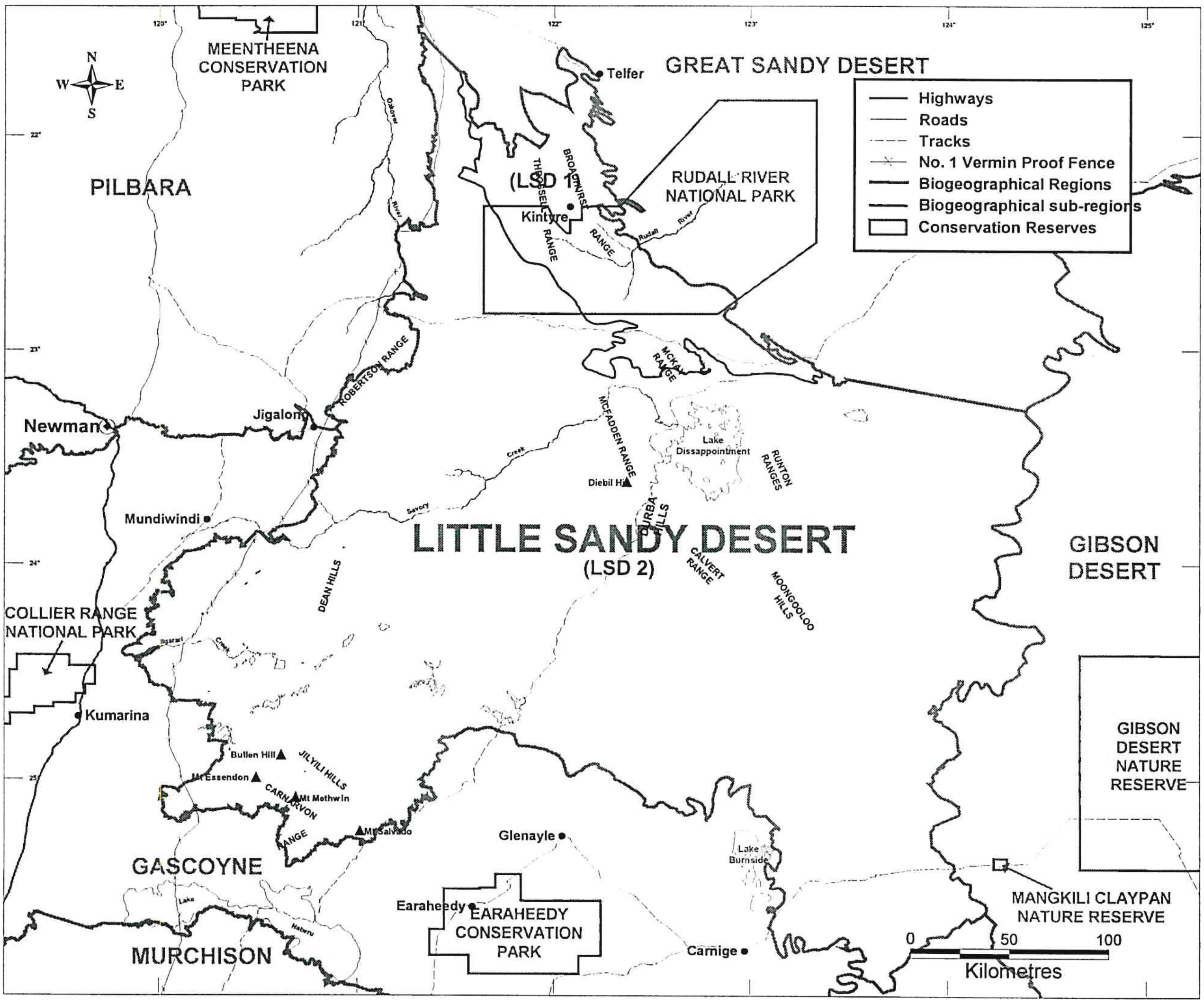

Figure 1.1 Regional setting of the Little Sandy Desert Biogeographical Region.

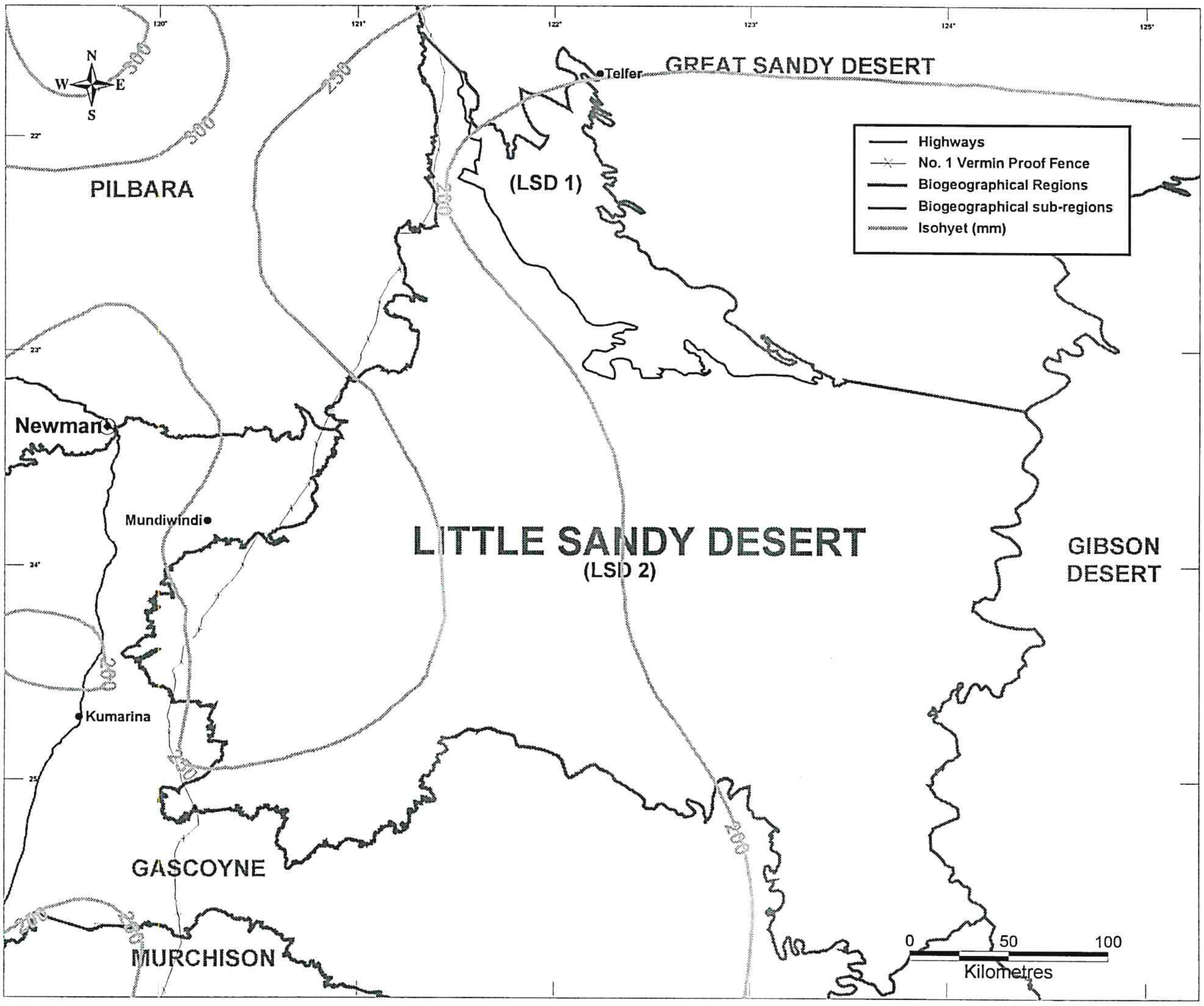

Figure 1.2 Isohyets of the Sandy Desert Biogeographical Region.

monsoonal lows. Winter rainfall is usually low (14% of annual average) although as noted by Williams (1995) it can be considerable as a consequence of baroclinicity associated with the interaction between north-west cloud bands and low pressure systems passing through the south of the State. Annual potential evaporation ranges from 3 600 mm in the north-west of the Desert to 4 200 mm in the south-east (Australian Bureau of Statistics 1989) while actual areal evapotranspiration ranges from 300 mm in the north to 200 mm in the south-east. (Bureau of Meteorology 2002b).

The Little Sandy Desert is dominated by broadly rolling sand dunes interspersed with extensive eolian plains, abrupt sedimentary mountain systems, sandstone ranges, rolling lateritic hills and extensive paleodrainage channels. Relief across the Desert varies from 910 m on Mt Essendon in the Carnarvon Range to 320 m at Lake Disappointment. Typically local relief is less than 50 m although the peaks of the Carnarvon Range are up to 320 m above the surrounding terrain. Conspicuous topographical features of the Desert are the 'whaleback' ranges, ridges, hills and breakaways which rise above a sea of red sand. These features include the Robertson Range, Throssell Range, Broadhurst Range, Hanging Rock, Diebil Hills, McFadden Range, Durba Hills, Runton Range, Constance Hedland, Calvert Range and the peaks of the Carnarvon Range such as Mt Essendon, Mt Salvado and Mt Methwin.

The red sand dunes of the Little Sandy Desert are the most striking feature of the biogeographical region. These dunes are smaller but more complex than the dunes of the Great Sandy Desert and range from sinuous longitudinal dunes through to chain dunes which often anastomose to forming a net-dune complex (Crowe 1975). Star dunes and pimple or pyramidal dunes are also present (Williams 1995). Longitudinal dunes may be up to 30 km long and 20 m high although the average is 5 km to 10 km long and 8 m to 10 m high. The swales between dunes vary from less than 100 m to over 1 km. The dunes trend mostly in an easterly direction and parallel to the prevailing winds which vary from south-easterly in the east to north-easterly in the west of the region. The dunes fringing many of the playas and lakes in the Desert are lunette and comprised of gypsiferous material, in particular kopi.

Drainage in the Desert is principally internal, trending east to north-east into Lake Disappointment, saline and associated with paleodrainage channels. Exceptions to this flow pattern are associated with the Rudall River which drains into Lake Dora, the Oakover River which is part of the De Grey River catchment and Jigalong Creek which is part of the Fortescue River catchment. In the south drainage on the southern side of the Carnarvon Ranges is into Lake Naberru and Kahrban Creek. The most prominent drainage feature of the Little Sandy Desert is Lake Disappointment and its associated network of playas and clay pans. Other large lakes include White Lake, Lake Aerodrome, Ten Mile Lake, Terminal Lake, Lake Wilderness and Lake Sunshine. The largest drainage channel in the region is Savory Creek which flows through the middle of the Desert into Lake Disappointment. Ilgarari Creek is another prominent drainage channel which flows into Yanneri and Terminal Lakes. Other paleodrainage channels are associated with the Durba Hills and the Disappointment Paleoriver (van der Graaff *et al.* 1977, Williams 1992). Numerous springs, soaks and developed wells are located throughout the Desert including Durba Spring, Curran Curran Rockhole, Bullen Well and Wells 11 to 21 along the Canning Stock Route.

Geologically the Little Sandy Desert is comprised of a number of geological structures the most significant of which are sedimentary basins (Williams 1990, 1992). These sedimentary basins are the Officer Basin in the east, the Bangemall Basin in the west, the Bangemall and Nabberu Basins in the south and most importantly, the Savory Basin. The Savory Basin is a

Precambrian (Late Proterozoic) sedimentary basin which has only recently been described (Williams 1987, 1992, 1995, William and Tyler 1991). It is captured entirely within the Little Sandy Desert Biogeographic Region and occupies approximately 48% of the Desert. Throughout the Desert the rocks of the Savory Basin are expressed as sandstone breakaways, ridges, hills and ridgelines. Interspersed amongst these sandstone features are mafic intrusions expressed as weather doleritic features. Another geological structure impinging upon the biogeographical region is the Late Precambrian Paterson Orogen which is comprised of metamorphic, sedimentary and igneous rocks that have a common tectonic history. This geological structure occupies the north-eastern portion of the Desert. Minor expressions of the Fortescue and Hamersley Group of the Hamersley Basin, which is part of the Archaean Pilbara Craton, are also captured within the Desert, primarily in the north-western corner of the region.

Throughout the Desert the sedimentary rocks are expressed as resistant upland features in a sea of unconsolidated or semi-consolidated Cainozoic deposits. Typically these deposits form a thin or skeletal veneer over the Precambrian rocks, however on the plains, dunefields and in valley floors they may attain depths of 20 m (Williams and Tyler 1991). The Quaternary (Holocene) eolian sands of the dunefields and sand plains are the most ubiquitous expression of these deposits. Other examples of these deposits include pebble strewn colluvial deposits which are usually down slope and adjacent to decomposing sandstone regolith. Where sandstone is absent such deposits tend to be lateritic and support a ferruginous or siliceous duricrust. Unconsolidated alluvial deposits of silts, sand and gravels are also present, mostly in close proximity to the active paleodrainage channels such as Savory Creek. Calcareous deposits are also common and are indicative of extant paleodrainage channels. These deposits are the remains of fluvial valley-fill sediments converted to chemical limestone by the subsurface replacement and cementation of calcium carbonate (Williams 1992). In many instances these calcareous deposits are expressed as outcropping cap rock overlain by 2 m to 3 m of eolian sand (Bagas *et al.* 2000). A final Cainozoic deposit is that associated with the playas and lake systems of the Desert. These deposits are generally saline, gypsiferous and comprised of black to red-brown to grey clay material (Williams 1995).

In broad terms the vegetation of the Little Sandy Desert can be described as shrub steppe dominated by *Acacia* and *Grevillea* species over hummock grasses (*Triodia* spp.) with scattered woodlands of desert oaks (*Allocasuarina decaisneana*) and mulga (*A. aneura*) (Beard 1975, 1990). Specifically, sand plains and expansive swales between the dunes are dominated by shrublands of *Acacia* and ericoid shrubs, in particular *Aluta maisonneuvei,* over hummock grasses. Mallee shrub of *Eucalyptus kingsmillii, E. gamophylla E. rameliana* and *E. pachyphylla* dominate over smaller wattles and hummock grasses when these sand plains overlay degrading sandstone and doleritic regolith. With progression up slope onto the dunes, grevilleas tend to replace the wattles and the sand dune bloodwood (*Corymbia chippendalei*) becomes conspicuous. On the consolidated colluvial soils and some of the calcareous and ferruginous hardpan deposits *Acacia* woodlands dominated by mulga in association with gidgee (*A. pruinocarpa*) and beefwood (*G. striata*) over perennial tussock grasses and ephemeral herb are prevalent. Some of the calcareous deposits, especially those overlain by eolian sands support dense groves of desert oak. The paleodrainage channels and their associated plains are dominated by shrubs and heaths of *Melaleuca* and *Acacia* species over scattered hummock grasses. The more active paleodrainage channels (Savory Creek) are often lined with dense thickets of *Melaleuca* and in areas of fresh water or on adjacent expansive calcareous pediments, coolibahs (*E. victrix*) and occasional river red gums (*E. camaldulensis*) may be present. When hypersaline conditions are encountered the eucalypts are replaced by groves of black oak (*Casuarina pauper*). The vegetation fringing the playas and lake beds tends to be a samphire health dominated by species of *Halosarcia*. On the rocky pediments *Acacia* shrubs dominate, often with emergent desert bloodwoods (*C. deserticola*) and beefwood. Minni-ritchi wattles such as *A. rhodophloia* and other species like *G. spinosa* and *E. oldfieldii* are also common on such substrates, usually occurring as emergents from open hummock grass.

Conspicuous elements in the flora tend to be the desert oak, spear wattles (e.g. *A. melleodora*), desert kurrajong (*Brachychiton gregorii*), desert grass-tree (*Xanthorrhoea thorntonii*) and when flowering, the hummock grasses and brightly coloured, floriferous grevilleas (*G. spinosa, G. eriostachya G. stenobotrya*). Variation in the composition of the vegetation across the Desert has been reported by Beard (1975) who noted the gradual disappearance of the desert bloodwood and conversely increasing abundance of *Eremophila* shrubs with progression to the south. Similarly an increase in the abundance of mulga woodlands was also noted, a phenomenon which was explained with reference to the phytogeographically important *Acacia-Triodia* line which traverses the region (Beard 1975). Beard (1975) and Williams (1992) also noted an increase in the abundance and distribution of ericoid shrubs (e.g. *A. maisonneuvei*) with progression into southern parts of the Desert. In areas south of Ilgarari Creek, *A. maisonneuvei* tends to occur continuously across the topographical sequence growing on both northern and southern facing dune slopes and across the intervening swales while in the north, towards Rudall River, this shrub is typically confined to southern facing dune slopes. The abundance of the desert grass-tree also appears to be greatest in southern and western portions of the Desert (Williams 1992).

The Little Sandy Desert is mostly uninhabited with the exception of a few scattered aboriginal communities in the vicinity of Jigalong and the Rudall River. A mineral exploration camp is also located at Kintyre in the Throssell Range. The closest noteworthy settlement to the region is the mining community of Telfer which is 50 km north of Kintyre. The closest commercial centre to the region is Newman in the Pilbara, some 105 km west of the region. The Little Sandy Desert is flanked by pastoral leases to the south and west, namely Wandanya, Balfour Downs, Robertson Range, Walagunya, Weelarrana, Kumarina, Marymia, Glenayle and Carnegie. The Desert falls within the administrative boundaries of the East Pilbara, Wiluna and Meekatharra shires. The Region is also within the Pilbara and Goldfields administrative regions of the Department of Conservation and Land Management. Ninety-seven percent of the Desert is captured within the bounds of five registered Native Title Claims by the Birrilburu (WC98-068), Martu (WC96-078), Ngalia (WC97-003), Njamal (WC99-008) and Nyiyaparli (WC99-004) claimant groups.

The majority (*ca.* 90%) of the Desert is Unallocated Crown Land although some significant reserves are present. Among these the Canning Stock Route, which traverses the central and north-eastern parts of the region, is perhaps the most renowned. Other reserves are associated with the abandoned No. 1 Vermin Proof Fence (↑ 12297). and the Jigalong Aboriginal Reserve. Perhaps the most noteworthy reserve impinging on the Desert is the Rudall River National Park (↑ 34607, Class 'A'), the largest national park in Western Australia. Approximately 40% of the Rudall River National Park occurs within the Little Sandy Desert. Another two conservation reserves encompassing the Carnarvon Range and Lake Disappointment areas are proposed for the Desert, however these recommendations have not come to fruition (Environmental Protection Authority 1975, Conservation and Land Management 1994).

Access to the region is very limited and mostly confined to unsealed graded road or four-wheel-drive tracks such as the Talawana-Windy Corner track, Canning Stock Route, Gunbarrel Highway and the service track associated with the abandoned No. 1 Vermin Proof

Fence. The region currently has limited financial prowess, although nature-based and four-wheel-drive tourism associated with the Canning Stock Route and Rudall River National Park is considerable. Pastoralism may also contribute somewhat to the financial stature of the region, however its influence would be minimal given no leases actually occur within the region, instead merely impinging upon the western and southern margins. The potential for mineral wealth in the region is considerable but varies markedly across geological structures. Exceptional prospectivity is associated with the Paterson Orogen in the northern part of the Desert as demonstrated by extensive mineralisation in the Throssell and Broadhurst Ranges (Bagas *et al.* 1995). The Carnarvon Range is also considered to be prospective for mineral resources (Bunting *et al.* 1982). The Savory Basin, particularly in the north-east is considered to provide a potentially favourable environment for hydrocarbons although further exploration is required to verify this proposition (Williams 1992).

The Little Sandy Desert is one of the least understood and appreciated areas in Western Australia with respect to its biota and natural history. This shortcoming in our knowledge can principally be attributed to the remoteness of the region and lack of convenient access. The first biological work undertaken in the Desert was by Earnest Giles in 1876 during his expedition from Perth in Western Australia to Peake in South Australia (Giles 1889). During this expedition Giles collected several plants which were subsequently passed to the government botanist of Victoria, Baron F. von Mueller. Not unexpectedly many of the plants collected by Giles represented new species and were subsequently described by Mueller. The most noteworthy and subsequently legendary of these plants was *E. rameliana*, which until its rediscovery in the Little Sandy Desert in July 1991, was presumed to be the only extinct *Eucalyptus* in Australia (Hopper 1992). Other examples of plants collected by Giles in the Little Sandy Desert and subsequently named by Mueller include *Stemodia linophylla* and *Hannafordia bissillii* subsp. *bissillii*. The Calvert Scientific Exploring Expedition of 1896 was next to visit parts of the Desert and make observations on the biota (Wells 1902). Over the next 70 years the Desert remained largely unexplored biologically with the exception of expeditions and collecting trips along the Canning Stock Route (e.g. Otto Lipfert in 1930) and along the No. 1 Vermin Proof Fence (e.g. R.D. Royce in 1947).

Contemporary interest in the natural history of the Desert was sparked in the mid-1970s as a consequence of the recommendations of the Conservation Through Reserve Committee for the establishment of new conservation reserves in the region (Conservation Through Reserve Committee, 1974). Consequently biological surveys were undertaken in the Carnarvon Range, Lake Disappointment and Rudall River areas of the Little Sandy Desert (McKenzie and Burbidge 1979, Burbidge and McKenzie 1983). The biological survey of the Rudall River area was the prologue to the creation of the national park and precursor to extensive biological investigations in the northern part of the Desert during the mid 1980s and throughout the 1990s. These investigations were mainly associated with the Kintyre project in the Throssell and Broadhurst Range but extended far and wide to cover the entire Rudall River National Park and areas of adjacent Unallocated Crown Land (e.g. Martinick and Associates 1986, 1987, Davis and Whittles 1988). In the 1990s the southern portion of the Little Sandy Desert and arguably the least known area in the region, as exemplified through the rediscovery of *E. rameliana*, began to attract biological interest. Most of this interest was in the picturesque Carnarvon Range (e.g. Kenneally 2002) although it quickly became apparent to land management agencies that the south-western portion of the Desert abutting the Gascoyne Biogeographical Region was one of the least known areas in the State with respect to its biota (Hopper 1992). This survey was initiated and designed to address this shortcoming.

SCOPE AND PURPOSE OF SURVEY

The principal objective of this biological survey was to comprehensively, systematically and quantitatively document the flora and fauna of the south-western Little Sandy Desert. Other objectives were to investigate the community arrangement of biota, identify how these communities are partitioned across the landscape and assess the biological and conservation significance of the species and communities encountered. The survey involved a rigorous and comprehensive field program supported by herbarium, museum and laboratory analyses.

The fundamental deliverable is an inventory of the flora and fauna of the south-western Little Sandy Desert. Commensurate with this output are contributions to inventories for the biogeographical region, and an assessment of the distributional, biological and conservation significance of plants and animals within the Desert. The inventories are also used to substantiate recommendations on the conservation status of species and provide the foundation for assessment of the comprehensiveness, adequacy and representativeness of the existing conservation reserve system in the Little Sandy Desert. Outputs from the survey are also used to justify recommendations for augmentation of the Little Sandy Desert conservation reserve network.

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Biological survey of the south-western Little Sandy Desert

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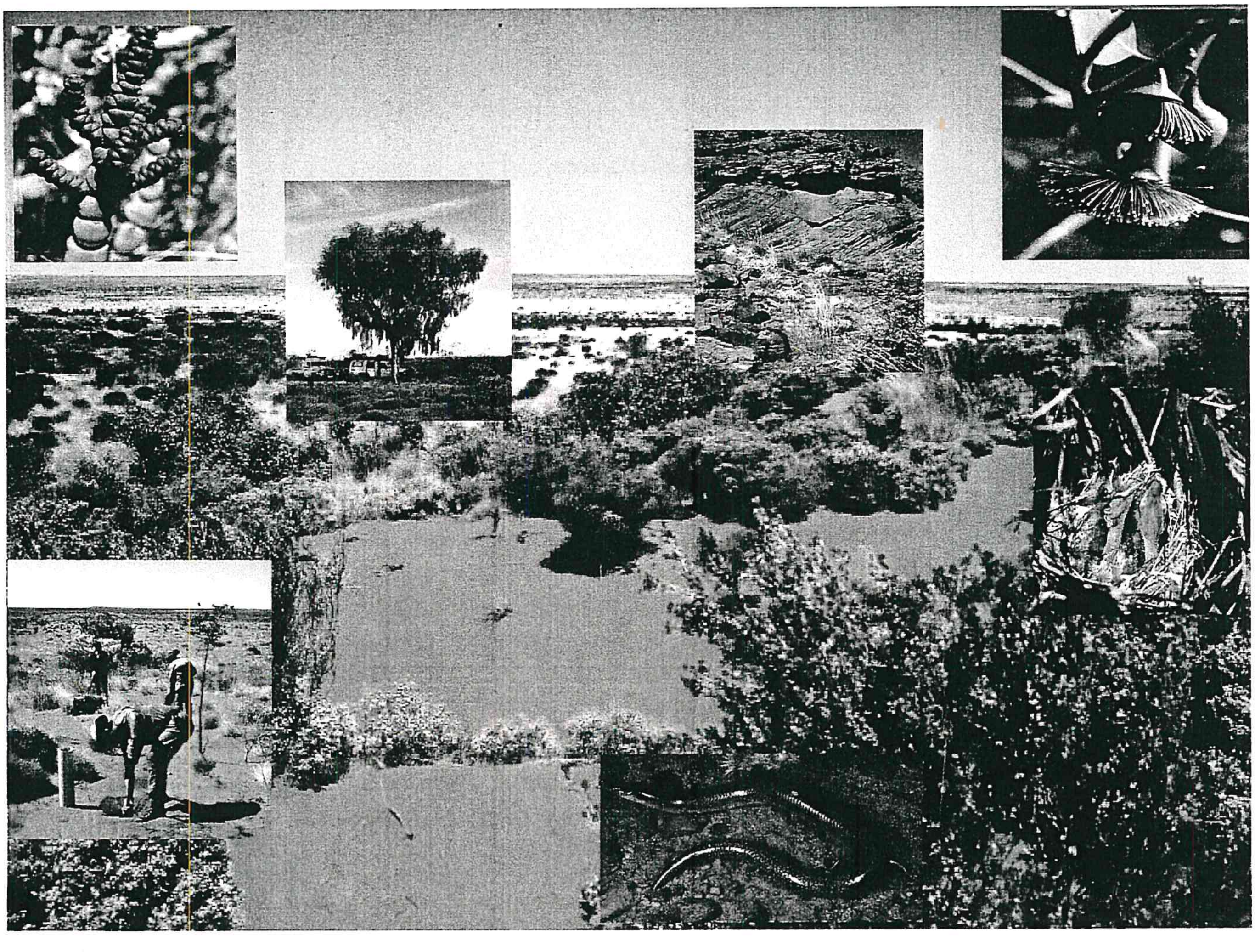

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DEPARTMENT OF Conservation AND LAND MANAGEMENT
Conserving the nature of WA