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Detecting areas with high levels of faunal species richness – a preliminary study

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Abstract

Synoptic overviews of hotspots in diversity of mammal, bird, reptile, termite, butterfly, and *Catasarcus* weevil species are provided for the South West Land Division of Western Australia. Except for waterbirds and butterflies, most diversity resides in the semi-arid parts of the Division.

Introduction

Mobilization of existing species occurrence data is a well-tried approach to understanding broad spatial gradients in species richness (often termed species density). Such maps have, however, tended to be produced at continental or country scales (eg: Simpson 1964; Pianka & Schall 1981, Anderson & Marcus 1992). Methods of amalgamating point source records differ between studies (Gaston 1994). Some studies impose a grid over the area of interest and record presence of each species in each cell; the total number of species per cell is then used to produce an isopleth map at a convenient contour interval.

The objective of this study is to detect any hotspots of biodiversity in WA forests, using taxonomically well known fauna. The approach favoured here is to use all available and reliable point source data to circumscribe the (original) geographical range of each species, mindful of possible discontinuities as genuine breaks in geographical range. The South West Land Division of WA (SWLD) provides the essential context for evaluating gradients in species richness in the RFA (Regional Forest Agreement) area.

On logical grounds it is important that species rich areas of State Forest are identified for consideration for inclusion in any modified reserves system. Additionally, the synthesis achieved from this study will permit, for the first time in WA forests, evaluation of whether diversity hotspots for different faunal taxa coincide. A study using butterfly, dragonfly, liverwort, aquatic plant and breeding bird species in Britain found that hotspots seldom coincided, and that most rare species do not occur in the most species-rich zones (Prendergast et al. 1993). It would, however, be premature to generalize such a conclusion to WA's forests as Gaston (1994) cites a number of studies which reveal that the number of rare species at a site does tend to correlate with overall species richness.

Methods

So far as possible existing expert knowledge, in the form of published range maps, was used.

Reptiles. Maps published in Storr *et al.* (1981, 1983, 1986, 1990).

Catasarcus weevils. Maps published in Thompson (1968).

Landbirds and waterbirds. The original range of each species, as detailed by Storr (1991), was mapped.

Butterflies. The point source locations of specimens (Dunn and Dunn 1991) were used as a basis for circumscribing the geographical range of each species. Initial maps were then checked by M. Williams, CALM's butterfly expert, and modified as necessary.

Termites. Specimen record maps published in Watson and Abbey (1993) were used and geographical ranges circumscribed.

Mammals. Specimen locations tabulated in Kitchener and Vicker (1981) were mapped. Other records since the 1840s were added; most of these came from papers published in *Records of the WA Museum*, *CALMScience* (and its predecessors), *Western Australian Naturalist* and *Wildlife Research* (and its predecessors). The dots were then circumscribed to produce a range map for each species.

All range maps were digitized. The individual species coverages were then integrated to produce a map of the South West Land Division showing the species richness gradient for each taxonomic group.

Data accuracy was accepted at face value for maps produced independently of CALM and published by experts at the WA Museum, CSIRO and the British Museum of Natural History (London).

Results

As expected, the maps produced novel information.

Most of the SWLD had 16-20 mammal species present. The mammal fauna in the southern forest was impoverished, whereas various localities in the semi-arid region had a richer fauna (Fig. 1).

Most of the SWLD had 61-75 species of land bird present (Fig. 2). The forest was particularly impoverished (46-60 species) whereas the southern semi-arid region was rich (76-90 species).

Species richness of waterbird species was greatest in the wetter portion of the SWLD (Fig. 3). This map needs to be interpreted cautiously, as waterbirds are restricted to rivers, lakes and other wetlands.

The richest reptile fauna (19-25 species) was present in the northern, semi-arid portion of the SWLD (Fig. 4). In the forest, species richness decreased with increasing latitude.

Termite species richness gradients decreased with increasing latitude (Fig. 5).

Butterfly species richness was greatest near the coast (Fig. 6), and least in the driest portion of the SWLD.

Catasarcus weevil species richness varied only from 0 to 3 species (Fig. 7), and may reflect insufficient information for much of the SWLD.

Discussion

Species richness was greatest outside the southwest forests for mammals, land birds, reptiles, termites and *Catasarcus* weevils. In contrast, waterbirds and butterflies were most diverse in a broad area of the lower southwest (including the Swan Coastal Plain). Thus, diversity hotspots coincide for some taxa and not for others.

The preliminary nature of the synthesis presented here needs emphasis. It uses best available information and cannot be regarded as definitive as the original range of many species changed once European settlement advanced (Abbott 1997), before specimens were collected comprehensively.

Acknowledgments

T. Burbidge (Science and Information Division, CALM) digitized the maps and B. Carr (Information Management Branch, CALM, later Micromine P/L) prepared the final species richness gradient maps (in colour). P. Pigott converted these to monochrome. J. Armstrong (then Director, SID) authorized expenditure for this project.

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Figure captions

- 1 Species richness gradient for native mammals in southwest WA, based on distributions prior to arrival of the fox.
- 2 Species richness gradient for native land birds in southwest WA, based on distributions prior to extensive settlement by Europeans.
- 3 Species richness gradient for native waterbirds in southwest WA, based on distributions prior to extensive settlement by Europeans.
- 4 Species richness gradient for reptiles in southwest WA.
- 5 Species richness gradient for termites in southwest WA.
- 6 Species richness gradient for butterflies in southwest WA.
- 7 Species richness gradient for *Catasarcus* weevils in southwest WA.

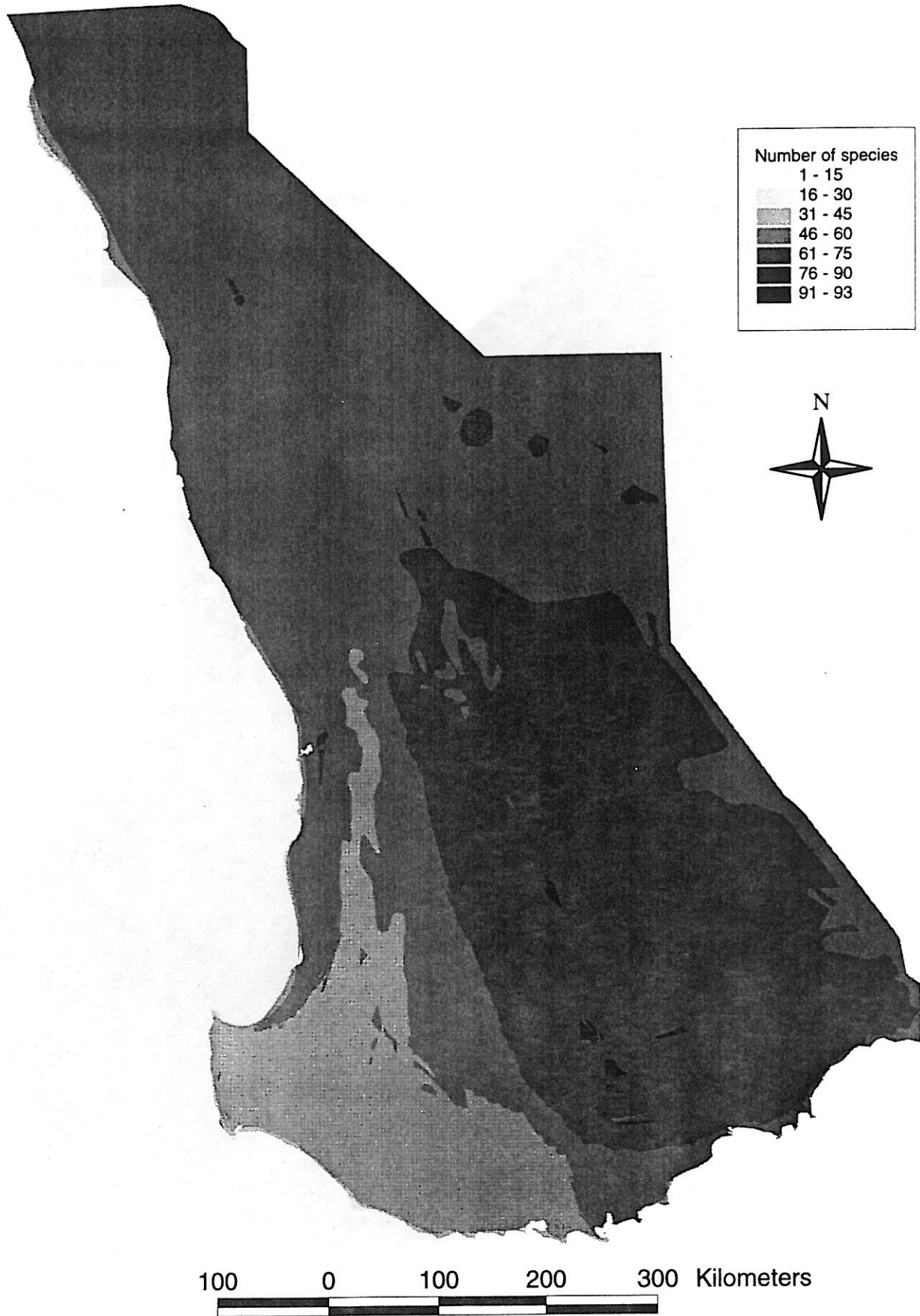
MAMMALS IN SOUTHWEST WESTERN AUSTRALIA: SPECIES RICHNESS GRADIENT



100 0 100 200 300 Kilometers

Mapped by JP Pigott, Science & Information Division CALM.
December 1997
Derived from coverages created by Micromine P/L.

LAND BIRDS IN SOUTHWEST WESTERN AUSTRALIA SPECIES RICHNESS GRADIENT

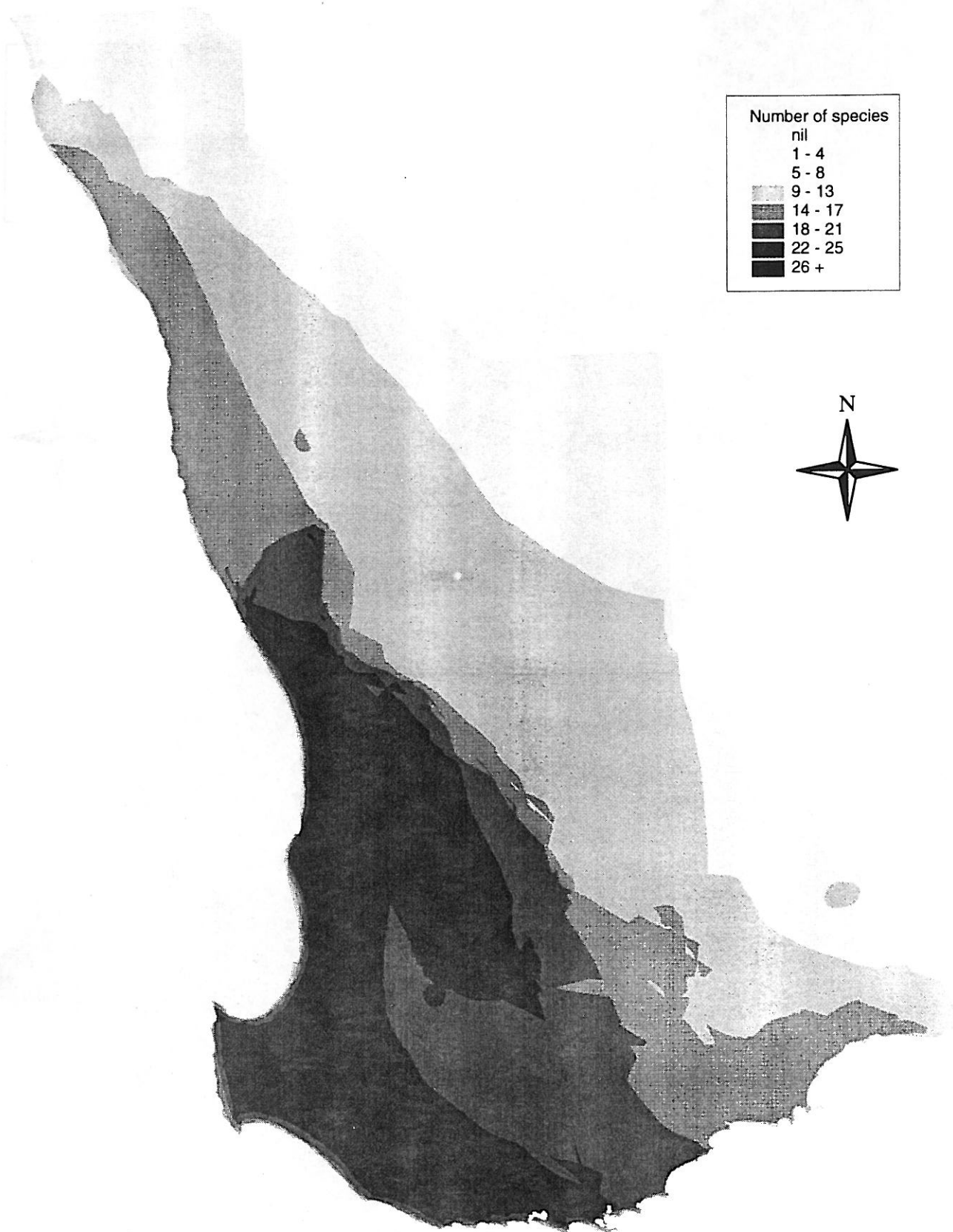


Mapped by JP Pigott, Science & Information Division CAI
December 1997

Derived from coverages created by Micromine P/L.

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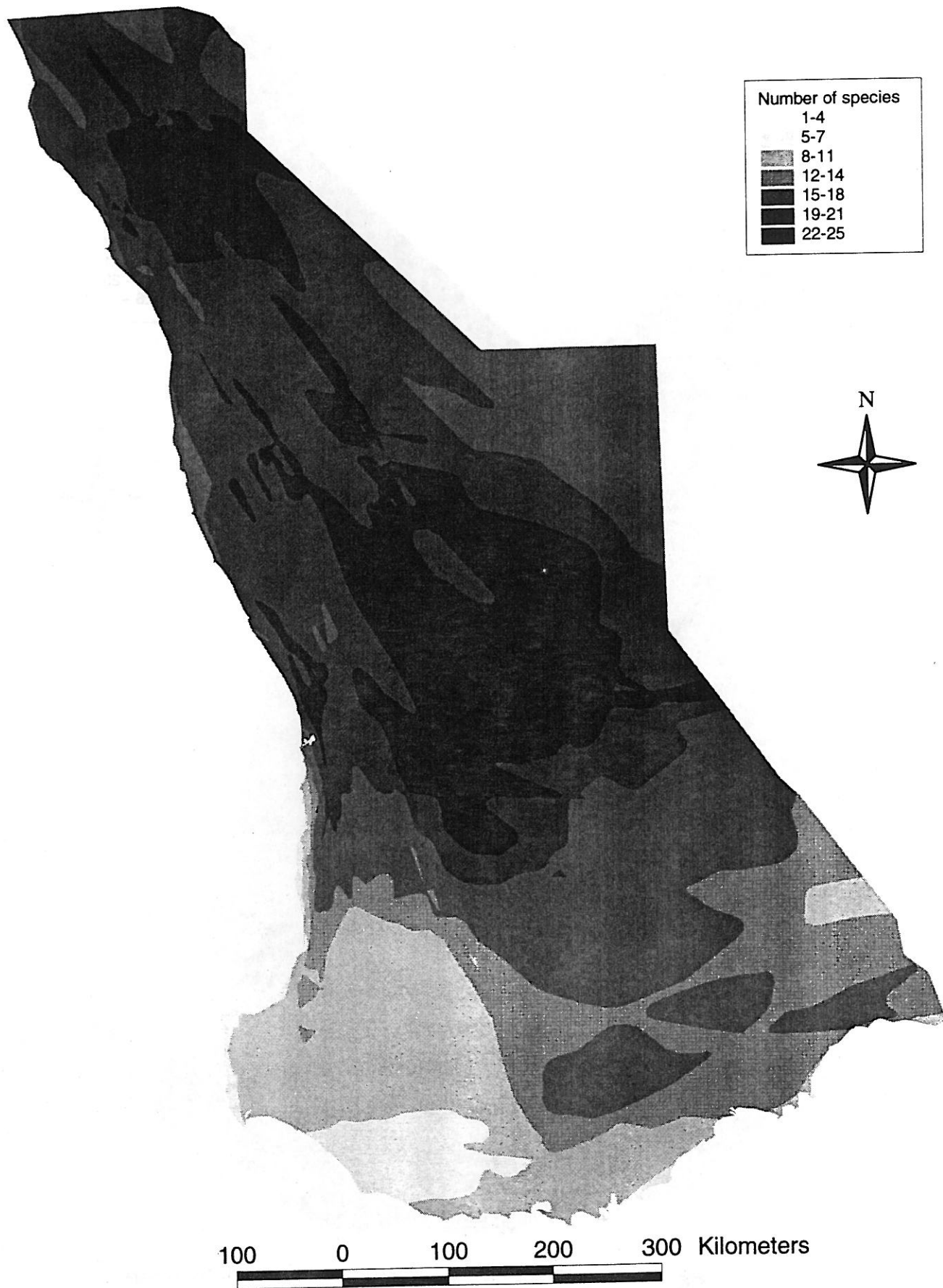
WATERBIRDS IN SOUTHWEST WESTERN AUSTRALIA: SPECIES RICHNESS GRADIENT



100 0 100 200 300 Kilometers

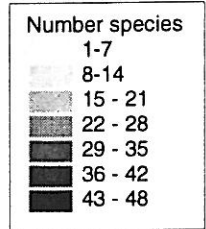
Mapped by JP Pigott, Science & Information Division CALM.
December 1997
Derived from coverages created by Micromine P/L.

REPTILES IN SOUTHWEST WESTERN AUSTRALIA: SPECIES RICHNESS GRADIENT



Mapped by JP Pigott, Science & Information Division CALM
December 1997
Derived from coverages created by Micromine P/L.

TERMITES IN SOUTHWEST WESTERN AUSTRALIA: SPECIES RICHNESS GRADIENT



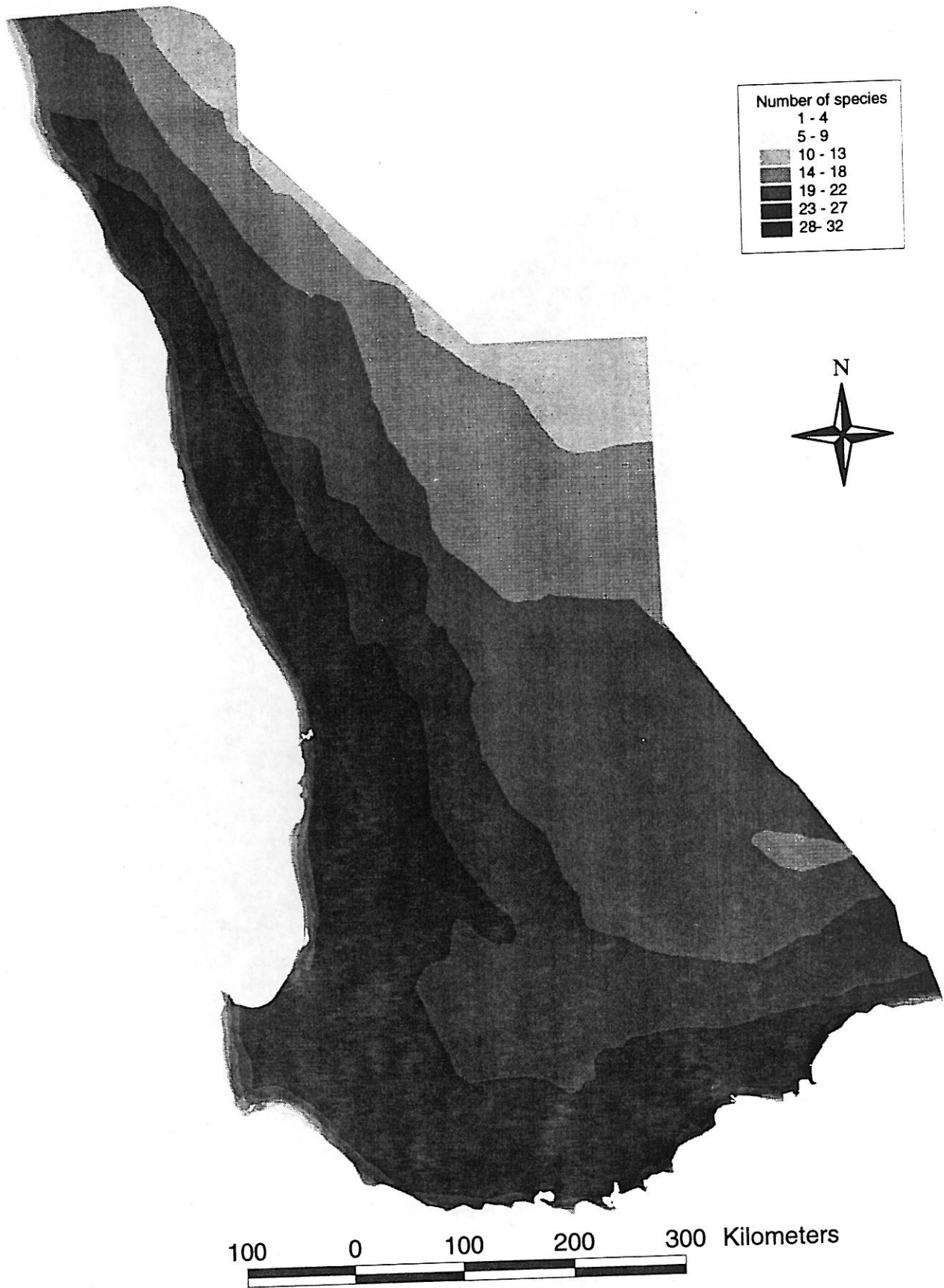
100 0 100 200 300 Kilometers



Mapped by JP Pigott, Science & Information Division CALM.
December 1997
Derived from coverages created by Micromine P/L.

ALM.

BUTTERFLIES IN SOUTHWEST WESTERN AUSTRALIA SPECIES RICHNESS GRADIENT



Mapped by JP Pigott, Science & Information Division C/
December 1997
Derived from coverages created by Micromine P/L

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CATASARCUS WEAVILS IN SOUTHWEST WESTERN AUSTRALIA: SPECIES RICHNESS GRADIENT



Mapped by JP Pigott, Science & Information Division CALM.
December 1997
Derived from coverages created by Micromine P/L.

CALM