

## Abstract

The Lake Johnston-Hyden Study Area is the most diverse region documented by the biological survey of the Eastern Goldfields. It lies between 32°00' and 33°00' South and 119°00' and 121°31' East, is 20 300 km<sup>2</sup>, spans the boundary of the South-West and Eremaean Botanical Provinces represented by the Roe and Coolgardie Botanical Districts respectively, and has rainfall varying from 340 mm in the south-west to 270 mm in the north-east.

Seven of the 10 Landform Units recognised in the Eastern Goldfields occur; the more extensive being Sandplain (47%), Broad Valley (36%) and Salt Lake Feature (13%). The ore-bearing Undulating Plain (greenstone) has been a focus for mineral exploration. Granite Exposure is common on slopes where Sandplain joins Broad Valley. The prominent Peak Charles and Peak Eleanora represent Hill (granite) and are the highest points in the Study Area. Drainage Line is infrequently encountered.

Vegetation and flora were examined at 198 sites in all nine vegetation systems of the Study Area and, when broadly classified, represented 51 vegetation types. Seven unique vegetation types and a further five that were rare both within the Study Area and Eastern Goldfields were recorded. Specialised vegetation mosaics were recorded on the banded ironstone formation of Bremer Range, North Ironcap, Middle Ironcap and South Ironcap (the greenstone belt from Hatters Hill to Mt Holland), and on the granites of Peak Charles and Peak Eleanora.

The vascular flora comprised 1076 species, 17 subspecies and 29 varieties of flowering plant and six species of fern. Twenty new species, 79 rarely collected species, of which 39 were endemic to the area, and 14 major range extensions were recorded in the Study Area. Gazetted Rare Flora were *Banksia sphaero carpa* var. *dolichostyla* *Drummondita hassellii* *prostrata*.

The vertebrate fauna of the Study Area was documented from survey areas at Lake Cronin, McDermid Rock, Frank Hann National Park and Peak Charles National Park. Nine amphibian, 54 reptile, 105 bird and 28 mammal species were recorded, with the bird and amphibian assemblages being the richest recorded in the Eastern Goldfields. Bird breeding data was recorded for 22 species. All vertebrate groups indicate the biogeographic importance of the area with mesic south-western species being replaced by arid adapted congeners in the north-east of the Study Area. The elapid snake, *Denisonia atriceps* is only known from Lake Cronin.

Although the Study Area encompasses the Lake Cronin Nature Reserve, Frank Hann National Park and Peak Charles National Park, several important Landform Units and numerous vegetation types are inadequately conserved. Several changes to existing conservation areas are advocated, particularly a major extension to the existing Lake Cronin Nature Reserve so that it incorporates the entire drainage pattern of this unique freshwater lake and adjacent Landform Units and vegetation types.

## I Introduction

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The Lake Johnston-Hyden Study Area is located between 32°00' and 33°00' South and 119°00' and 121°31' East and encompasses an area in excess of

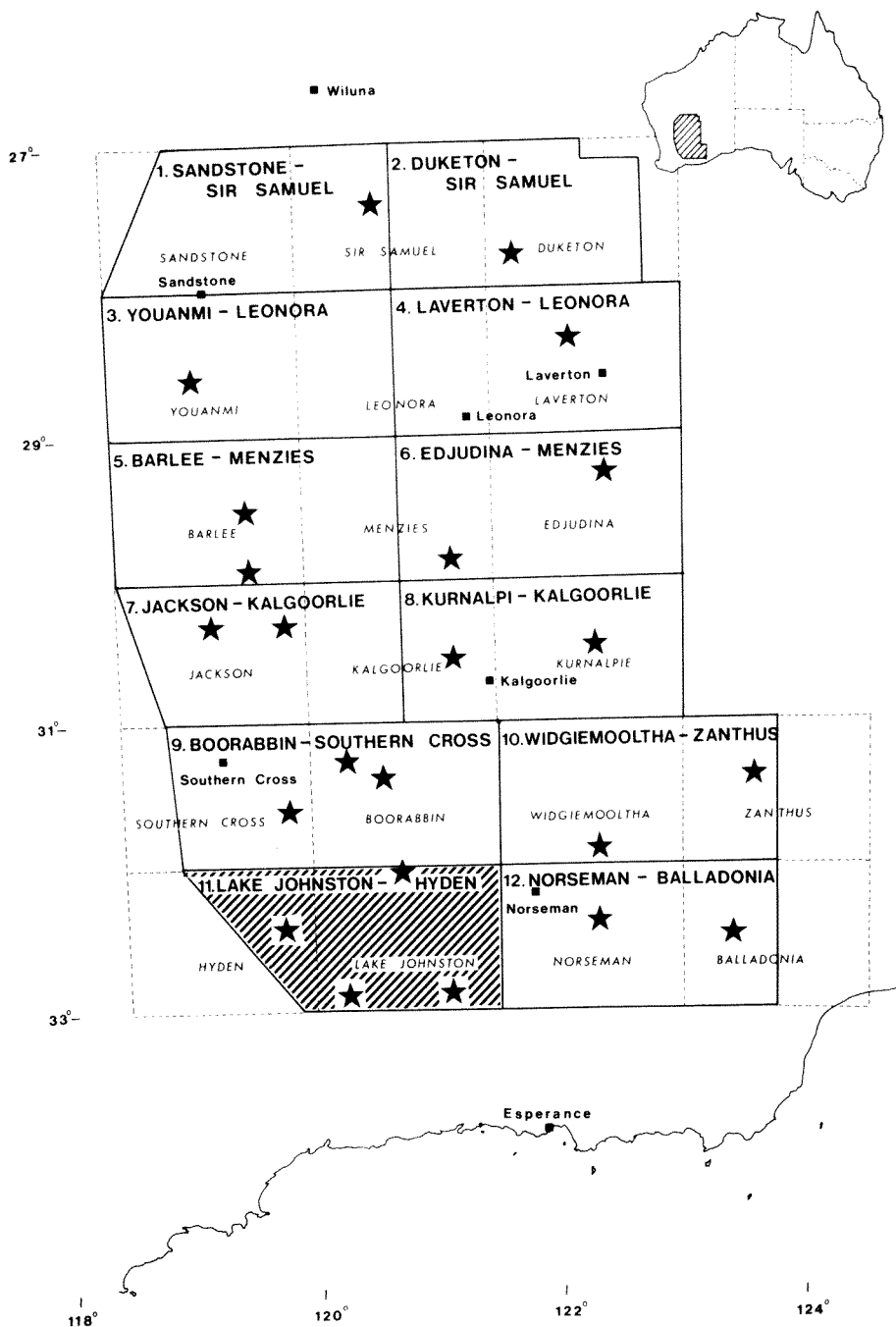


Figure 1 The extent of the Eastern Goldfields Region, the vegetation districts and the boundaries of the Study Areas included in the biological survey. The shaded portion shows the Lake Johnston-Hyden Study Area covered by this report.

20 300 km<sup>2</sup> (Figure 1). This report on the biota of the Study Area is the third covering the Eastern Goldfields region (Newbey *et al.* 1984, Dell *et al.* 1985).

The Study Area covers the entire Lake Johnston 1:250 000 national map sheet (SI/51-1) and the eastern third of the Hyden 1:250 000 sheet (SI/50-4); the No. 1 Rabbit Proof Fence forms the western boundary. The towns of Hyden and Norseman lie just to the west and east of the Study Area, respectively, and there is no permanent settlement within its boundaries.

Following recommendations by the Conservation Through Reserves Committee (1974) the Biological Surveys Committee of Western Australia undertook a survey of the Study Area as part of a major investigation of the Eastern Goldfields (Biological Surveys Committee 1984). The southern and western sections of the Lake Johnston-Hyden Study Area were investigated briefly in March 1978 and the northern and western sections in May 1978 before survey areas were selected. The major field programme was commenced in September 1978.

The Study Area is not only remote from habitation but also has limited vehicular access. Three graded roads occur: from Marvel Loch past Mt Holland to Forrestania, from Hyden to Forrestania and from Lake King to Daniell south of Norseman (Figure 2). An infrequently graded track runs from Forrestania to the Great Eastern Highway, north of Norseman, and provides access to the northern section of the Study Area. Numerous additional tracks have been constructed for mineral exploration and to assess the agricultural potential of the area. However, most tracks become impassable after even moderate falls of rain. Small patches of deep loose sand are present on many tracks.

The first European to explore within the Study Area was Lieutenant John Septimus Roe, the State's first Surveyor-General. During his journey from Albany to Russell Range in 1848-49, he recorded and named the Bremer Range and its highest peak, Mt Gordon, after the naval officer Sir Gordon Bremer, as well as the Fitzgerald Peaks, including Peak Charles (658.4 m) and Peak Eleanora (502.9 m), after Governor Charles Fitzgerald and his sister, Eleanora (Roe 1852). In 1893 John Holland pioneered a track between Broomehill and Coolgardie which traversed the north-western portion of the Study Area; most of the track is now overgrown. Holland was intent on establishing a link between the south coast and Coolgardie Goldfield (Hill 1978) but, like Roe before him, he failed to enthuse about the agricultural potential of the area. In 1901 the prospector-explorer Frank Hann traversed from south-west to north-east and in the process named a central feature of the region, Lake Johnston, after the then Surveyor-General.

The Rabbit Proof Fence, which marks the western boundary of the Study Area, was constructed in 1902-3 (Beard 1972) with the intention of halting the invasion of rabbits from the east. This it failed to do, although the fence and access track are still maintained and form a partially effective barrier to emus, kangaroos and dingoes which may move to the south and west when drought affects inland areas.

The discovery of gold in the Forrestania Greenstone Belt in 1915 led to increased prospecting activity in the western section of the Study Area but activity quickly ceased with failure to locate any significant large ore bodies. During the



1920s some of the Study Area was within the ill-fated "3500 farm scheme" for land settlement between Southern Cross and Salmon Gums. This scheme collapsed in 1929 due to the Depression and salt encroachment on land cleared near Salmon Gums, about 25 km south-east of the Study Area. When the scheme collapsed, farm blocks had been surveyed in the Forrestania-Mt Holland area and a start had been made on clearing parts of them (Teakle 1938); evidence of this clearing is still present as distinct vegetation patterns on aerial photography flown during 1972. A small area (c. 370 ha) remains under cereal crop production in the extreme south-east of the Study Area (Beard 1969).

Pastoral leases were granted in the Lake Johnston and Lake Sharpe areas. Despite the presence of extensive areas of suitable grazing country these have all been abandoned because of unreliable stock water; underground freshwater was not available and runoff from large exposures of granite bedrock proved too unreliable. The remains of a small dwelling were seen during the survey near Knapp Rock, some 9 km south of McDermid Rock, and are presumably associated with the pastoral leases taken out by J.O. Magee in 1954-55 and cancelled in 1958. Sheep were grazed in the Lake Cronin Area during the 1930s but this proved to be only a temporary enterprise (Young pers. comm.).

Mining occurred on a small scale in the vicinity of Hatters Hill in the 1930s (Hill 1978). However, the mining boom of the 1960s and 70s greatly increased activity in the Study Area. Field traverses undertaken during the survey and aerial photography have shown signs of extensive mineral exploration near Hatters Hill, South, Middle and North Ironcaps, Lake Cronin, Bremer Range-Mt Day and Bronzite Ridge; all these areas are underlain by greenstone or banded ironstone formations.

A large area in the north-east of the Study Area was leased for cutting firewood and mine timbers between 1950-1973 (Brennan pers. comm.) although little evidence of extensive cutting was seen during field traverses. Sandalwood (*Santalum spicatum*) extraction and kangaroo shooting have occurred in the past; beekeepers currently make periodic use of the low shrublands and mallees in the southern areas (Bradby pers. comm.) and the mallees and woodlands around Lake Cronin.

In 1980 the Western Australian government announced plans to release large areas of vacant Crown land for agriculture; much of the land considered for release occupied the western and southern sections of the Study Area. A moratorium (RAIC 1979) on all new land releases has now been implemented pending the outcome of recommendations made by the Agricultural Land Release Committee's working party (Anon. 1985).

The geology of the Lake Johnston area has been documented by Gower and Bunting (1976) and of the Hyden area by Chin *et al.* (1982). These publications also give a brief account of the history of geological exploration and a detailed account of the surface geology and stratigraphical sequence within the Study Area.

The history of botanical investigations in the Lake Johnston area has been outlined by Beard (1969). In this, and later studies (Beard 1972, 1980), he des-

cribed and mapped the vegetation of the Study Area and placed it in the context of major phytogeographical regions of Western Australia. The Study Area is of major biological significance in that it spans the boundary of the South-West Botanical Province and the Eremaean Botanical Province. Fire has had a major impact on vegetation types and has extensively modified the naturally occurring mosaics.

Three portions of the Study Area have been set aside as either National Parks or Nature Reserves (Figure 2). An area was set aside in December 1963, in what is now Frank Hann National Park, for the "Conservation of Flora". This was changed in May 1970 to "National Park" and vested as a C class reserve in the National Parks Authority, and with extensions in August 1973 now occupies 61 420 ha. Peak Charles National Park (39 959 ha) was created in April 1979 and also vested with the National Parks Authority as a C class reserve for "National Park and Water". In February 1980 an A class reserve of only 1016 ha was created around Lake Cronin and vested in the Western Australian Wildlife Authority for the "Conservation of Flora and Fauna". The Study Area also encompasses the very southernmost portion of the Jilbadgi Nature Reserve, an area to be considered in a subsequent report.

The botanical survey work for this study was undertaken during several short trips between July 1979 and October 1981. Traverses (Figure 2) were selected to document vegetation on most landforms identified and to evaluate the broad patterns described by Beard (1969, 1972). A vegetation and flora survey of the Frank Hann National Park has been published elsewhere (Monk *et al.* 1979).

The vertebrate fauna was documented in four areas chosen to represent the major landforms and vegetation types within the Study Area. The fauna surveys were undertaken within a 15 km radius of Lake Cronin (32°22'50"S, 119°45'30"E) and 7 km radius of McDermid Rock (32°01'15"S, 120°44'05"E) during September 1978, July 1980 and February 1981, and at Frank Hann National Park (between 32°41' to 33°01' S and 119°58'E and 120°43'E) and Peak Charles National Park (32°53'S, 112°06'E) during March 1980, November 1980 and August 1981.

This report outlines the climate and landforms of the Study Area and documents the major vegetation associations, flora and vertebrate fauna. Collections of invertebrates were made and lodged in the WA Museum.