

Australia's Biodiversity and Climate Change

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THIS volume is the result of an initiative by the Natural Resources Management Ministerial Council, to assess the vulnerability of Australia's biodiversity to climate change. It may be said at once that this remit is interpreted, not as referring to changes in "biodiversity" as usually understood — the number of species present — but rather as covering all responses of organisms and the ecosystems in which they participate to the climate changes now in progress and in prospect. This extension of "biodiversity" is clarified by the statement that "modern biodiversity conservation . . . should ensure . . . the maintenance of ecological processes and the delivery of ecosystem services".

It is not clear to what readership the book is addressed. Much of it would hardly be appreciated without a modicum of scientific knowledge — such as one hopes would be acquired in the course of completing high school (though these hopes are often dashed!). Many illustrations (of landscapes, and photogenic animals) seem to be aimed at a less sophisticated readership; but the diagrams and tables would often not be out of place in a scientific paper.

There are eight authors, all of whom presumably take collective responsibility for all the chapters; but different styles suggest that the chapters had different lead authors. There are many boxes, most with an attributed author, several taking up more than one page. Some tables also consist mainly or entirely of text, and may cover several pages. This does not make things easy for readers trying to read the text proper; they may have to search several pages for the continuation of a sentence. One wonders whether it would not have been possible to incorporate material from these tables and boxes into the text, or alternatively to segregate boxes and tables at the end of each chapter.

The English style is better than in much current scientific writing, though the regrettable strings of nouns without prepositions (requiring the reader to sort out their interrelationship for him/herself) do occur. An egregious example (with six nouns!) is "climate change impact risk reduction strategy".

There are abundant illustrations, including many maps; some of these are difficult to understand, because of the use of colours which differ only slightly, or without any key to differing colours (e.g.

Figs 2.1, 3.14). The maps of Fig. 5.7 are not identified as to location. I had to look up the reference to find that they represented a part of Litchfield National Park.

When a map or other illustration is reduced in size for publication, the needs of the reader should be considered, so that reduction does not make the illustration too difficult to appreciate (e.g. the detail of the maps in Fig. 3.1, or the lettering on Fig. 3.2). Redrawing of diagrams or maps at the new scale might have been worth while.

Some illustrations are reproduced without adequate attribution. Figs. 2.1 and 2.2, for instance, come from "Department of the Environment, Water, Heritage and the Arts" without further detail.

The volume reflects the common preoccupation with larger animals and plants; there is little mention of invertebrates, fungi, microscopic algae or other microorganisms, species of which may be considerably more numerous than those of mammal birds or vascular plants. Besides making large but often unrecognized contributions to biodiversity, these neglected groups often also play important parts in the stability (or changes) of ecosystems. In considering the effects of climate change, we shall ignore them at our peril.

Chapters 2 and 3 give an account of Australia's biological patrimony. Here, inevitably perhaps, "biodiversity" drifts back to its earlier and more standard meaning — the range of species present. This is particularly true of the account of south-western Western Australia (p. 55) where this customary more limited interpretation of biodiversity is used, the likely loss of rare species to climate change is regarded tragically. Unfortunately such losses are probably inevitable. What is important is to maintain ecosystem services despite changes in species composition — adaptive management should be the watchword, rather than risk aversion.

The effects of climate change (already in progress!) on Australia's biota and ecosystems are well covered. At times, though, the volume goes outside its remit, including effects which are ascribable more directly to people rather than to human effects in causing climate change. Extinctions, for instance, are probably not yet due to climate change, though this may occur before the end of the century. On the other hand, in Box 3.5, David Lindenmayer reports a **positive** correlation between human density and species richness, yet goes on to warn of a risk of loss of biodiversity with population expansion. The species which are favoured by human populations are not those at risk of extinction. Both are included in "biodiversity". Will biodiversity in total suffer from increased human population?

The treatment of climate change in Chapter 4 is good and very convincing (where conviction may be needed). There is emphasis on the unprecedented **rate** of rise in temperatures observed in recent years.

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This chapter might well be recommended to such climate sceptics as still exist.

Most discussion of the possible effects of climate change on biota is in relation to terrestrial environments; admittedly oceanic environments are shared by Australia with the rest of the world at large, and so hardly fall within the range of the volume's title. This is not true of coral reefs, and these are given full attention — for instance, in Box 5.5. One would have welcomed an explanation of “coral bleaching”, though. In the same chapter, Tables 5.3 and 5.4 present good summaries of the threats to Australia's biological heritage posed by climate change — Table 5.3 covering the vulnerability of particular taxa, and Table 5.4 likely effects on whole ecosystems, including those of Australia's marine surroundings.

Chapter 5 has interesting comparisons of Australia with other continents in respect of the vulnerability of ecosystems to climate change; Australia's lack of topographic variety means that there is little scope for ecosystems to migrate, and that responses in phenology may be of greater importance.

The importance of connectivity in landscapes in permitting ecosystems to adapt to climate change is emphasized. But connectivity is something which has diminished greatly in Australia in historical times. It has always been lacking for freshwater systems; but in terrestrial environments it is often a new challenge for endangered ecosystems.

Chapters 6 and 7, which deal with responses to expected climate changes, are worthy of special attention. There is emphasis on the need to move away from preserving existing species combinations in existing ecosystems. One must recognize that ecosystems may move with the climate, while changing in their species composition as they do so, and facilitate this process. It is the maintenance of ecosystem integrity under change which is important.

A noteworthy feature of the climate changes we are confronting is their speed. Within the life-time of a tree, the climate conditions around it may have changed beyond recognition. It is not enough for a species, or an ecosystem, to be well adapted to the current conditions — they need to be adapted to the conditions which are to be expected decades or centuries hence. Without this prescient adaptation, there is no knowing which biota may succeed or fail. The text emphasises the fact that the environment in Australia, like the rest of the world, is moving rapidly into uncharted territory, and that the future may contain irreducible uncertainties. These considerations point to the need for environmental management to be highly flexible — able to adjust constantly as the ecosystems in question change, and as their future becomes, step by step, clearer.

The volume also considers governance structures within which the flexible policies needed to deal with the unpredictable changes facing us may be developed. This is admittedly shaky ground, and the approach taken by the volume is admittedly tentative. A creditable attempt, though! The electoral cycle, which controls government action, sets a window of foresight one or two orders of magnitude shorter than that required by ecological events. In con-

sequence, it is difficult to get politicians to take ecological problems seriously. Oh! For a long-sighted outlook!

The volume is completed with a glossary, a bibliography, an index and a (very welcome!) list of acronyms. The index is, however, rather inadequate; a few tests showed the absence of desirable entries, and it appears that the indexer concentrated on the text only — figures, tables and boxes seem largely to have been ignored. There is inadequate subdivision of entries — more than five page references for an entry are too many for the reader to search unaided, and a good many exceed ten!