

## Book review

### Fire in Ecosystems of South-west Western Australia: Impacts and Management

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This book comprehensively explores fire in ecosystems of south-western Western Australia. There are 22 substantial chapters and 40 authors. The book is based on papers presented to a scientific conference held in April 2000 and attended by 350 people, reflecting an outstanding level of both scientific and public interest in fire and its management in Western Australia.

The south-west of Western Australia is one of 25 recently recognised 'global biodiversity hotspots', with a rich flora of some 8000 species of which 75% are endemic. Why is this so? This is a region which has been free of major landscape perturbations for 250 million years. However, there has been continuing change in the biota, associated with continental drift (declining soil fertility and a drying climate), glacial and interglacial climatic phases, recurrent fires of unknown intensity and frequency, and — for the past 50 000 y — burning by Aboriginal people. This begs two questions: (i) what role has fire played in the rich speciation within the region, the evolution of plant and animal attributes, and the functioning of ecosystems; and (ii) how should fire be used in the continuing management of these ecosystems?

The book addresses a wide range of relevant themes including: the evolution of landscapes; the effect of fire on species diversity; the fire history of the region before and after European settlement; scientific understanding of fire behaviour and fire management; relationships between fire and soil fertility; fire, plant and ecosystem interactions; and the effect of fire on terrestrial invertebrates, birds, frogs, reptiles and mammals. The concluding chapter provides a concise synthesis of our current understanding of these themes, the implications for management, and new research directions.

It is impossible to draw attention to all the themes developed in the book, but a few examples may give something of the flavour of the work.

**Fire frequency:** Analysis of charcoal deposits suggests a long history of lightning fires in the south-west of WA, perhaps since the onset of aridity 35 million years ago. Following Aboriginal occupation there were 2 to 4 fires per decade in those areas used as food resources. Fire frequency declined following European settlement — to once each 5–7 y, and, in the past 20 y, to once each 15 y.

**The evolutionary role of fire:** Does the observed response of plants to fire represent a primary adaptation of those plants to

historical fires, as claimed, and can the high level of speciation be attributed to fire? While there are many who would endorse these propositions, others advocate caution with such reasoning. There are numerous evolutionary pressures that can be invoked to interpret the attributes of the native vegetation. For example, many of the attributes of plants conferring fire tolerance may also be seen as evolutionary responses to declining soil fertility, a drying climate and herbivory. It would be useful to explore this theme in greater depth — it must underpin, at the most basic level, the way we address questions of fire management.

**Plants, ecosystems and fire:** To what extent has fire affected individual plants and plant communities? Site factors are accepted as more important than fire in determining floristic composition: that is, much of the diversity of vegetation can be attributed to natural variation in soils and topography. Nevertheless, as a superimposed factor, fire diversity promotes biodiversity at both landscape and local levels: patterns of post-fire succession can be varied and complex. While we might accept this observation, it will be no simple task to use fire to conserve this biological complexity. No fire regime is optimum for all plant species. Species and communities vary in their adaptation to, and reliance on, fire. Some species are rare without fire, others are rare if there *is* fire; and the effects of any particular intensity and frequency of fire are likely to vary significantly among the ecosystems of the region.

**Fire and fauna:** Fire is also an integral part of the habitat ecology of terrestrial mammals. While their responses to fire differ greatly, these mammals display attributes enabling them to persist in a fire-prone environment. For example, there is a linkage between fauna and vegetation succession following fire, as mammals respond to successional cues (cover, structure, floristics). It may not be so much a question of whether fire is used as a tool for conserving the regional fauna, but rather of how to use fire to help maintain critical elements of habitat for the full range of native animals.

**Fire management:** There is broad acceptance that fire has a vital place in the continuing management of ecosystems in the south-west of WA, and that use of fire for biodiversity conservation should be planned at a range of scales — bioregional, landscape, and individual ecosystem. It will be necessary to determine, for each scale, ecologically-based fire regimes, using all available knowledge (fire history, vital attributes of flora and fauna, and so on). The approach must be both precautionary and adaptive.

The south-west of WA is an ideal region within which to come to grips with the role fire has played in the evolution of species, species attributes and ecosystems, and the role it might play in the continuing management of those ecosystems. This book goes a long way in establishing fire management as an essential part of conservation and land management. However, this is only the beginning. There are serious challenges ahead, including the formulation of a great array of fire regimes needed to manage the great diversity of ecosystems, continuing monitoring and adaptive management of ecosystems, and appropriate responses to impacts of climatic change.

This book is an important contribution to vegetation management in Australia, and indeed in any other countries where there is scientific and public debate about the role of fire in ecosystem management. It is highly commended to anyone with an interest in managing and conserving the natural environment in all its complexity.

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