

## Abstract

The Norseman-Balladonia Study Area is situated in the south-eastern corner of the Eastern Goldfields region of Western Australia. It lies between 32° and 33° South, and 121°30' and 123°45' East and covers an area of 23,730 km<sup>2</sup>. The Study Area spans the boundary of the South-West and Eremaean Botanical Provinces.

Seven of the Landform Units recognised in the Eastern Goldfields occur within the Study Area. The most extensive landforms are Calcareous Plains and Salt Lake Features. Granite Exposures and small Sandplain areas are scattered throughout the Study Area. Undulating Plains and Hills of both greenstone and basic granulite have restricted distributions within the Study Area. Greenstone areas are confined to the north-western corner, while the primarily basic granulite Fraser Range extends north into the adjacent Study Area. The Fraser Range is a landform unique within the Eastern Goldfields. Soils of the Study Area are dominated by Calcareous Earths with carbonate nodules present in the A and/or B horizons.

Vegetation and flora were examined at 162 sites. Forty-nine typical sites, that represent 29 broadly classified vegetation types, are presented in detail. Major transitions of vegetation communities occurred from west to east and north to south. The vegetation of the Study Area is dominated by Goldfields *Eucalyptus* woodlands and low woodlands of the South-Western Interzone. These grade into the low open *Eucalyptus oleosa* woodlands of the Eucla Basin to the east, and to the south, the mallee and *Banksia* heaths of the Roe Botanical District.

The flora of the Study Area comprised seven species of fern and 698 taxa of flowering plants. Four species of Declared Rare Flora, six priority taxa on CALM's Reserve Flora List, four undescribed species and a number of notable range extensions were recorded in the Study Area.

The vertebrate fauna of the Study Area was documented from two principal survey areas in the north-west and north-east. Three additional survey areas, in the central section and south-western and south-eastern corners, were also sampled for fauna. Fifteen native mammal species, five introduced mammals, four amphibian species, 51 reptile taxa and 97 bird species were recorded during the survey. A total of 31 (including 5 introduced) mammal species, 60 reptile taxa and 143 (including 3 introduced) bird species have now been recorded from the Study Area since the time of European settlement.

Results of the vertebrate survey are presented in tabular form. Quadrats were classified in terms of their passerine bird and small ground mammal species composition. There is some preliminary discussion on species richness of the vertebrate assemblages, the influence of stratigraphy and vegetation structure on species composition, and of sampling problems. Observations on the foraging microhabitats of six of the seven insectivorous bat species recorded are also discussed.

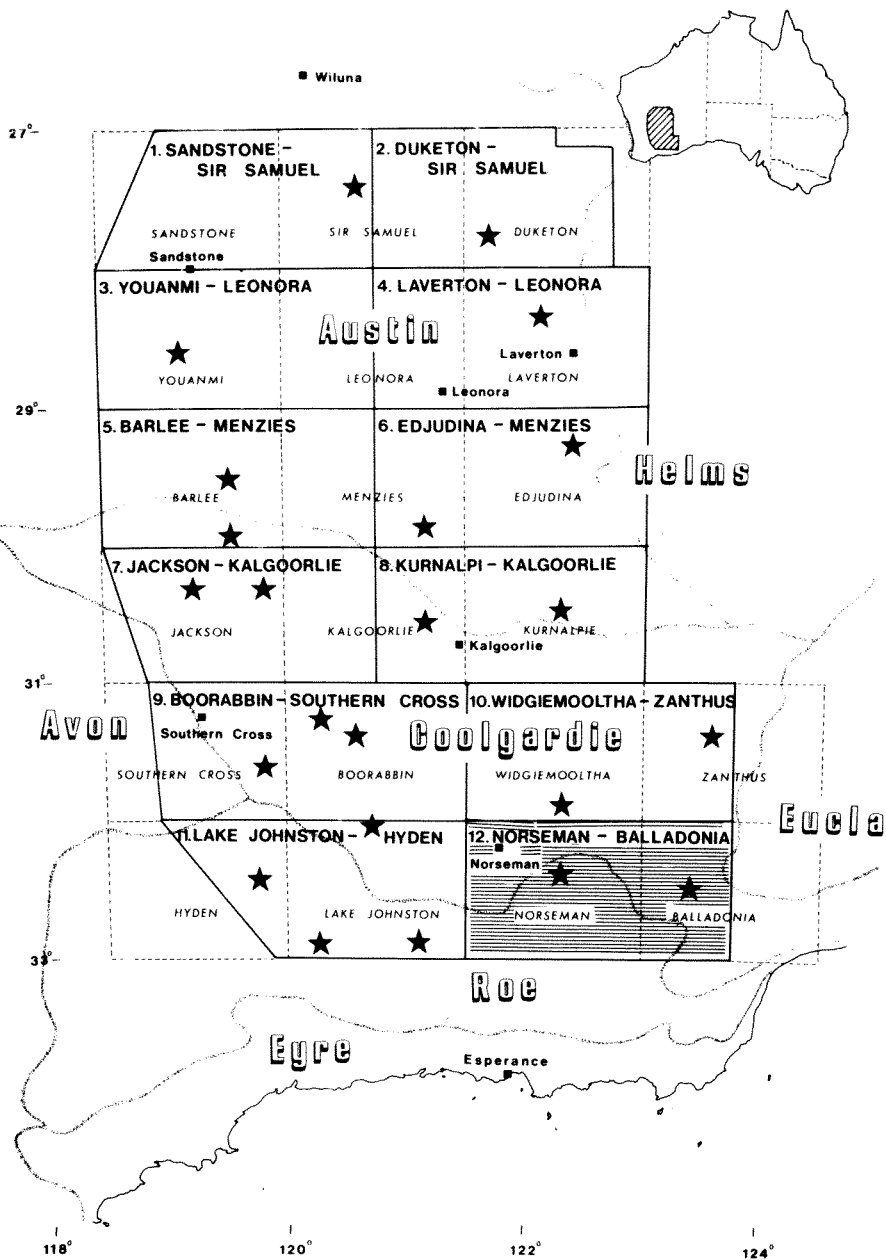
The Dundas Nature Reserve covers 33% of the Norseman-Balladonia Study Area. A number of other small conservation reserves also occur within the Study Area. The importance of the original area proposed for the Dundas reserve, incorporating the southern transitional zone, is highlighted. The Fraser Range, a poorly studied landform unit supporting distinctive vegetation communities, is not represented in any conservation reserves.

## I Introduction

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This report is the ninth in a series of biological survey reports covering the Eastern Goldfields Region (e.g. Newbey *et al.* 1984, Dell *et al.* 1985, How *et al.* 1988, Dell *et al.* 1988, Dell *et al.* 1992, How *et al.* 1992, McKenzie & Hall 1992).

The Biological Surveys Committee of Western Australia, formed in 1977, decided



**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 Norseman-Balladonia Study Area covered by this report.

that the Eastern Goldfields was the region in most urgent need of survey (Biological Surveys Committee of Western Australia 1984). The region was divided into 12 Study Areas. Herein we document the vegetation, flora and vertebrate fauna recorded during our survey of the Norseman-Balladonia Study Area.

This report aims to present data rather than focussing on regional interpretation. The data from all Study Areas will be pooled for analysis, and a quantitative synthesis of patterns in the Eastern Goldfields biota will be published later.

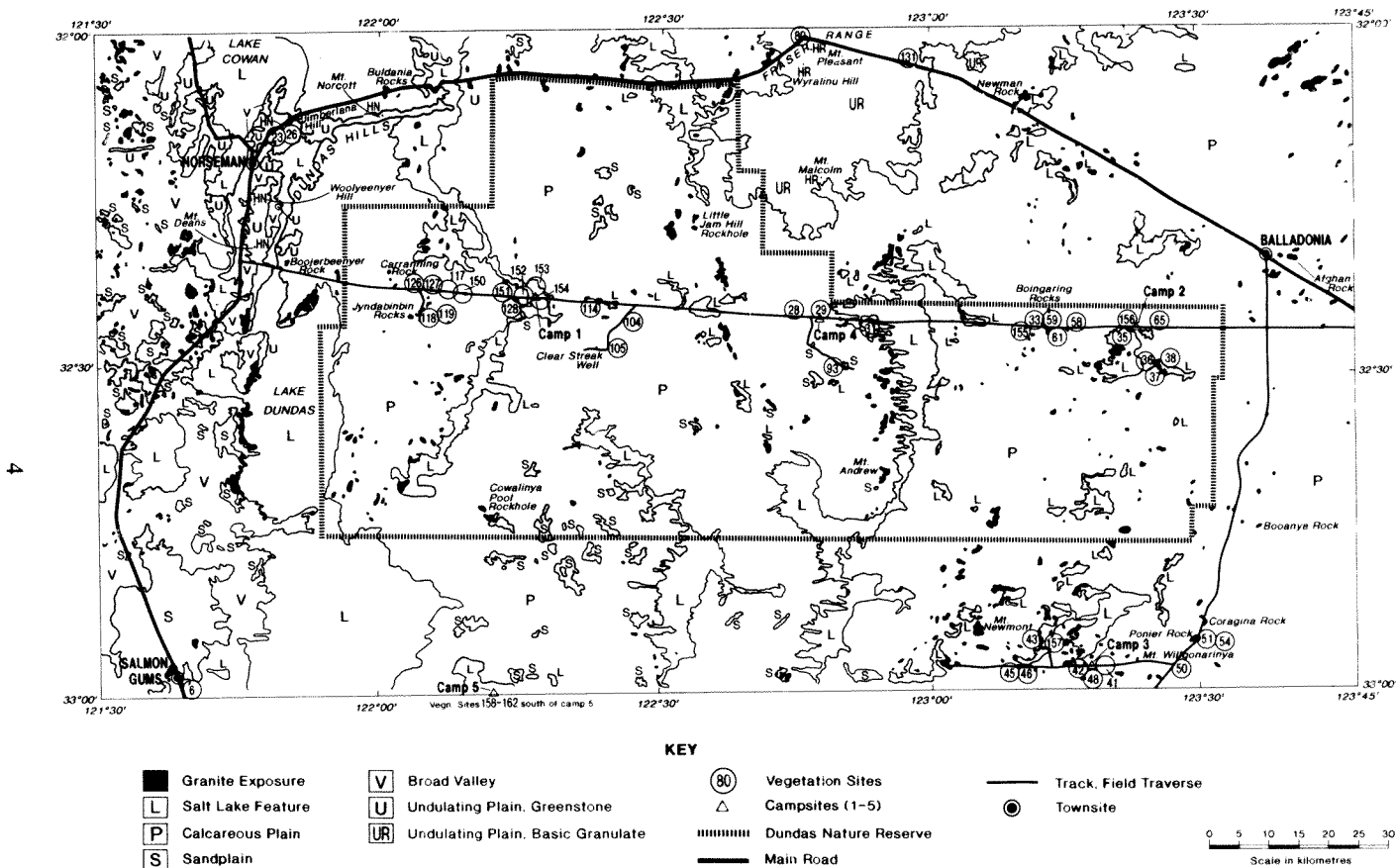
The Norseman-Balladonia Study Area (Figure 1) is a rectangle of approximately 23,730 km<sup>2</sup> that lies between 32° and 33° South, and 121°30' and 123°45' East. The Study Area is covered by two 1:250,000 geological maps: "Norseman" (Doepel 1973) and the western half of "Balladonia" (Doepel & Lowry 1970). The Study Area is situated between Norseman and Salmon Gums to the west, and Balladonia in the east.

During 1977, the Western Australian Department of Fisheries and Wildlife (now the Wildlife Research Centre, Department of Conservation and Land Management) commenced a biological survey of the proposed Dundas Nature Reserve. This followed recommendations by the Conservation Through Reserves Committee (1974). Consequently the design and methods employed in the survey of the Norseman-Balladonia Study Area (1977-80), the first in this investigation of the Eastern Goldfields region (System 11 of the Conservation Through Reserves Committee Report), differ slightly from those outlined by the Biological Surveys Committee of Western Australia (1984).

The major botanical survey work was carried out by K.R. Newbey during March, September and October 1980. Additional sampling of vegetation sites was conducted by G.J. Keighery in December 1990. Field traverses and vegetation sample sites (Figure 2) were selected to document the vegetation on the main landform units. The southern portion of the Norseman-Balladonia Study Area, except in the south-western and south-eastern corners, was not surveyed due to lack of access.

The vertebrate fauna was documented in sample sites selected to represent each of the major vegetation formations within a 15-20 km radius of the two principal survey areas: near Jyndabinbin Rocks (Campsite 1: 32°24'00"S., 122°17'30"E.) and near Boingaring Rocks (Campsite 2: 32°28'00"S., 123°23'00"E.). During each visit, five days and nights were spent sampling the sites in each survey area. Jyndabinbin Rocks Survey Area was visited during October 1977, May 1978 and November 1978. Boingaring Rocks Survey Area was visited in October 1977, May 1978 and September 1987. Three additional survey areas were each sampled during a single five-day visit: Campsite 3 (32°59'00"S., 123°18'00"E.) in the south-eastern corner (March 1978); Campsite 4 (32°26'30"S., 122°49'00"E.) in the central section (March 1978); Campsite 5 (33°01'55"S., 122°17'07"E.) on the south-west periphery (October 1978). Survey areas (Campsites 1-5) are shown on Figure 2. Vegetation sample sites and corresponding fauna site codes are listed at the beginning of Appendix I.

Beard (1975) outlines the early exploration of the Norseman-Balladonia Study Area. The earliest European explorers in the Study Area were the Dempster brothers who



**Figure 2** The main landform units of the Norseman-Balladonia Study Area. Field traverses for the vegetation study are indicated with numbers identifying the vegetation sites described.

discovered the Fraser Range in 1866. Following an expedition by John Forrest in 1870, the overland telegraph line to Adelaide was constructed from 1874-1877. In 1896, a connecting line running from Coolgardie to the Eucla relay station passed through Norseman and Balladonia.

The first pastoral station in the Study Area was established at Fraser Range in 1866. Pastoral leases at Balladonia and Nanambinia, on the fringe of the Nullarbor Plain at the eastern edge of the Study Area, were granted in 1883. A route was opened up from Esperance to Coolgardie and Norseman in 1892, after gold was discovered in the region.

Norseman, in the north-east, is the largest town within the Study Area. Smaller townsites occur in the extreme south-western corner (Salmon Gums) and just outside the eastern boundary (Balladonia). The Eyre Highway runs eastward from Norseman through Balladonia, along the northern boundary of the Study Area. A sealed highway runs down the western boundary, linking Coolgardie and Esperance via Norseman and Salmon Gums.

A graded gravel road along the eastern edge of the Study Area links Balladonia on the Eyre Highway to Esperance. Other graded roads are restricted to the agricultural areas in the south-western corner, although numerous station tracks are associated with the pastoral leases at Fraser Range, Balladonia and Nanambinia. Numerous additional tracks have been constructed for mineral exploration, particularly in the vicinity of Norseman. However, access to the majority of the Study Area is limited (see Figure 2). A number of infrequently used tracks link remote granite outcrops and rock holes such as Jyndabinbin Rocks, Cowalinya Pool, Clear Streak Well and Mt Andrew. Another track traverses the centre of the Study Area from east to west, following the route of the disused overland telegraph line.

The geology of the Study Area has been documented at a scale of 1:250,000 (Doepel 1973, Doepel & Lowry 1970). Beard (1975, 1980) has described and mapped the vegetation of the Study Area and placed it in the context of major phytogeographical regions of Western Australia. The Study Area spans the boundary of two major Botanical Provinces, the South-West and the Eremaean.

Thirty-three percent (780,883 ha.) of the Study Area (see Figure 2) has been set aside as a B Class reserve gazetted in 1981 for the Conservation of Flora and Fauna, following recommendations by the Conservation Through Reserves Committee (1974). It is known as the Dundas Nature Reserve (No. 36957).

#### References

- Beard J.S. (1975). The vegetation of the Nullarbor area. Vegetation Survey of Western Australia, 1:1 000 000 Series, sheet 4 and explanatory notes. University of Western Australia Press, Perth.
- Beard, J.S. (1980). A new phytogeographic map of Western Australia. *West. Aust. Herb. Res. Notes* 3:37-58.
- Biological Surveys Committee of Western Australia (1984). The Biological Survey of the Eastern Goldfields. Part I: Introduction and Methods. *Rec. West. Aust. Mus.* Supplement No. 18. 1-19.
- Conservation Through Reserves Committee (1974). Conservation Reserves in Western Australia (Systems 1-5,8-12). Report to the Environmental Protection Authority, Perth.

- Dell, J., How, R.A., Newbey, K.R. and Hnatiuk, R.J. (1985). The Biological Survey of the Eastern Goldfields of Western Australia. Part 3: Jackson-Kalgoorlie Study Area. *Rec. West. Aust. Mus.* Supplement No. 23.
- Dell, J., How, R.A., Milewski, A.V. and Keighery, G.J. (1988). The Biological Survey of the Eastern Goldfields of Western Australia. Part 5: Edjudina-Menzies Study Area. *Rec. West. Aust. Mus.* Supplement No. 31.
- Dell, J., How, R.A. and Milewski, A.V. (1992). The Biological Survey of the Eastern Goldfields of Western Australia. Part 6: Youanmi-Leonora Study Area. *Rec. West. Aust. Mus.* Supplement No. 40.
- Doepel, J.J.G. (1973). Norseman. Geological Survey of Western Australia 1:250,000 Geological Series Explanatory Notes (SI/51-2). Geological Survey of Western Australia, Australian Government Publishing Service, Canberra.
- Doepel, J.J.G. and Lowry, D.C. (1970). Balladonia. Geological Survey of Western Australia 1:250,000 Geological Series Explanatory Notes (SI/51-3). Geological Survey of Western Australia, Australian Government Publishing Service, Canberra.
- How, R.A., Newbey, K.R., Dell, J., Muir, B.G. and Hnatiuk, R.J. (1988). The Biological Survey of the Eastern Goldfields of Western Australia. Part 4: Lake Johnston-Hyden Study Area. *Rec. West. Aust. Mus.* Supplement No. 30.
- How, R.A., Dell, J., Milewski, A.V. and Keighery, G.J. (1992). The Biological Survey of the Eastern Goldfields of Western Australia. Part 7: Duketon-Sir Samuel Study Area. *Rec. West. Aust. Mus.* Supplement No. 40.
- McKenzie, N.L. and Hall, N.J. (Eds) (1992). The Biological Survey of the Eastern Goldfields of Western Australia. Part 8: Kurnalpi-Kalgoorlie Study Area. *Rec. West. Aust. Mus.* Supplement No. 41.
- Newbey, K.R., Dell, J., How, R.A. and Hnatiuk, R.J. (1984). The Biological Survey of the Eastern Goldfields of Western Australia. Part 2: Widgiemooltha-Zanthus Study Area. *Rec. West. Aust. Mus.* Supplement No. 18.