

# A test of our civilisation: conserving Australia's forest fauna across a cultural landscape

Daniel Lunney

Department of Environment and Conservation (NSW)

PO Box 1967 Hurstville NSW 2220 Australia

dan.lunney@npws.nsw.gov.au

## ABSTRACT

Most people in Australia live in areas that were forested in 1788. Much of it is now a cultural landscape, and it may be hard to see it as habitat for forest fauna. The challenge of managing Australia's forest fauna across this cultural landscape will be a major test of our civilisation. The *National Forest Policy Statement* (Commonwealth of Australia 1992) opens with the statement: "The Governments share a vision of ecologically sustainable management of Australia's forests". The *Policy Statement* launched the Regional Forest Agreement (RFA) process, with its emphasis on public forests, and the private forests consequently become the forgotten forests, even though all of it is habitat for forest fauna. One of the successes of the RFA process has been the development of reserve selection procedures. Yet, as necessary as the new reserves are to conserve forest fauna, they are not sufficient to conserve that fauna into the future. Another success is *Australia's State of the Forests Report 2003*, and although it contains much valuable information, such as that 70% of Australia's native forest is privately managed, it is far too brief on the matter of forest fauna. The guidance for Australia provided by the British forest historian Oliver Rackham is to see each forest as a unique entity, with its own history, including its pre-European history, and each deserving of special study. If Rackham is right in describing Australia as a miniature planet, then we cannot go elsewhere and start again if we fritter away this opportunity, an ethic that lies behind the diverse chapters in this book. The World Commission on Forests and Sustainable Development noted that forests contain at least two-thirds of the earth's terrestrial species. This second edition of the *Conservation of Australia's Forest Fauna* focuses on Australia's rich share of that international heritage and seeks to conserve forest fauna, wherever it occurs on the landscape, as part of a larger enterprise of conserving Australia's natural legacy.

**Key words:** forest fauna, reserve selection, forest history, Regional Forest Agreements, threatened species, national parks, *National Forest Policy Statement*, ecologically sustainable forest management (ESFM).

## Cultural vegetation

Kirkpatrick's (1994) little gem of a book, *A Continent Transformed. Human Impact on the Natural Vegetation of Australia*, has many qualities, one of these being that it fits into the back pocket of a pair of jeans so you can take it to a rugby match or Australian rules game as a patient parent seeking something to read during the warm-up sessions. Among the virtues of such tough sports are the ritualistic release of aggression, the spirit of team play and the agreement to abide by the rules. All this is good training for a social existence in a crowded human world. However, the appearance of the sporting field takes on a new dimension after Kirkpatrick's whimsical lament: "The successes of the pioneering drive against the bush were celebrated in the lavish construction of cities with gardens derivative of Europe and bereft of reminders of an alien land". The sporting field is just such a celebration. It is what Kirkpatrick calls "cultural vegetation". At each sporting field there is usually a plaque stating the name of the person to whom the field was dedicated, generally someone of authority in the recent past. Any indication of the people, flora and fauna that once occupied the site is missing.

The new disciplines of ecological history, environmental history, forest history, or the better-established historical geography and archaeology, have the potential to remedy this cultural blind spot and contribute to current policy debates on sustainability (e.g. Dargavel *et al.* 2002; Dovers 2000a,b; Griffiths 2001). The chapters by English (2004) and Legg (2004) show how this is being done by describing the depth of investigation necessary to catch a glimpse of forest fauna long after the footprints have gone, and the difficulty of seeing the world through other eyes, especially a human world that has all but vanished. Much of our forest fauna is now found in a strange new setting that is being managed under different rules, such as those for urban wildlife (Lunney and Burgin 2004) or for farm wildlife (Lindenmayer *et al.* 2003) or, more usually, as a matrix of habitats (Lindenmayer and Franklin 2002). One forest and woodland species, the Squirrel Glider *Petaurus norfolcensis*, features as an animal of urban Brisbane (Goldingay and Sharpe 2004) and as an endangered population on cleared farmland in NSW (Claridge and van der Ree 2004). This is a species of forest fauna being managed in a non-forest

environment as far as land-use designation is concerned, but more pragmatically as a species in a hostile matrix of fragmented forest/woodland, an existence recognised by Rowston and Catterall (2004) in their study in south-eastern Queensland.

Another cultural vegetation pattern has been formed by the forests that have been the subject of the intensive Regional Forest Agreements (RFA) process (National Forest Inventory Report 2003). It includes the public forests in Crown ownership, and it is their use, such as logging or nature conservation, that was at the heart of a major conservation/development tug-of-war through the 1990s, a process that has yet to run its course. Further, as Dargavel (1998) concluded, the RFA does not signify the end of the history of Australian forests, nor of contests over their rightful use. Yet these extant forests are largely biased remnants, predominantly on the steeper, least fertile soils, and so they do not carry the only habitats, or even the best habitats, of forest fauna (e.g. Braithwaite 2004; Flint *et al.* 2004; Newell and Goldingay 2004; Norman *et al.* 2004; Pressey *et al.* 1996, 2002). Even if every issue of land use, whether logging, fire or fauna management, were resolved on these Crown lands, which they are not (e.g. Calver and Wardell-Johnson 2004; Garkaklis *et al.* 2004; Green *et al.* 2004; Law 2004; Lindenmayer and Gibbons 2004; Meek 2004; Penna 2004; Smith 2004; Vanderwoude and Johnson 2004; York and Tarnawski 2004), then the matter of conserving forest fauna across the landscape would remain. The reason is that the forest fauna lived in, and therefore could be restored to, the entirety of the landscape that was forested in 1788 when European settlement began its drastic alteration for agriculture, timber-getting and the growth of towns. In eastern NSW, for example, it was in the rich, coastal valley country that was settled, cleared and farmed in the 19<sup>th</sup> century that the fauna became diminished long before it arose as a subject for conservation (Knott *et al.* 1998; Lunney and Leary 1988; Lunney and Matthews 2002; Lunney and Moon 1997; Stubbs and Specht 2002), with Reed (1991) calculating the loss of forest and woodland in NSW to be over 50%. Consequently, this book is organized around the forest fauna of Australia, and not the extant forests. Some of the fauna is totally dependent on forests, while others survive across various levels of disturbance or loss of forest, as well as in other vegetation types (Craig 2004; Goosem 2004; Kavanagh *et al.* 2004; Loyn 2004; Lunney and Matthews 2004; Newell and Goldingay 2004).

### **Landscape is an aesthetic category, and not a real thing**

According to Mabey (1994), landscape is an old idea but it is a comparatively new word. The term, he explains, comes from the Dutch *landschap*, meaning region or province. It entered the English language in the 17<sup>th</sup> century as a piece of fashionable artistic jargon, and what is barely conceived of, says Mabey, is a landscape fashioned by people, nature and weather. Thus, he concludes, landscape is “not a real thing at all but an aesthetic category”. As a nature writer of great insight, Mabey has helped explain why the concept is so new in conservation biology. He also asked the question: can a

whole landscape be defined by something as inherently mortal as a single tree species? You might think so, he answered, if you lived in the Chilterns. He grew up among vast beech plantations and shared the widespread local sadness when they died of drought or disease, or were munched by grey squirrels or blown over in gales. Across Australia, one genus *Eucalyptus* and its closely related taxa evoke the same response. Witness the battleground over one eucalypt, jarrah *Eucalyptus marginata*, in Western Australia in the suite of chapters from that state (Abbott and Burrows 2004; Brennan and Majer 2004; Calver and Wardell-Johnson 2004; Craig 2004; Garkaklis *et al.* 2004; Rhind 2004; Strehlow *et al.* 2004; Wardell-Johnson *et al.* 2004; Whitford and Stoneman 2004). Let us turn Mabey’s observation to another landscape element, fauna.

If we let a forest-dwelling species, or suite of species, define a landscape, we can arrive at a different way of conserving our forest fauna. Among the cultural obstacles we face are tenure boundaries between private and publicly owned land in a rural landscape combined with a pattern of economic growth that manifests itself as simplified habitats, such as woodchipped forests (e.g. Lindenmayer and Gibbons 2004; Penna 2004), or more drastic changes such as land cleared for crops or stock (e.g. Paton *et al.* 2004; Woinarski 2004), or linear barriers such as roads (e.g. Goosem 2004). However, those forest species now in need of conservation had established patterns of land use long before such cultural barriers were constructed. When those land-use patterns clash, we have a conservation problem. Only those species with preferred habitats on the least fertile ground, (that is, on land not touched by agriculture), are at all secure. If such species are mobile, and can readily cross altered habitats to reach new patches, we may be witnessing the emergence of species “pre-adapted” to modern Australia. A few native species have increased in numbers in altered habitats but, ironically, they are called pests. Further, if you propose utilizing them as the best animals to occupy the land in question, and, for example, you advocate eating kangaroos and support a commercial operation based on their products, you are attacked for being hostile to our wildlife (Archer 2002; Archer and Beale 2004; Grigg 2002). Philosophically, there is much to be debated if we are to manage both our forests and our fauna ecologically with a long-term vision, a point not lost on the many authors in this edition (e.g. Kitching 2004; Leary and Mamu 2004; Martin and Martin 2004; Parnaby and Hamilton-Smith 2004; Recher 2004).

### **The signature of Australia is its distinctive trees**

The signature of Australia is its distinctive trees (Seddon 1997). The signature tree for most of Australia’s forest fauna is the eucalypt (e.g. Williams and Woinarski 1997), although a small but vital element of Australia’s forest estate is rainforest and its fauna (Burnett and Marsh 2004; Catterall *et al.* 2004; Coughlan and Pearson 2004; Goosem 2004; Moran *et al.* 2004; Stanistic and Ponder 2004; Winter 2004). There are even smaller elements of Australia’s forest estate, such as the peppermint trees *Agonis flexuosa* with their Western Ringtail Possums *Pseudocheirus occidentalis* (Jones *et al.* 2004). Some of these

vegetation types are in reserves, and there is a concerted national policy to select a Comprehensive, Adequate and Representative (CAR) reserve system for all these vegetation types, backed by a sustained research agenda (ANZECC/BDAC 2001). Whatever proportion of the forested vegetation types are included in reserves, there will always be individual trees, strips, stands and tracts of these forest types in non-reserved lands. In fact, *Australia's State of the Forests Report 2003* (National Forest Inventory 2003) records that 70% of Australia's native forest is privately managed. All of it is habitat for forest fauna.

The sum of the distinctive characteristics of a given area, whether natural or human-made, can be called a "landscape" according to Seddon (1997). He employs the term "landprints" as being the marks left on the surface of the earth by its inhabitants, many of them by our species. Although they have a physical substrate, landscapes are also a cultural construct. The ways in which we read them, talk about them, perceive them, work over them, use them, evaluate them functionally, aesthetically and morally are, Seddon says, all informed by our culture. Lindenmayer and Franklin (2002) have complemented this view in their book *Conserving Forest Biodiversity: a comprehensive multiscaled approach*. They firmly assert in their preface that management practices on unreserved lands, such as those not in national parks or nature reserves, will largely determine how successful human society is at conserving forest biodiversity. These unreserved areas they call the "matrix" which, as they point out, includes most of the productive and diverse lands. Reflecting on a lifetime of research, Braithwaite (2004) has also arrived at this conclusion. His emphasis is on conserving the fauna on the fertile lands, which are mostly privately owned. This is the fauna that is, in his view, in peril. Yet, while there is a sharp focus on logging and threatened species in state forests under the Integrated Forest Operations Approval process (e.g. Green *et al.* 2004; Kavanagh *et al.* 2004; Law 2004; Lemckert and Slatyer 2004; Meek 2004; National Forest Inventory Report 2003), the private native forests have become the forgotten forests (Prest 2004). If one accepts the principle in Lindenmayer and Franklin (2002), then the struggle to conserve forest fauna across the matrix of the Australian landscape is far from being achieved (e.g. Moran *et al.* 2004; Munks *et al.* 2004; Paton *et al.* 2004; Recher 2004; Woinarski 2004). The cultural context has yet to be fully comprehended, although what has been grasped further stimulates our imagination (e.g. Curtin 2004; English 2004; Kitching 2004; Leary and Mamu 2004; Legg 2004; Parnaby and Hamilton-Smith 2004; Shields 2004).

As Seddon (1997) grimly remarked, "the cadastral survey, that rectilinear grid imposed at various scales on an entire continent by the geometers of a remote imperial power in the nineteenth century, squaring off this old, irregular landscape to impose an order convenient to an authoritarian colonial administration" is a major cultural force in Australia. Forest fauna, its identity, management and conservation, is caught up in that force. I believe that a new approach to conserving the forest fauna of Australia is possible and I propose that forest fauna can be

used to help define the Australian landscape. Is this going to be easy? Read the plea by Claridge and van der Ree (2004) for an intelligent application of the meaning of an endangered population in their research and management of the Squirrel Glider for a glimpse of the trials ahead. Routley and Routley (1973) saw the fight for the forests largely as a battle with intensive forestry operations and state forest services. In 30 years the struggle to conserve our forest fauna has begun to spread across all tenures. The alternative of working on private lands gains articulate advocates in the chapters by Braithwaite (2004) and Martin and Martin (2004). The scope for expansion is considerable and a new approach – ecosystems services – is being pioneered in Australia by the CSIRO (2004). This is a collaborative natural resource management project to investigate what services people obtain from their environments, the economic and social values inherent in these services (which are currently in decline), and the opportunities that can arise from considering them in land management policies. While the battle lines of tenure, and thus the proprietary use of resources, have been along class divisions in our society, part of the struggle is to see to what extent our English past is dictating our Australian future (Legg 2004).

### Tree rabbits: an aesthetic contest between space and species

Bonyhady (2000) is a critic of Flannery's *The Future Eaters* (Flannery 1994) in that he rejects Flannery's claim that 19<sup>th</sup> century settlers showed no concern at all about the wastage of timber because they were confident about the abundance of Australia's forests. Bonyhady concluded that, while some colonists were alienated by their new environment, others delighted in it. The standard test, says Bonyhady, is the settlers' response to the gum tree (a common name for any eucalypt species), noting that many members of the First Fleet lauded the gum tree for its distinctiveness. Bonyhady's thesis is a subtle one. He concluded that the destructiveness of colonial society cannot be explained as the work of invaders antagonistic to their new landscape and blind to its limits. He argues that there is a rich history of environmental concern and that an environmental aesthetic is deeply embedded in Australian culture. However, this environmental aesthetic, Bonyhady notes, is matched by our resistance to putting environmental ideals into practice. What is clear is that this intellectual enquiry has only just begun, and primary sources will be crucial. Bonyhady makes wonderful use of colonial art, and draws much from an erudite range of original sources. Legg's (2004) painstaking investigation of vast piles of colonial newspapers has much in common with Bonyhady's research. Both examined the use of forests and timber and the views of colonial society as seen through contemporary eyes. Legg found little that was specific to forest fauna in his research, despite assiduously searching for such references. The paucity of forest fauna references in Bonyhady is also likely to be a reflection of the lack of its specific mention in the historical record.

The few remarks about forest fauna (from historical figures and in debates) that Bonyhady recorded are revealing.

Bonyhady (2000, p.151) quotes the *Launceston Examiner* of 18 August 1860: “The primitive human denizens of our forests have been extirpated, and all the lower tribes of animals that refuse to yield allegiance to civilized man must share a similar fate. But we do not apprehend that this event, however distressing to zoologists, will be attended with very alarming consequences for the colony...”. The writer of this piece was right. It has been distressing to zoologists, and the writer would no doubt be amazed to see so much attention given to the subject of fauna conservation, and would be quite nonplussed by the outlook in English’s (2004) chapter on the Aboriginal values of forests in NSW, or the approach to conserving the fauna in PNG (Leary and Mamu 2004). Bonyhady (2000, p.213) noted a call in 1884 in Victoria for the list of protected birds to be increased from 39 to 239 species and that the proponent, Archibald Campbell, simultaneously called for the retention of native forests and wetlands on the basis that they were at least as significant as law enforcement. This has a very modern ring to it, and the record of such insights is critical to our sense of how Australia was developed and how long it takes for a good conservation idea to become accepted practice. Bonyhady’s book ends in the 1990s with the word “failures” as the key word in the first sentence of the last paragraph. These failures relate to government neglect and mismanagement of Tower Hill in Victoria. The heading of these last three pages is “The Tree Rabbits”. The tree rabbits are the Koalas *Phascolarctos cinereus* introduced into this isolated 144 ha site. The Koalas, reports Bonyhady, had increased from 19 introduced animals (as part of a major translocation program in Victoria since 1944, Martin and Handasyde 1990) to “hundreds if not thousands” by 1988, and by the mid-1990s “between two-thirds and three-quarters of the manna gums were dead”.

In reference to von Guérard’s *Tower Hill*, painted in 1855, Bonyhady observed that if the gap between art and nature narrowed dramatically in the 1970s and 1980s, it widened through the 1990s. Bonyhady’s outrage is evident when he stated that a quarter of a century of public enthusiasm and expenditure on restoring Tower Hill was undone by a decade of negligence by the government and the department with responsibility for this site. One can share that despair, yet acknowledge that referring disparagingly to Koalas as “tree rabbits” may not help solve the problem of managing overabundant Koala populations. However, the value of such a derisive term is that it jolts people into thinking about them in a different way, at least in the situation that turned them into a localised pest. Changing perceptions will be a significant part of the solution. It highlights the vexatious problem of how to manage this native forest species that has become a local pest at the southern end of its range, but not through most of the rest of its range (ANZECC 1998; Melzer *et al.* 2000; Stratford *et al.* 2000). Contemporary society is now conditioned to accept the need for special attention to threatened species, but philosophically we are not at all well experienced in the converse – managing superabundant native species, particularly if it is an icon. One would be very mistaken to refer to Koalas as “tree rabbits” where

the local population has just declined to extinction, such as in Iluka on the north coast of NSW, or is declining from fierce fires and savage dogs at Port Stephens (Lunney *et al.* 2002, 2004). This points up the deficiency of making decisions based on aggregated numbers with respect to conserving forest fauna. The answer lies in dealing with Australia’s forest fauna by spatially explicit statements of the issues (e.g. McAlpine *et al.* 2002), so culling Koalas at Tower Hill and caring for sick and injured Koalas on the north coast of NSW are appropriate wildlife management recommendations for both of these local, much disturbed, forest environments.

The most powerful image that arises from Bonyhady’s writing is his strong sense of place. His appreciation of colonial art and letters project a deep aesthetic response to the Australian environment. That sense of place is evident in his previous writings (e.g. Bonyhady 1997) and they express the commitment that underpins the strength of those movements to create and conserve areas, particularly those dedicated in perpetuity, such as national parks and nature reserves. To those who have spent years, decades no less, protecting land from what others call “development”, there is nothing at all odd about Bonyhady’s outrage, his imagery or his bias. What is difficult is to integrate the equally valid concept of heritage that resides in our fauna, whether it is a native pest, an endangered species or somewhere in between, into the cultural landscape that we have created.

Most people in Australia live in areas that were forested on 26 January 1788. This is, or rather was, the domain of Australia’s forest fauna. Much of it is now a cultural landscape, and it may be hard to see it as habitat for forest fauna. To many people, forests may simply be places where one drives down a dirt road with trees arching overhead in an area that may be part of national park, or part of a commercial state forest where active logging programs are carried out. Such areas become the focus of forest campaigns and they photograph well. However, forests look different when they are logged and when they are burnt, and the issues of protection of property and life are ever present. Not nearly so evident is the fact that such forests and the adjacent rural and urban lands are part of the matrix for forest fauna. Lindenmayer and Franklin (2002), with respect to conserving biodiversity across this matrix, and Bradstock *et al.* (2002) and Cary *et al.* (2003) with respect to fire, are ahead of their time in viewing the landscape ecologically. Recher *et al.* (2003) take a different tack and, using the Western Australian wheatbelt as their example, begin to articulate their vision that biological conservation in the 21<sup>st</sup> century is about farming and farmers, not wilderness and conservation reserves. This vision has much in common with that of Archer (2002) and Archer and Beale (2004), whose practical approach is derived from what they call “deep time”, the palaeontologist’s perspective (Archer *et al.* 1991). Australian society has yet to catch up with managing fauna across this cultural landscape in a holistic fashion. Given that the habitat for most people overlaps with habitat for forest fauna, the challenge of managing Australia’s forest fauna across this cultural landscape will be a major test of our civilization.

## The Forest Eaters

A few scientists are also gifted writers and their words reach the headlines and influence the policy debates. After one of many searches of the shelves of a vast barn-sized secondhand bookshop in Newtown, the owner Bob Gould looked at the titles of the books I was buying and asked whether I was one of Tim Flannery's mates who wanted to turn Australia into a wildlife theme park. Without a doubt, Flannery's (1994) *The Future Eaters* captured the public imagination and, as summarized by David Suzuki on the cover of Flannery's book, gives us a powerful insight into our current destructive path. A possible sequel would be *The Forest Eaters*, which would have been a suitable title for a group of chapters in this new edition. One only has to read Lindenmayer and Gibbons (2004) on the near escape of the NSW south coast forests around Mogo in relation to logging for industrial fuel to cite a case in point, especially in light of the political ecology chapter on woodchipping by Penna (2004), or the thesis on sustained unsustainability by Calver and Wardell-Johnson (2004) in relation to the jarrah forests of Western Australia. But *Forest Eaters* certainly does not apply to all the chapters. An intelligent, critically responsive set of chapters, such as on monitoring in Western Australian jarrah forests (Abbott and Burrows 2004) or the forests of eastern Australia (Kavanagh *et al.* 2004), the personal history of wildlife management in NSW public forests (Curtin 2004; Shields 2004), the current dilemmas in managing state forests in NSW in the wake of the RFA decisions (Meek 2004), the management of reptiles in the forests of south-east Queensland (Goodall *et al.* 2004), the extensive experience in fauna management in forests in Victoria as set out in Loyn (2004) and the thoughtful chapter on Swift Parrots *Lathamus discolor* in Tasmanian forests by Munks *et al.* (2004) should dispel any view that conservation is an activity confined to just a few groups, such as government fauna authorities, academic institutions and non government organizations (NGOs). This book is a catholic collection of ideas and actions across a broad conservation front. The theme that links the chapters is the painstaking research of the authors and their capacity to draw conservation conclusions from that research.

A possible new title for this book was the subject of discussion in the council of the Royal Zoological Society of NSW largely because every chapter in the second edition was new. The decision to stay with the original title was made on the basis that many of the authors were contributing to a theme idea and an ethic of writing that they had endorsed, namely the one contained in the first edition. The success of the first edition can be attributed to the fact that it promoted both science and conservation, and was open to a wide range of viewpoints. Anyone who reads this new edition will again sense that there are many viewpoints on forestry matters, some of which are potentially incompatible. Conflict is part of the process of science, and it is the management of conflict, not its suppression, that is required. The best course of action is to allow people to put their views, backed up with ideas and data, and participate in the ensuing debate. That is the formula adopted here. Carron (1988) wrote a carefully worded text on forest history, in which he commented that, "For various reasons, forestry in Australia has attracted a

considerable number of inquiries...". The delivery of this talk on the day of the conference was couched in much stronger language. Assuming that my memory has not failed me, he spoke in the vernacular and said that he was appalled that his profession of forestry continued to be "taken to the cleaners". Carron was quite right to feel that his profession had come under keen scrutiny. After all, many forestry activities, such as woodchipping and rainforest logging, had come under intense criticism in the 1970s and 1980s, at both the operational level in the forest and at the level of government policy. However, no one, including Carron, has argued that conserving wildlife in state forests had been a government priority.

A point to bear in mind when reading about forestry matters is the concept of forest and where it was located. Carron's (1985) book has a map on the end papers that shows the emphasis he placed on knowing the location, type and tenure of Australian forests. Here the forest estate is presented as it was in 1982, with its strong east coast distribution, the bulk (28.1 million ha of the total of 40.8 million ha) of forest being eucalypt, and an ownership category showing 11.4 million ha as state forest, 16.9 million ha as "other public", 3.8 as national park and 8.7 as private. The *Australia's State of the Forests Report 2003* (National Forest Inventory 2003) alters this picture considerably by adopting a broader definition of forest and arriving at a total figure of 164.3 million ha for Australia. A contemporary of Carron, Curtin (2004), has reflected on this transition from forester to conservator of biodiversity and the institutional difficulties he noted on the way. Two points emerge when one reads the words of these two accomplished foresters and their peers. The first is that seeing the forests through the eyes of a fauna specialist is not easy. Curtin was prodded by Harry Recher and it did take a dedicated effort to bridge that divide. Among the immediate beneficiaries of this exchange were young researchers in what was then the Forestry Commission of NSW who have remained active in the debate (e.g. Kavanagh *et al.* 2004; Shields 2004) with a flow-on effect to new wildlife staff (e.g. Law 2004; Lemckert and Slatyer 2004; Meek 2004). Recher's (2004) contribution has remained focused on his favourite faunal group, the birds, and his conservation conclusions emerge from detailed studies of individual species in locations well known to him. The second point that emerges from reflecting on the struggles encountered by Carron (1985, 1988) and Curtin is the need for bold communication skills for those with a bent for conserving fauna.

Recher remains one of the most vocal advocates of the responsibility of scientists to communicate, and to publish, and he opposes any suppression of ideas or findings (e.g. Recher and Ehrlich 1999). The *Sydney Morning Herald* of 14 June 2004 listed Harry Recher as a Member in the General Division of the Order of Australia, which entitles him to use the initials "AM" after his name. He was given recognition for "service to ecological science, particularly through the development of ecosystem management in Australia, and as an educator, author and advocate for biodiversity". He is a self-confessed "big mouth" (as reported in his local newspaper, the *Hornsby Advocate* 17 June 2004). He has been an inspiration for many young

scientists, this author included, and to all those who have felt a bit shy about speaking up, or have felt intimidated about raising their voice in opposition to threats to the long-term interests of Australia's wildlife. However, not everyone wants to be a clone of Recher, or indeed of Flannery, so there is a lot of space left for others to work in. This book captures part of that diversity of viewpoints (e.g. Belcher 2004; Calver and Wardell-Johnson 2004; Claridge and Trappe 2004; Stanisic and Ponder 2004; Whitford and Stoneman 2004)

The title, the *Conservation of Australia's Forest Fauna* (Lunney 1991 and this new edition), was conceived to provoke such questions as: "Has the fauna of Australia's forests been conserved?" While the short answer is "no", it is only a useful one if subsequent questions take a more focused form, such as: "What do we know about Australia's forest fauna, what are the threats, where will the solutions lie?" If you are looking for the long answers to these questions from the researchers who have carried out the work, then this book provides a treasure house. The threats-solutions approach to conserving biodiversity reflects a researcher's emphasis in the text. It is the approach a group of us utilised in the NSW National Parks and Wildlife Service (now the NSW Department of Environment and Conservation) when looking at a broad sweep of issues related to biodiversity conservation when the term "biodiversity" was still seeking a toehold in Australian conservation writings (Bradstock *et al.* 1995). The framework of describing threatening processes and conservation options and providing a detailed record of the problem and the proposed solutions has stood the test of time (e.g. Bickel and Tasker 2004; Catling and Coops 2004; Moore *et al.* 2004; Tasker and Dickman 2004; York and Tarnawski 2004). The difficult question of how research scientists can reach beyond their discipline to communicate their findings, or whether they should even try, continues to tax many scientists, as is evident in a range of chapters (e.g. Calver and Wardell-Johnson 2004; Claridge and van der Ree 2004; Lindenmayer and Gibbons 2004; Parnaby and Hamilton-Smith 2004; Penna 2004; Recher 2004; Smith 2004).

### **Resources are social, cultural and environmental values as well as economic**

Clive Hamilton, now at the Australia Institute, had had a brief but intense period in the Resource Assessment Commission (RAC) as a research economist, and recorded some of its forestry ideas in Hamilton and Glyde (1991) in the first edition of this book. He also has reflected on the process used by the RAC and the times in which it operated to draw conclusions that provide valuable insights into this style of enquiry (Hamilton 2003). Among its legacies, he concluded, is that the RAC experiment contributed to our understanding that resources include social, cultural and environmental values, as well as economic factors. This may seem to be obvious now, but it was a breakthrough for those caught up in the debates, the conflict no less, throughout the 1970s and 1980s (e.g. Curtin 2004; Shields 2004), although there are many who conclude that economic rationalism still plays a larger

role than it deserves (e.g. Calver and Wardell-Johnson 2004; English 2004, Flint *et al.* 2004; Penna 2004; Recher 2004; Parnaby and Hamilton-Smith 2004). Noting that the RAC experience advanced the way in which environmental debates are carried out in Australia, and that there is now a greater emphasis on analysis and a more careful statement of views, Hamilton concluded that judgments reflecting society's valuation must enter into the final decisions. That view has guided the writing and editing of this book.

Hamilton is now famous for challenging the dominant economic and social paradigms of our age with such books as *Running from the Storm* and *Growth Fetish* (Hamilton 2001, 2003). He knows well the value of first-hand, skilled information on a subject; the arcane subjects in which he works – the national and international economy, taxes, climate change, legislation and social policy – require a lot of backroom work. He has first hand experience of the series of steps must be taken before good science can become sound policy. What this book has done is to put good science on display so that those who draw policy conclusions can have a better basis for doing so, and that the critics of policy can have access to the science which informs it (e.g. Banks and Taylor 2004; Dickman and Steeves 2004; Milledge 2004; Moore *et al.* 2004; Rankmore and Price 2004; Woinarski 2004).

Hamilton is well aware that scientists are just another advocacy group, with a special interest in obtaining government funding for sustained research. He also knows that policy-makers respond to economic, social and political pressures, and not to a technical compendium of scientific papers that have no conservation content. In this context, the first word in the title of this book – "conservation" – is most apposite. A primary aim of this text is to apply the knowledge and skills of researchers to the pressing matters of conserving the forest fauna of Australia, and all the authors turned their mind to this requirement when crafting their chapters. Some scientists are reticent when it comes to discussing how their research may be applied to the urgent questions of how to conserve our forest fauna. That shortcoming was not an attribute of any author in this book (e.g. Catterall *et al.* 2004; Lemckert and Slatyer 2004; Paton *et al.* 2004; Recher 2004; Stanisic and Ponder 2004; Winter 2004).

The chapter on the plight of the avifauna in South Australia by Paton *et al.* (2004) provides a framework for debating policy in relation to avifauna conservation in that state. Paton *et al.* pursue the case for conserving farmland, but rather than arguing for one tenth of every farm to be set aside for bird conservation (because the poor 10% of the farm would likely be chosen), they argue for one farm in ten to be selected and restored, because a whole farm is much more likely to carry the wide range of resources needed by the birds. They also advocate that the locals remain as managers to sustain the social fabric of the local community and to promote the initiative. There is nothing faint-hearted in this policy position, and in the context of Recher's (1999, 2004) dire warning about the future of our avifauna, it would seem that anything less would let half our avifauna decline to inevitable extinction within a century.

If you have been told that the forest fauna of Australia has been adequately conserved, or if you assume from an apparent silence that all is well with our forest fauna, yet you have some niggling doubt on this matter, then read this book. It has been written by the people who have conducted the work for a wide range of people who want to know what is happening to our fauna. The *Australia's State of the Forests Report 2003* (National Forest Inventory 2003) is a great boon considering the absence of reports in previous decades, but it is well removed from the researchers with dirt under their fingernails or the scent of the eucalyptus smoke in their clothes. It does provide important data, maps and responses under internationally agreed indicators, namely the Montreal process, but by holding its focus too narrowly on Commonwealth responsibilities, such as species listed under the *Environmental Protection and Biodiversity Conservation Act 1999*, it misses most of the diversity of Australia's forest fauna and, with that, many of the conservation options.

### National Forest Policy Statement 1992

Since the publication of the first edition of this book (Lunney 1991), the influential *National Forest Policy Statement* (Commonwealth of Australia 1992) was formulated, which led to the Regional Forest Agreements (RFAs) and the Comprehensive Regional Assessments (CRAs), backed by threatened species legislation. To what extent, one can ask, have the *National Forest Policy Statement* initiatives tackled the problems of conserving our forest fauna? The simple answer is: a great deal, but they are limited to the extent that dedicating land as national parks or nature reserves is adequate to conserving a nation's biodiversity, and the extent to which threatened species legislation is adequate for all faunal groups from land snails (Stanisic and Ponder 2004) to Spotted-tailed Quolls *Dasyurus maculatus* (Belcher 2004; Burnett and Marsh 2004). This quoll – our largest native mainland predatory mammal – is among our rapidly fading forest fauna. It was listed as endangered nationally in May 2004 as this book was going to press. Land snails, however, have yet to enter the national collective consciousness as forest fauna. The purpose of this book is to bring these specialist opinions to the fore, present a set of readings that depict the problems and present rare insights that are precursors to developing a clearer vision for the future. It will not be surprising then, to find, tucked in among the graphs, maps and detailed scientific studies, a sense of a deep appreciation of Australia's forest fauna and the heartfelt desire to conserve it.

By 1991, the Commonwealth's Resources Assessment Commission (RAC) had devoted much attention to forests (Hamilton and Glyde 1991; Lunney 1991a). The final report on forests was published in March 1992 (Resource Assessment Commission 1992a), and while it carried much useful information and ideas, it did appear to be overshadowed by events, particularly Australia's signing of the *United Nations Convention on Biodiversity* and the *Non-legally binding authoritative statement of principles for*

*a global consensus on the management, conservation and sustainable development of all types of forests*<sup>1</sup>. The foreword of the *National Forest Policy Statement* (Commonwealth of Australia 1992) acknowledges both of these documents, but it does not state that the fashioning of Australia's national forest policy was done in the context of the RAC report, whose limitations have left their mark in the policy. The *National Forest Policy Statement* gave little guidance on how to implement the visions for conserving forest fauna, and maintained a narrow emphasis on nationally threatened species, the number and size of reserves, and the use of aggregated numbers rather than spatially-explicit insights. In view of the promise of the draft RAC report (Lunney 1991a), this author took the view that the RAC had lost its nerve in the final report (Lunney 1992). The final RAC report stated that a review of the human uses of forests, which would need to cover hundreds of Australian references, and thousands of references if the world literature were taken into account, would do little to resolve the controversy about forest uses and their impact on forest values. This shows a dismal failure to distinguish between assessing the measurable impacts of humans on forests from the conflict over values. The RAC was not given the responsibility to resolve the conflicts, but it was given the responsibility to assess the resource and the impacts of human activities upon it. That it did not do so was a major failure, the scale of which can be seen by comparison with Laurance and Bierregaard (1997) on tropical forests, and Lindenmayer and Franklin (2002) on temperate and boreal forests. I estimated that there were about 1600 entries in the reference list provided by Lindenmayer and Franklin (2002), so it is not an impossible task. The real issue is whether one is willing to see the problems, resolve them ecologically and work with an ethic that is bold enough to draw conclusions from existing research and to offer guidelines for future work.

The *National Forest Policy Statement* (Commonwealth of Australia 1992) opens with the statement that: "The Governments share a vision of ecologically sustainable management of Australia's forests. This vision has a number of important characteristics". The first of these nine characteristics is (the present tense is used because the policy is still the national position): "The unique character of the Australian forested landscape and the integrity and biological diversity of its associated environment is retained". The *Policy Statement* launched the RFA/CRA process, with its emphasis on public forests (mainly state forests and national parks), and while the word "ensure" was applied in the policy statement to public native forests, the word "encouraged" was the operative verb for private native forests. These private native forests have subsequently become the forgotten forests (e.g. Prest 2004).

The final report on forest use by the ecologically sustainable development (ESD) working group (Commonwealth of Australia 1991) was published at the watershed of the national and international promotion and acceptance of the concept of ecologically sustainable development.

<sup>1</sup> The full texts, which were adopted at the UN conference in Rio de Janeiro on the Environment in May and June 1992, were reproduced in *Australian Zoologist* 28: 88-107.

Regrettably, the report is little used in current debates. Among its virtues is that it does formally record many matters that were of prime importance at the time, so it allows one to gauge how rapidly the debate has changed. The report noted the common attitude that forest areas have been considered to be a ready source of land for agricultural development until very recent times, and that this attitude “still continues to some extent to the present day.” The report noted that the conversion of forest to agriculture is “a major contributing factor to the pervasive community concern about our remaining forests.” It is in the context of the forestry conflicts of the 1980s and early 1990s that the emphasis, and limitations, in the immediate application of the *National Forest Policy Statement* (Commonwealth of Australia 1992) needs to be interpreted (e.g. Flint *et al.* 2004; National Forest Inventory 2003; Newell and Goldingay 2004; Norman *et al.* 2004; Penna 2004; Prest 2004).

The final report on forest use by the ESD working group (Commonwealth of Australia 1991) noted that the forest ecosystem is complex, that our understanding of it is far from complete and that the shift in values is relatively recent, and concluded with the insight that “perhaps of most importance, we must still work with value judgements.” All of these points continue to apply today, often with greater strength, as can be noted from the many strong conclusions throughout the chapters in this book. The report made a most telling statement from the standpoint of conserving forest fauna: “The prime reason why our forests have created so much debate and disharmony in recent years relates to their conservation value. Forests provide the habitat for much native flora and fauna, and it is fundamental to the principles of ecologically sustainable development that this habitat be managed to maintain biodiversity and other conservation values.” This is a blunt and powerful statement that sets a high standard for setting policy and evaluating its outcomes. It deserves wider reporting and application. This edition of the *Conservation of Australia's Forest Fauna* goes to the heart of that issue by providing not only criticism of past practices, but also specific guidance to on the management of forests for their fauna. The application of ESD to forest use by the final report (Commonwealth of Australia 1991) has provided an exacting benchmark for decisions, such as those made during the RFA process. It represents a major shift from previous decades, but one that has yet to be realised (e.g. Calver and Wardell-Johnson 2004; Catterall *et al.* 2004, Flint *et al.* 2004; Kavanagh *et al.* 2004; Lindenmayer and Gibbons 2004; Lunney and Matthews 2004; Meek 2004; Paton *et al.* 2004; Recher 2004; Woinarski 2004). The value judgment that one can apply to conserve forest fauna is that any development decision that does not actively incorporate the principles of ESD, including providing the habitat for native flora and fauna, will undermine the vision and the intent of the *National Forest Policy Statement* and thus the future of Australia's forest fauna. This edition of the *Conservation of Australia's Forest Fauna* provides a high level of specificity as to how to apply the fundamental principles of ecologically sustainable development to manage forest habitat for its fauna.

If the RFA process were to go beyond forested lands to other ecosystems, as was considered by Tribe (1998) from a legal perspective, there are difficulties to be overcome. One is that most agricultural areas are on private or leasehold land and so are not subject to the same legislative restrictions as public land. Another is that some ecosystems, such as those in arid areas, are more variable, and so the costs of instituting both the Comprehensive, Adequate and Representative (CAR) reserve system and an ecologically sustainable management program will be extremely high. Tribe considered that the RFA process deserved to be applied more widely, and in light of that possibility, it is instructive to assess the legacy of the RFA process. One of the lessons is that the conservation of fauna is a long-term matter that will not be resolved by quick negotiations. This is because the results of long-term fauna monitoring programs have yet to be obtained and fed back into the system, and this necessitates adopting an adaptive management approach. An insight that arises from the exercise of extending the process to other ecosystems is that it shows the extent to which the RFAs were dependent on redrawing the boundaries of what were already public lands. The implementation of ecologically sustainable development was thus mostly focused on the allocation of state commercial forest to state conservation reserve, and there were measurable limits to the success of that approach (Flint *et al.* 2004). From a broader perspective, the performance of the *National Forest Policy Statement* has yet to satisfy the fundamental principles of ecologically sustainable development.

Private lands were mapped and included in the assessment and some conservation values noted (Ryan *et al.* 2002), but they largely remained out of the land transfer equation, as did the need to extend the Ecologically Sustainable Forest Management (ESFM) effort to fauna conservation beyond CAR reserves. Thus much fauna conservation work remains ahead of us, and this has yet to be adequately acknowledged as the current state of play. This is evident from Dargavel's (1998a) summary of the politics of the RFA process. He identified the main driving forces behind the debate as the environment movement, which wanted to preserve the native forests by ensuring that adequate conservation reserves were created for every ecosystem, and the industry, which wanted the wood resources of the native forests for domestic use and export as woodchips or paper pulp. Industry wanted the resource agreement by governments to be free of subsequent diminution on environmental grounds, the unions and the loggers wanted secure jobs, and the politicians wanted to get the conflicts off their agenda. Kirkpatrick (1998) concluded that the outcomes of the RFA process not only fell short of the spirit and the letter of the national forests policy, but they may also have been politically inept. He noted that although the reserve system has been greatly expanded, it fell well short of the degree that would ensure a quiet future for the forest industries and the politicians who support them. In Slee's (2001) view, the RFAs may result in some economic benefits and conflict resolution, but in other cases they have polarized and exacerbated the conflicts. These are all strong comments, but what has been noticeable in the discussion of the RFA process has



been the omission of clear outcomes for the conservation of forest fauna. The importance of the analysis by Flint *et al.* (2004) thus becomes apparent in beginning to close this critical gap, as does the value of community voices. Flint *et al.* found that the forestry reform process in north-east NSW was successful with respect to major elements of the scientific side of the process, such as the conservation planning software in reserve selection with fauna as a key component. In contrast, their assessments showed that only 49% of the targets across all populations was achieved, and that the poorly reserved habitats were of those species with large home ranges, species most vulnerable to threatening processes, and the dry sclerophyll forests on the coast and tablelands. If the RFA approach, as was employed in the 1990s, is expanded as suggested by Tribe (1998), or the focus remains on the forests themselves, then conserving fauna by this process will remain largely a lost cause.

One of the successes of the *National Forest Policy Statement* has been the support given to the development of reserve selection procedures, including recognising the limitations of the current forest reserves and the need to work beyond their boundaries (e.g. Flint *et al.* 2004; Margules and Pressey 2000; Newell and Goldingay 2004; Norman *et al.* 2004; Pressey *et al.* 1996, 2000, 2002). Among the other commitments in the policy statement was the continuing development of the National Forest Inventory. Its second edition *Australia's State of the Forests Report 2003* (National Forest Inventory 2003) contains much valuable information, clarified some nagging points of data and definition, but was far too brief on the matter of forest fauna. Its pre-occupation with threatened species on the schedules of the Commonwealth's *Environmental Protection and Biodiversity Conservation Act 1999* is disturbing because it narrows the issues relevant to conserving all forest fauna by focusing attention on such a tiny subset of our fauna.

### **The area of Australian forests: 43 million ha in 1992; 164 million ha in 2003**

Among the striking set of figures in the *Australia's State of the Forests Report 2003* (National Forest Inventory 2003) are those that arise from the new definition of forest: "An area, incorporating all living and non-living components, that is dominated by trees having a single stem and a mature or potentially mature stand height exceeding two metres and with existing or potential crown cover of overstorey about equal to or greater than 20%. This also includes Australia's diverse native forests and plantations, regardless of age. It is also sufficiently broad to encompass areas of trees that are sometimes described as woodlands". If you have understood all of that statement you are in a minority. In the *National Forest Policy Statement* (1992) the definition of forest has three characteristics that differed from this new definition. The tree height in 1992 was five metres; it is now two metres. Further, the cover was 30% in 1992; it is 20% in the current definition, but it is the meaning of cover that matters most. "Potential crown cover" has replaced the term "potential projective cover of overstorey strata". The significance here is that a crown,

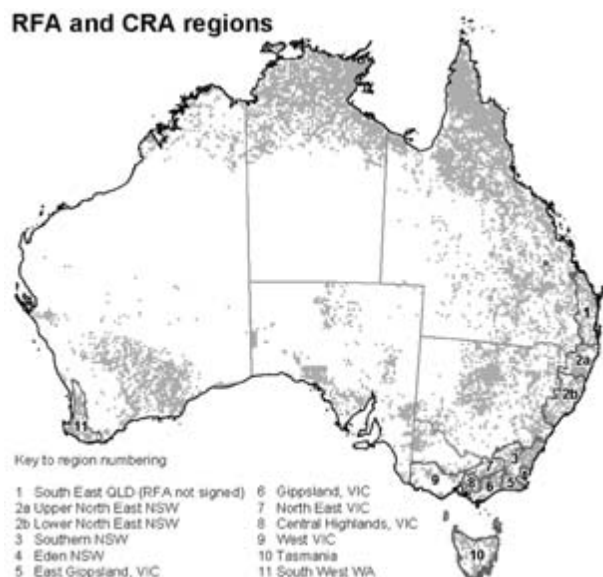
*i.e.* the canopy of the tree, is regarded as opaque under the definition of crown cover. It is the vertical projection of the circumference of the crown that now applies, whereas previously the potential or existing projective foliage cover estimated the degree of cover actually provided by the foliage and the branches that is projected onto the ground. Projective foliage cover can also be visualised as the degree of shadow cast by the foliage. Thus an open crown of a eucalypt with sunlight streaming through it would score a much lower figure under "projective foliage cover" than would a dense crown of a rainforest tree, but if the circumference of the crown were the same, then the crown cover under both the eucalypt and the rainforest tree would be the same. As Hnatiuk *et al.* (2003) explain, crown cover of 20% is equivalent to 10% projective foliage cover. Thus any woodland by earlier definitions (principally Specht *et al.* 1974) is now incorporated within the definition of forest. Sunburn cream, and not a hard hat, is now the most important protective measure in the newly defined forests.

The RAC (Resource Assessment Commission 1992a) commissioned its own Forest Resource Survey (see Lunney 1991a for a more detailed summary). Using the figures from the Forest Resource Survey, the RAC determined that there were 34.0 million ha of forest in Australia, which amounted to 4.4% of the area of Australia (768.2 million ha). The Forest Resource Survey, and thus the RAC, also gave figures for woodland, *i.e.* where 10% projective foliage cover was the lower limit. By including woodland, the figure for Australia rose to a total of 42.2 million ha, *i.e.* 5.5% of Australia. Now be amazed by the comparison. *Australia's State of the Forests Report 2003* (National Forest Inventory 2003) gives the total figure for native forest for Australia as 162.7 million ha (or 164.3 million ha when plantations are included). This is four-fold the estimate of 12 years previously. How did we get there? The answer lies in the definition, which does need explaining, but one has to go elsewhere than the *Australia's State of the Forests Report 2003* to find it. Hnatiuk *et al.* (2003) provide an explanation. They explain that the *Australia's State of the Forests Report 2003* definition was to meet "operational implementation requirements". The reason for changing to crown cover was because it provided the most consistent means of mapping forest density by aerial photography, and because satellite landcover mapping programs could reliably map crown cover down to 20%.

The main point that emerges from all these figures is that the definition is crucial to understanding what Australian forests really are at any given time, and this is why comparisons between years or different sets of figures need to be read with great care. It is bizarre to find in Williams *et al.* (2001) that the biggest problem facing biodiversity in Australia is land clearing, yet forest cover has increased fourfold between two major national government enquiries conducted a decade apart yet covering the same period in which Williams *et al.* were reporting. Secondly, the new definition is now the one to use because all national documents will refer to it as well as the figures provided by the *Australia's State of the Forests Report* as it is updated. This new definition also makes ecological sense from a forest

fauna point of view because the fauna do not neatly fit the old categories and are more likely to fit the new, although this has yet to be tested. The research by Paton *et al.* (2004) in South Australia, Coughlan and Pearson (2004) in dry rainforests in Queensland and Woinarski (2004) in the Northern Territory are working in forests described under the new definition. One cynic remarked recently that there are some political advantages to be gained from such shifts in the figures, and while that may be true, there is no point in retaining the definition of projective foliage cover in Specht *et al.* (1974), rather than crown cover as in McDonald *et al.* (1990), if it is not amenable to the new technology. However, one might note that the definitions may change as technology is developed and modelling becomes more sophisticated. One can also note that others use a different set of definitions and maps, which are more relevant to particular applications (e.g. Keith 2004 for NSW)

Among the important figures that are presented in *Australia's State of the Forests Report 2003* (National Forest Inventory 2003) is that of the total of 164.3 million ha of forest, most is eucalypt (127 million ha), with the next largest being Acacia (16.5 million ha). Rainforest is recorded as 4.2 million ha, and plantations as 1.6 million ha. These figures feature in the national debates because of their spread, commercial value or special significance. The record of native forest types within and outside the RFA process was recorded as 23.2 million ha and 139.5 million ha respectively. Thus, while the RFA was extensive, it did not include 83% of the forest estate. In fact, when one examines the map of the RFA regions (Figure 1), they coincide with the areas that fit the more traditional definition of forest. When one examines the percentage of forested land transferred within the RFA



**Figure 1.** The Regional Forest Agreement (RFA) and Comprehensive Regional Assessment (CRA) regions superimposed on a map of the extent of Australia's forests as defined in the *State of the Forests Report 2003* (National Forest Inventory 2003). (This map is figure 2 in the *State of the Forests Report 2003* and has been reproduced with the permission of the Bureau of Rural Sciences, Canberra.)

framework, the figure of 39% increase of area under reserves as a result of the RFA process is confined to the RFA regions (p.42 in *Australia's State of the Forests Report 2003*). Confusion can arise if one reads Davey *et al.* (2002) where it is stated: "Agreements achieved an increase of 2.51 million ha (39%) in Australia's native forest reserve system...". The area refers to the RFA regions, but if the percentage alone were given, and not in RFA framework as provided by Davey *et al.*, then it would be misleading if quoted out of context. This appears to be a fine point, but as information becomes condensed for various executive summaries, the possibility for misinterpretation rises. Nevertheless, the figure is large, the actual area being a substantial increase from 7.5 million ha to 10.4 million ha in reserves. The figures for tenure are also important in relation to how the forests are to be managed and monitored and which legislation applies, as well as to the serious matter of how to manage the matrix.

*Australia's State of the Forests Report 2003* (National Forest Inventory, 2003, pp.38-39) identified that 70% of Australia's native forest estate is privately managed under either private or leasehold tenure. The report notes that "over the last decade there has been a great deal of public investment and debate over the detailed forest conservation and management codes and policies, however, these have predominantly been directed at the small portion (20%) of forest that is in public estate". The report also noted that 7% of Australia's native forest is subject to multiple use, managed by state and territory agencies, in which timber harvesting can occur. The report pointed out that timber harvesting also occurs on other tenures, such as leasehold and private land, and that 13% of the forest is formally protected in nature conservation reserves. These figures give the debate a sense of balance, and demonstrate that forest fauna management on either private land or leasehold land will be vital for managing forest fauna. If the *Australia's State of the Forests Report 2003* assessment is correct in noting that management effort has been concentrated on the public forests, then there is much to do in the private forests to bring the standard up to those that apply to public land, as well as to increase the management prescriptions in public forests where the focus has been concentrated on threatened species (e.g. Law 2004; Meek 2004). Threatened species form the group on which the *Australia's State of the Forests Report 2003* has focused its interest. What is missing is a sense of how the vision of the ecologically sustainable management of Australia's forests (ESFM), as espoused in the 1992 National Forest Policy Statement, is being implemented with respect to the conservation all fauna.

The terms can be difficult and, as pointed out by Chikumbo *et al.* (2001), misunderstandings have arisen in the both the RFA and CRA stages. This is not surprising, especially in the light of the aims of ESFM, which are presented by Chikumbo *et al.* as including the maintenance of biological diversity in forests. Their view is that an adaptive management approach to the forest ecosystem is needed because we have only "a rudimentary concept of how to take its pulse, especially about non-timber values". Not surprisingly, these authors concluded that more thought needs to be given to developing

better techniques for monitoring the implementation and effectiveness of the procedures for achieving forest sustainability. One can also note that little seems to have changed between the conclusions in relation to fauna habitats in the final report by the ESD working group on forest use (Commonwealth of Australia 1991) and the conclusions by Chikumbo *et al.* (2001), thereby demonstrating that conserving forest fauna has yet to receive the attention necessary for its long-term survival. The many authors who have contributed chapters to the *Conservation of Australia's Forest Fauna* have applied much thought to this matter, as recommended by Chikumbo *et al.* (2001), and share these thoughts in this edition.

What is also required is the addition of a new dimension to the commitment of “meeting operational implementation requirements”. That dimension, in my view, will be forest fauna, as a part of ESFM, which should receive the same consideration as the CAR approach has for reserve selection. This will necessitate a different operational approach because forest fauna cannot be seen from space, or even from low-flying aircraft. Here we encounter a new difficulty, namely that of managing the matrix (*e.g.* Lindenmayer and Franklin 2002) with its requirement of covering the entire landscape, irrespective of tenure, to implement monitoring and to adopt a series of activities that occur on the ground.

The focus of the *Australia's State of the Forests Report 2003* on area, rather than species, reflects a technological bias, and it could be argued that the RFA process to date and *Australia's State of the Forests Report 2003* have both avoided the difficulty of working on private land and of developing a long-term sustained program of research and monitoring. Forests grow slowly compared to a human lifetime, and they can appear to be stationary on a political timetable. Of the list of the nine heads of government who signed the 1992 *National Forest Policy Statement*, only one is still in parliament.

One valuable objective would be to better integrate species studies with area studies. At present, fauna work is mostly limited to species surveys followed by estimates of the area needed by the fauna, as was central to the CRA/RFA process of reserve selection (Flint *et al.* 2004). It would be most useful to set targets for conservation reserves based on species data as advocated by Brooks *et al.* (2004), although as with any strong-held position, there is debate on this subject (*e.g.* Pressey 2004). Brooks *et al.* wrap up their paper on the World Parks Congress of 2003 with the conclusion that conservation biology needs to shake itself free of armchair environmental classification and undergo a massive renaissance of natural history, which they regard as a passion for the study of species. The craving for more data at the outset of the CRA process resulted in widespread surveys, but what is really required are more dynamic sets of species' data, which include population dynamics, habitat use, food preferences and movement patterns, and a range of other ideas that go well beyond one survey and are evident in so many chapters (*e.g.* Banks and Taylor 2004; Catling and Coops 2004; Claridge and Trappe 2004; Goodall *et al.* 2004; Loyn 2004; Rankmore and Price 2004; Rhind 2004; Wardell-Johnson *et al.* 2004).

## A culture shock and a reality check

Terborgh (2004) reflected on the World Parks Congress of 2003, which hit him as a culture shock and a reality check. He realised that many of his academic colleagues do not engage in parks and their management because it is not cutting edge science. His comment was arresting: “But we do so [ignore parks] at our peril because protected areas are all that is going to save nature and biodiversity after the remaining unprotected habitat is ‘developed’”. He noted that recent research shows that many parks are unable to sustain their biodiversity over time and that we need to understand the science behind the low background extinction rate. Mastering this, he said, should become our highest priority. Actually, Terborgh expressed an even higher priority: he urged scientists to engage in political events such as the World Parks Congress or, as scientists, risk becoming irrelevant. Recher and Ehrlich (1999) could not agree more, and the debate on the long-term value of national parks and nature reserves as the centrepiece for conserving biodiversity has a long way to run. We may know the answer in 100 years, but by then too many options will have been lost, and all today's players will be no more than the subject of 22<sup>nd</sup> century ecological history studies. Indeed, those scientists who exclude themselves from the debate are not the only outsiders; the exclusive politics of the RFA process has also drawn some sharp comment because it too produced outsiders.

The RFA process has attracted much attention from those policy makers who were not as involved with the outcome as they were with the process. Lane (1999), for example, concluded that the RFA process did not succeed in resolving the resource conflicts but that it did manage the conflict. Ananda and Herath (2003) noted that the forest RFA program was the most ambitious and expensive resource planning exercise ever undertaken in Australia, yet they questioned the success of the intent to include stakeholder participation. They noted that, as a result of the institutional obstacles in the policy process, conservationists did not accept the outcomes for the East Gippsland and Tasmanian RFAs. These authors proposed an alternate process, even though the policy debate is well underway. In terms of forest fauna, however, the debate is only just getting underway as to how to implement an effective ESFM process for fauna that covers not only all the RFA areas, but all forests, especially those on private lands.

Some of the criticisms of the RFA policy process are more scathing. Lane (2003) concluded that the governance of the RFA process subverted rather than promoted the democratic process. In particular, Lane concluded that state agencies, civil organizations (conservation groups) and capital (forestry companies) colluded to secure gains for their own group interests. The state wanted the conflict to end, conservation groups wanted an extension to the conservation estate and industry wanted security of access to public forests for logging and woodchipping. Lane's parting shot was aimed at another aspect of the process, namely the exclusionary effect of science in public deliberations. Lane considered that when public policy deliberations are dominated by scientific

discourse, the broader citizenry can be excluded and the role of other knowledge impeded. English (2004) provides a clear example of other knowledge with his chapter on Aboriginal values. Such writing will produce many lively discussions.

There is congruence between Lane's conclusions and those of Mobbs (2003), who produced a most insightful paper on the policy context of the RFA process. Mobbs thought the RFA process deserved a thorough analysis since, on her estimate, it cost about \$0.5 billion over five years. Mobbs' critique was confined to native forests in public ownership – only a small proportion of all forests. Any expansion of the RFA process across a broader area would incur considerable further outlay, and the aim here is to add fauna to the next round before it starts, so that it avoids being primarily limited to another land-tenure debate, but is one in which ESD comes of age. Mobbs noted that in the Upper North East NSW RFA there was not enough high value forest left on public lands to deliver a win-win outcome, *i.e.* to meet biodiversity targets in national parks and to deliver least cost to the timber industry in terms of job losses, long-term security and continued development. Flint *et al.* (2004) provide graphic detail of that process. Mobbs, using the North East NSW RFA process as the example, made the same point as Lane, namely that there was dissatisfaction by the regional, community-based committee, known as the Regional Forest Forum, with the level of access to decision-makers and information from the technical and steering committees, and with the intensifying focus on the resource allocation between national parks and state forests. Mobbs' analysis allowed her to draw the conclusion that the debate was essentially on the allocation of land between state forests and national parks since the focus of the RFA process was on minimizing conflict over public native forests and ESFM was a lesser consideration. Mobbs noted concern that the expansion of national parks had been achieved at the expense of intensified logging in state forests, and that ESFM considerations were not taken into account in this scenario, nor on plantations and private property.

In the biodiversity theme report of the Commonwealth State of the Environment report, Williams *et al.* (2001) concluded that "During the 1990s, Australia's biodiversity has experienced continued degradation and decline". Given that a growing population in Australia will accelerate environmental losses (Foran and Poldy 2002), there is a pressing need to debate issues of governance and the role of science in public policy forums. The matter of science is of immediate relevance to the authors and readers of this book, and this is itself a major debate that is not peculiar to the forests or to fauna. However, in the context of this book, a number of points can be made. Firstly, fauna was a feature of the RFA/CRA process. Much information was gathered on faunal locations, but only on a limited range of species compared to the full compass of forest fauna. In this book, the spiders, snails and insects are covered (Bickel and Tasker 2004; Brennan and Majer 2004; Kitching 2004; Stanisic and Ponder 2004; Strehlow *et al.* 2004;

Vanderwoude and Johnson 2004; York and Tarnawski 2004), but are outnumbered by the chapters on the vertebrates. The CRA process was also vertebrate biased, and the RFA almost completely so. Further, the RFA process of negotiations had fauna on the table as an issue, but there was no obligation to reach a formula that conserved the fauna. It was a bargaining chip, placed in a basket with other interests. Thus the vision of the *National Forest Policy Statement* (1992), including its aim of retaining the unique character of the Australian forested landscape and the integrity and biological diversity of its associated environment, has yet to be realised. The role of science here is that it does make clear that there was a shortfall in the RFA process in securing a future for forest fauna. Perhaps this will stimulate others to seek a better future for forest fauna through other means, across a broader landscape, and to incorporate more species and ideas in the process.

The predominant science in the RFA process related to the reserve selection procedures (*e.g.* Pressey *et al.* 1996, 2000, 2002, 2004), although as Davey *et al.* (2002) point out, there was much science that contributed throughout the process. The reserve selection research and its immediate application was world-class because it was so new and so well framed and it has contributed a great deal worldwide on this theme (*e.g.* Cowling and Pressey 2003; Margules and Pressey 2000). Was this particular branch of science the subject of Lane's (2003) concern about the exclusionary effect of science in public deliberations? Was his concern about science the awkward way that fauna fitted into any of these tight policy debates? Was his concern about the misuse of science in public deliberations and the fact that fauna too can become an instrument that can be adapted to fit any viewpoint. An example of the last point is provided by Parnaby and Hamilton-Smith (2004), who are blistering in their attack on how bats have been co-opted for corporate causes. Yet again one can return to Recher's injunction for scientists to communicate so that science contributes to the debate, not hinders it by keeping science apart and inaccessible.

### **Preserving what we have; planning the future landscape; managing what is left**

In the final chapter of their ground-breaking book on tropical forest remnants (Laurance and Bierregaard 1997), a large team presented a menu of challenges to those who are working to study and conserve what they call the richest and most intricate terrestrial ecosystems on earth (Bierregaard *et al.* 1977). Not all of Australia's forests can make that claim, but the line taken by Bierregaard *et al.* (1977) fits the Australian forest landscape. They noted that three approaches to conservation management were possible: "preserving what we have now; planning the nature of the landscape that development will leave behind; and managing what is left". As there is a strong parallel with the efforts to study and conserve Australia's forest fauna, a selection from the tropical menu of Bierregaard *et al.* (1977) is presented here.

Under methodological issues, the key points raised by Bierregaard *et al.* were that studies have been highly eclectic, often rendering generalizations tenuous because of different methods of study, different spatial scales, different taxa, and different habitats and surrounding landscapes. They also noted the confounding influence of edge effects and isolation, and drew attention to the need to incorporate ongoing human influences. At the species level, the authors noted that fundamental information on the natural history of most species is missing, and that such data would enhance our ability to generate predictive models of the implications of various land-use decisions. They specifically stated that we need to know the size of territory or home range, demographic data on survivorship and fecundity, the yearly and seasonal variation in population sizes in natural habitats, and the likelihood that a given species will traverse different types of matrix habitat. We need better data on distributions to improve estimates of extinction, and more information about the characteristics of vulnerable species. They noted that no single model or target taxon provides insight into forest fragmentation. They asked whether locally vulnerable species, such as narrow endemics, island species, habitat specialists, rare species, migratory or nomadic species, species with low reproductive rates, and species with limited dispersal abilities, are also prone to global extinction. They identified that the field of the application of molecular genetics to ecology, while still in its infancy, has immense potential to help identify management units, assess the connectedness of apparently isolated populations, and clarify the distinction between historical processes and recent anthropogenic changes, a point given specific application to Australian forest fauna by Banks and Taylor (2004). The authors also point to the value of a metapopulation approach to understand the dynamics of populations in natural and fragmented landscapes.

Regarding what the authors call the “community-level” issues, they identified that the overall level of extinction in fragmented landscapes is difficult to assess and that further work at local, regional and global scales is needed. They asked whether forest type, matrix type, fragment size or disturbance regimes (e.g. fire, logging) in fragmented communities influence their vulnerability to invasion of exotic or generalist species. They also posed the question as to whether some regions are more vulnerable to fragmentation than others. Under their next major heading, resource management and conservation, the authors opened with the statement that there is a need for better communication among resource managers, landscape ecologists and conservation biologists. They added the unequivocal statement that scientists should make extraordinary efforts to ensure that their research findings become available to real-life managers, conservationists, and the lay public. The authors posed the tough questions as to how landowners should interact with forest fragments. They were not convinced by the value of existing reserve design algorithms for protected areas, and noted that a range of models, such as spatial, bioclimatic and socio-economic, are needed to conserve and manage forest fragments. The authors also pointed out that the modified matrix surrounding forests had been poorly studied and that research was needed to

explicitly assess the effects of different matrix habitats on animal movements, animal invasions, faunal population changes in fragments and the efficacy and design of corridors. Such a set of conclusions is a shot in the arm for Australian forest fauna research because it identifies what is internationally important as well as providing support for those researchers who both designing and applying their research to conserve forest fauna. In short, both the authors and readers of this edition of the *Conservation of Australia's Forest Fauna* have an international yardstick and need not be reticent in exploring new fields or applying what has been found. Conversely, it also identifies that the research that has been done in Australia, as exhibited throughout this edition, is not only contributing to the conservation of Australia's forest fauna in a contemporary manner, but it is also adding valuable examples and ideas to the international corpus of studies in this discipline – a point noted by Laurance (2004) in the foreword.

### **Fragmentation - a change in outlook since the 1991 edition of the *Conservation of Australia's Forest Fauna***

In their review of forest fragmentation using Australian case studies of the Montreal process, McAlpine *et al.* (2002) found differences among the possums and gliders in their three study areas. They concluded that a) the landscape context is important for species living in Australia's eucalypt forests; b) each species has a different response; c) species' responses to landscape metrics vary regionally; d) the patch structure and the ecological neighbourhood must be specified from the species', rather than a human, perspective; e) the mapping of the landscape must be accurate and sensitive to the ecology of the target species; and f) fragmentation effects should, ideally, be measured over the longer time scales, e.g. 10-20 years, at which population dynamics operate. What is striking about these conclusions is that they are so new. They were not part of the language of mammal conservation in the 1980s, although the concept of ecosystem management had come of age and by then was the name of a department at the University of New England. These conclusions did not appear with any clarity in the first edition of this book (Lunney 1991), but were emerging on a case-by-case basis because of the imperatives of studying various species, such as the migratory flying-foxes (Eby 1991), but by the end of the decade, the subject of forest fragmentation and wildlife had been formally recognised (e.g. Hunter 1990; Rochelle *et al.* 1999; Saunders *et al.* 1996; Craig *et al.* 2000). As Bunnell (1999) recognised in the foreword to the book by Rochelle *et al.*, it had by the late 1990s become possible to give practical meaning to the term “fragmentation”.

Changing technology, particularly GIS, population modelling, and radiotracking of individuals across large landscapes, have expanded the possibilities for seeing the world differently at a range of scales while dealing with large data sets. Missing though, are the long-term runs of data. In their final principle in relation to long-term data sets, McAlpine *et al.* (2002) used the word “ideally”.

One can argue that it should be moved to the category of “essential”, and not just remain an ideal. To call long-term data sets “ideal” allows others to draw the inference that one is seeking a luxury extra on a basic program. Neither new technology nor greater funding in any one year can replace years or decades of sequential data. In this context, I note that ecological history is an under-utilised method for long-term studies, particularly for those species that reside in human memory or were commercially important, such as koalas, rock-wallabies, kangaroos, dingoes, flying-foxes and the introduced pest mammals (rabbits and foxes), and data sets for these groups stretch back for well over a century. Such studies will require a positive policy and an active commitment to the principle of long-term monitoring. The idea of long-term data sets is acknowledged but as yet its application to forest fauna has so far been modest. Without it, much current work will not be fully realised; for example, predictions cannot be followed up, nor management programs evaluated and adjusted, nor policy amended or applications for research support given appropriate weight compared to the fashionable problems and projects of any one year.

Another fundamental point to emerge from these principles is the need to work within the context of each species and specific locations. A detailed analysis, species by species, forest-by-forest, shire-by-shire, catchment-by-catchment, and region-by-region, would yield a valuable list of those species to study on various sites, patches, landscapes and at the catchment, state and national levels, a point made by Kavanagh *et al.* (2004). However, the studies on which one can draw to be able to fulfil that requirement are few and far between compared with what is necessary for catchment-specific and species-specific programs. Any scan of recent studies shows that the potential exists, but it also shows that current efforts cannot fulfil the need at the level required by the principles expressed in McAlpine *et al.* (2002). Thus, with the priorities enunciated in *Biodiversity Conservation Research: Australia's priorities* (ANZECC/BDAC 2001) and the commitments in the *National Objectives and Targets for Biodiversity Conservation 2001-2005* (2001), the need for support for studies of the basic elements of the ecology of our native forest fauna is essential because all the biodiversity projects depend on them.

### **From the drained fens of Lincolnshire to the cleared lands along the Clarence**

The way Bierregaard *et al.* (1977) tackle the many issues of conserving tropical forests finds resonance in the study by Lindenmayer and Franklin (2002), which was directed to temperate and boreal forests. One can observe the common themes, such as that detailed studies of the fauna are needed from a diversity of standpoints, in different localities and at different scales. One can also find some differences between Bierregaard *et al.* (1977) and Lindenmayer and Franklin (2002) with the set of chapters in this book, which reflect the ways in which Australian forests have been identified, managed and fought over, as well as the comparatively recent period over which this has occurred. Even this editor has been

alive for over a quarter of the time that Europeans have settled and transformed Australia! Like many Australians, I can reflect on the nation's English heritage by remembering my English grandfather (Lunney 1999). He was born in 1880 and left England in 1901. The legacy he imparted was a love of the land, but he saw it through the eyes of a farmer from the drained fens of Lincolnshire. He admired the cleared lands under crops on the banks of the Clarence River near Grafton in northern NSW where he lived, but by the time he died in 1972, a revolution was underway as to how to see the land other than through English eyes. Subsequently, I was to discover through historical searches, that the cleared lands my grandfather so proudly showed me had been forested habitat for Koalas and flying-foxes *Pteropus* spp when the *Susan* sailed up the rainforest-clad banks of the Clarence in 1832 (Lunney and Moon 1997; Reed and Lunney 1990).

The township of Maclean on the lower Clarence has a small, valuable museum of local material. To me, one of its great possessions is a sulky (a light, two-wheeled, one-horse carriage) identical to the one I rode on with my grandfather through the agricultural lands of the Clarence Valley in the 1950s. To my children looking at this sulky, it belongs to a very distant past, but to me it is the immediate past, and by reflecting on the gaps between three generations, I can draw a number of conclusions. The most pressing is that the change has been so recent yet so great. The forest remnants along the Clarence still contain trees that were growing prior to settlement and the evidence is that the local fauna is still in retreat and has not yet reached equilibrium. Here I can see there is an extinction debt that has been incurred but not yet paid.

The battle over the rainforest remnant with its flying-fox camp at the back of the Maclean High School shows that our ability to manage our remnant fauna is limited and fractured (West 2002). The demise of the Koala population at Iluka at the mouth of the Clarence River in the late 1990s is further evidence that the slide to local extinction of the Valley's forest fauna is still underway, despite some last minute efforts to conserve the koala population (Lunney *et al.* 2002). A lack of concerted action will allow the local fauna to continue to fade, so a positive program by all parties – not just the local land care or dune care group - of preserving what we have now, planning the nature of the landscape that development will leave behind, and managing what is left is imperative if we are to conserve the forest fauna of the lands that are arable, coastal and accessible. There are doubtless many people who are seeking more information, more ideas, and a sympathetic grasp of how we arrived at this predicament of how to conserve our natural environment, yet still earn a living from the land. I reflect on my grandfather's ethic and wonder whether, if he were still alive, he would redirect some of his commitment to the land to conserving its native fauna. My guess is that he would yield to a new way of seeing the world, but it would take patience to see Australia through Australian eyes, and not through the eyes of the son of an English farmer. It is clear we have a fair way to go to convert the land ethic of one who admired the drained fens to a vision that sustains the land and its fauna in the context of Australia.

In our attempt to make clear assessments about conserving our fauna, we need to consider how others have regarded Australian forests. Some fascinating books are emerging, such as *The People's Forest* (Borschmann 1999), *For the Forest: A history of the Tasmanian forest campaigns* (Gee 2001) and *Forest Giants: Timbergetting in the New South Wales Forests 1800-1950* (Hannah 1986). These are complemented by publications such as those that focus principally on the logging in state forests in one state (e.g. Cubit 1996; Merrick 1995; Rowland 1992; Taylor 1994; Wallace 1971), those that sweep across the continent (e.g. Dargavel 1995; Norton and Dovers 1994; Routley and Routley 1973; Rule 1967; Williams and Woinarski 1997), and those that promote a new experience, with such titles as *The Gift of the Forest* (Brissenden and Brissenden 1982), *Australia's Eucalypts* (Smith 1980) and *Trees of the Australian Bush* (Worrell and Sourry 1967). The text you are reading now keeps its focus on forest fauna, even if the forest has been logged, farmed and fragmented, or whether it is on Crown land, or private land, or in remote parts of the Northern Territory (e.g. Woinarski 2004) or suburban Brisbane, where thousands of people share the Squirrel Glider's habitat (Goldingay and Sharpe 2004). It is the fauna, not the forest, that sets the boundary. This can be rephrased by saying that it is yesterday's forest, and not today's forest, that is the frame of reference for today's fauna.

### Reserve selection and conservation planning: necessary but not sufficient

Bierregaard *et al.* (1997) were not convinced by the value of existing reserve design algorithms for protected areas, yet it is this author's view that the work by Pressey *et al.* (1996, 2000, 2002, 2004), Margules and Pressey (2000), Cowling and Pressey (2003), Lombard *et al.* (2003) and Ferrier *et al.* (2000) should dispel any concern about the relevance of reserve selection research. Pressey *et al.* (2002) concluded that two major challenges for conservation decisions in forested north-eastern NSW are common to conservation planning generally. These challenges are the need to "focus protection within public tenure on habitats and species most vulnerable to threatening processes such as logging" and "to provide effective conservation management on private lands where loss of native vegetation continues". Thus, through the investigative process of reserve selection, the same general conclusions have emerged as have been revealed by zoological investigations into our forest fauna. The differences emerge in the area of where our research effort should be applied. This is recognised in such reviews as *Biodiversity conservation research: Australia's priorities* (ANZECC/BDAC 2001), which identified that these research strands are complementary, not either-or approaches. The rigour and scope of this reserve selection work has greatly enhanced what was already a great concept for wildlife, namely the protection of areas through reservation in the secure status conferred by dedication as national parks and nature reserves (Lunney and Recher 1986, Lunney 1998). Notwithstanding, this is insufficient on its own, as recognised by Pressey *et al.* (2000). They concluded that three things are needed for better fauna conservation: better data, better procedures for identifying and protecting priority conservation areas, and better measures of effectiveness.

Pressey *et al.* (2000) noted that much of the public debate in late 1998 over the expansion of the reserve system was pre-occupied with the wrong numbers, namely, the 85 new reserves with a total area of 360,000 ha. Neither figure, they pointed out, was necessarily related to progress in protecting species or environments that actually need protection. Progress was related to the area added to the reserve system that would otherwise be logged or cleared for agriculture or urban growth. They add that clearing was a minimal threat in the context of north-eastern NSW because the new reserves were being drawn only from public land. This point is central to their concerns because public land is already a skewed sample of all lands, exhibiting a high degree of ruggedness and a low degree of inherent land-use potential. They noted that the criteria for measuring progress in reservation are not well developed in Australia and that this problem reflects a worldwide emphasis on assessing the effectiveness of reserve systems in terms of their representativeness, *i.e.* the portion of regional or national biodiversity patterns that are reserved. These astute observations, based on detailed quantitative analyses, allow others to draw additional conclusions. This line of research is new in the world of wildlife conservation and its value and limitations have yet to be absorbed.

Pressey *et al.* (2000) drew comparisons with a series of papers in a 1990 theme edition of the *Australian Zoologist*, entitled *Nature Conservation Debate: Bats, National Parks and State of the Nation* (Lunney 1990). These papers, prepared by key players in reserve selection in NSW, described both the opportunities and limitations in how reserve selection had operated over the preceding 30 years. Pressey (1990) too had a paper in that edition, with the reverberating phrase, "where to from here?" in its title. In an important sense, he has answered his own question at a level of skill that continues to make an international contribution to the subject. Nevertheless, in his 1990 paper, Pressey drew a number of conclusions that are as yet to be addressed: the likelihood of conserving all the remaining natural environments and native species in the state is decreasing rapidly as clearing, woodchipping and other land uses reduce biodiversity and limit the choices available for reserving it; and the primary needs for improving the database for reserve planning are the mapping of natural environments, surveying the distribution and abundance of species and researching their habitat requirements. The concern in these two points about native species, particularly central aspects of their ecology, remains to be addressed. The intellectual revolution in computer technology and the modelling for reserve selection has left the pursuit of detailed species studies in the dark. Indeed, it is the nocturnal and/or the cryptic habits of forest fauna that contribute to this problem. Forest animals are hard to study or, more precisely, it takes time, which is a scarce resource, to acquire the data that Pressey identified as necessary for future reserve selection procedures. In lieu of such studies, expert teams have worked to estimate population sizes and area requirements both in and out of possible reserve options, but these estimates fall well short of Pressey's original call for species-specific data. As Pressey

*et al.* (2000) concluded, the principle of adequacy is only partly addressed by targets for representation in protected areas. It also requires consideration of many other factors that influence the persistence of species within established reserves. Thus, an important conclusion from the work of Pressey, and the teams with which he has worked, is that forest fauna cannot rely solely on the reserve system for its long-term survival. Reserves, and all the current selection criteria that go with them are, as Pressey has counselled a number of times, necessary but not sufficient.

We need to note the caution by Pressey *et al.* (2002) that off-reserve conservation measures in north-eastern NSW vary widely in terms of security, *i.e.* the ease of their removal, and effectiveness, *i.e.* the prevention of threatening processes, and they are also biased towards steep and infertile areas. Hence, advocating better management of the matrix was never going to be an easy solution. We also need to note that those who push for better management of the matrix, such as Lindenmayer and Recher (1998) and Lindenmayer and Franklin (2002), do so as ecologists with a long record of studies of individual forest species. The conclusion drawn is that an adaptive management program, focused on the ecology of the forest fauna itself, will yield results that will support reserve selection procedures and provide the measures of efficiency that Pressey *et al.* (2000, 2002) and Cowling and Pressey (2003) have called for, and better manage the matrix as expressed by Craig *et al.* (2000), Lindenmayer and Franklin (2002), Lindenmayer and Recher (1998), Harris and Harris (1991) and McAlpine *et al.* (2002).

There is another problem facing those who are concerned about conserving forest fauna and want to see how the big picture is constructed. That problem is the one of aggregated data, data that have been pooled to such a high degree that it masks the messages, and trends cannot be quickly picked up. This occurs when just one figure is presented for the status for biodiversity conservation. This problem can arise all too easily when indicators are relied on heavily, as they are for state and national reports. Backhaus *et al.* (2002) concluded that most available indicators are conceived as statistical parameters that do not reflect any specific spatial distribution. Sustainability indicators are required for political and operational purposes, including problem recognition and awareness, but most indicators are highly aggregated data sets with little or no underlying spatial distribution. They concluded that the sustainability of landscapes needs spatially explicit indicators at the regional level that relate to ecologically functional landscape units. To those for whom the forest/farm matrix matters (*e.g.* Craig *et al.* 2000; Lindenmayer and Franklin 2002), or those who are by inclination spatially explicit in their studies, such as McAlpine and Eyre (2002) in their study of Yellow-bellied Gliders *Petaurus australis* in fragmented forests, this conclusion would come as no surprise. The need to be specific about where the problems lie is particularly applicable to forested coastal Australia where the human population continues to grow, build houses, own dogs, drive cars and demand that authorities reduce the undergrowth and logs (for which one can read habitat) to minimize bushfire risk.

Those who have read *Future Dilemmas* (Foran and Poldy 2002; Lunney 2002, 2003) will see a distressing future for our resources and our environment as the Australian population continues to grow. It is that sense of the future, with its crushing human impact, that lies behind the drive to create more reserves with secure tenure, namely national parks. Yet, as necessary as reserves are to conserve our forest fauna, they are not sufficient to conserve Australia's fauna into the future. What also emerges as obvious to those who recognise that the human population of Australia hugs the coast is that aggregated data on the human population size, lists of threatened species, area of national parks and remaining area of forest do not tell the whole story. Spatially explicit data are essential for managing the forest/farm matrix, and these data need to be combined with spatially explicit information on movement patterns, home ranges and location and quality of food sources, drought and fire refuges, fire regimes, and the likely effects of climate change in different forested regions on forest fauna species. There is much research to do to reach that stage, but the research that has been done, examples of which are displayed in this book, shows what is needed and the effort that is required (*e.g.* Burnett and Marsh 2004; Craig 2004; Jones *et al.* 2004; Moore *et al.* 2004; Rankmore and Price 2004; Rhind 2004; Tasker and Dickman 2004; Vanderwoude and Johnson 2004; Winter 2004).

The engaging Leadbeater's possum *Gymnobelidius leadbeateri*, an endemic Victorian species, has been put forward as a test case for sustainable forestry in Lindenmayer's (1996) clearly-presented book *Woodchips and Wildlife*. Lindenmayer's tantalising juxtaposition of these two words was one posed by Recher *et al.* (1981) as a head-on conflict in *Woodchips or wildlife*. On the back cover of Lindenmayer's book, this same tough question is also asked: "can we reconcile the conflicting goals of logging and the conservation of wildlife?" Answering that question for Leadbeater's possum has been both a monumental challenge and an equally epic achievement, and the world has been the beneficiary of both the detail and the general principles that have emerged (*e.g.* Lindenmayer and Franklin 2002, 2003). This research also demonstrates the high level of work that is required to study one species. This effort needs to be repeated for a wide range of forest species across Australia. The research that has been done, such as presented in this edition, demonstrates the value of studying different species in different places, as well as the contribution from different approaches to the problems (*e.g.* Brennan and Majer 2004; Catling and Coops 2004; Green *et al.* 2004; Law 2004; Milledge 2004; Moran *et al.* 2004; Munks *et al.* 2004; Smith 2004).

## Deforesting the Earth

*Deforesting the Earth: from prehistory to global crisis* looks like the headline of a sensational leaflet putting the case for one interest group. In fact, beneath the arresting title is the scholarly text of an historical geographer (or an environmental historian) with a global reach and a time span that looks back to the end of the last ice age (Williams 2003). Williams observed that deforestation is as old as the human occupation of the earth and posited



the idea that more of the earth's surface has been affected by this process than any other single resource-converting activity. He finished his account with a few telling remarks. The topic of deforestation rates he found to be under-researched, and noted it was difficult to separate the rhetoric from the reality, whether dealing with reforestation, climate change, or the truth of reduced biodiversity. In the developed world, Williams claims, the wrong culprits, such as iron-making, shipbuilding or railway enterprises, were the deforestation scapegoats, whereas land clearing for permanent agriculture was so normal that it was excused, overlooked or ignored. This sounds familiar to Australian ears, as noted, for example, in the final report on forest use by the ESD working groups (Commonwealth of Australia 1991). Williams' closing sentence in his book has a sting that he may not have intended. He mused that, in "a decade or so, perhaps another chapter will have to be written, outlining how humans grappled with the problems of the use and abuse of their incomparable heritage, a green, global mantle of forest". The sting is the time span – a decade or so. Is Williams really saying that the rate of abuse of our global forest heritage is so great that in 10 years the changes will generate enough material for a new chapter in a history text that spans 10,000 years? The logic of his text says that it will, especially considering the likely impact of a growing human population, but one of the intuitive steps he takes is to consider all forest matters geographically and not be caught by numbers alone. His tract on Australia in this context is interesting.

Australia, says Williams (2003), was no different to other new countries where the settlers and timber-getters cut indiscriminately, and he cites the figure that the original forests of NSW had been reduced from 10.1 to 4.5 million ha by 1900. He commented that, "inevitably, the biographies of individual forests give a more detailed clue as to what was going on". Australian forest historians will agree and point to many studies (e.g. Dargavel *et al.* 2002). Williams noted that clearing was "brutal and complete" in the high rainfall areas containing rainforest and wet sclerophyll forest along the coasts of Queensland, NSW, Victoria and Western Australia, and that the expansion of dairying and the destruction of forests in both Victoria and NSW-Queensland had much to do with butter making, which flourished after the perfection of the refrigerator in 1880, and the railways that opened up these regions. Australia, he noted, had also become "enmeshed" in the global timber trade, a point expanded upon in detail by Penna (2004).

Williams (2003) was troubled by the difficulty of separating the rhetoric from the reality in relation to the truth of reduced biodiversity. Where would he go to find out the truth in relation to Australia's forest fauna? If he were to read the *Australia's State of the Forests Report 2003* (National Forest Inventory 2003) and the biodiversity theme report of the Commonwealth State of the Environment report (Williams *et al.* 2001) he would be dealing with the truth, but not necessarily the insight that truth should arguably provide.<sup>2</sup> The reports on species' status do not necessarily reflect the

associated conflicts, nor are there projections on rates of change and probabilities of extinction or recovery. Yet such matters are of central concern if one is trying to conserve fauna on time scales that are commensurate with the slow rate at which forests regrow, or if one considers the difficulties of restoration (Catterall *et al.* 2004; Paton *et al.* 2004).

Viewpoints matter, they are valid expressions of preferences, and they reflect changes in society over the decades and centuries. One should also point out that strong words appear in this book but, it can be argued, their inclusion can be justified as being the logical outcome of each author's research (e.g. Calver and Wardell-Johnson 2004; Flint *et al.* 2004; Lindenmayer and Gibbons 2004; Meek 2004; Parnaby and Hamilton-Smith 2004; Smith 2004). There has been no retreat from tough conclusions in this edition, but also no chapter survived the refereeing process with unsupported statements. Opinions were encouraged (Williams 2003 has a delightful collection of his own), but the case had to be built on science that could stand being tested. Could you write a brief summary of this book for Williams to incorporate into his additional chapter? If you undertook that exercise you would be confronted by a number of questions of scope, such as: would you include the land once occupied by the rainforests where the clearing has been "brutal and complete"?; would you include the fauna that appears to be secure in national parks?; and would you include common species, species that lived beyond forests, and spiders, snails and flies as well as the Koala? The eclectic editor of this book would do so, and the major challenge, such as scope, is to see the landscape ecologically through the lives of the animals. In this case, the word "forest" must be applied to the animals, not the vegetation as seen through a satellite, or even on the ground, whether it is a dairy farm, a logged coupe, a city commons or the core of a nature reserve. These ideas emerge from chapters as diverse as Banks and Taylor (2004), Braithwaite (2004), English (2004), Martin and Martin (2004), Moore *et al.* (2004), Milledge 2004, Moran *et al.* (2004), Stanisic and Ponder 2004, Strehlow *et al.* (2004) and Woinarski (2004).

## Australia is a miniature planet

"Australia is a miniature planet: its ecosystems work on different principles from the rest of the globe." Rackham (2003) made that grandiloquent remark in the most recent of his long succession of scholarly works: *Ancient Woodland: its history, vegetation and uses in England*. Oliver Rackham visited Australia in 1996 to attend an Australian Forest History Conference (Rackham 1997), which was well within his academic territory. He also came to see some Australian forests which were, judging from the preceding quote, way outside his working experience. In our visit to Mumbulla State Forest, a coastal forest near Bega in south-eastern NSW, he was much struck by the proliferation of plants flowering in a coupe that had been logged for woodchips and sawlogs about two years earlier. In Rackham's (2003) words: "Seedling silvertop ash and sprouts of other eucalypts, exhibiting their colourful and

<sup>2</sup> A special skill is needed to read some of these bureaucratic writings, as Watson (2003) has amusingly pointed out in *Death Sentence: the decay of public language*.

paradoxical juvenile leaves, proliferate among shrubs, tall herbs, climbers, and grasses, species of *Bursaria*, *Goodenia*, *Pimelea*, *Solanum* and *Senecio*, with bracken the sole reminder of Europe". This glorious sense of the vegetation in a logged burnt coupe is hardly the stuff of a hostile attack on forest managers or on logging as a legitimate activity in a forest. It does show a quick appreciation of the dynamics of forest vegetation. It gives another view from another planet, a glimpse of a woodchip battleground through the eyes of someone who considers the history of each forest (or wood if you are English).

Rackham continued with his observations: "In three rotations of felling and regrowth a eucalyptus forest has thus turned into something like a coppice-wood, complete with coppicing flora. The illusion is completed by the big eucalyptus stools in later stages of regrowth". What is fascinating is to stand in a forest that you think you know (e.g. Lunney and Moon 1988) and see it in English terms as a coppice-wood, and let yourself be taken beyond the frame of reference in which you have been working. His next sentence is more elliptical: "It may not be particularly good as animal habitat because around ten years' growth it passes through a densely shading phase, which is unnatural for eucalyptus woodland". What Rackham did not write, but did comment on at the time, was how that regrowth might be managed. He said that a forester in England would be expected to actively manage the regrowth, such as by thinning. What is not clear is how long the "unnatural" densely shading phase would last. On a short logging cycle, envisaged as 40 years in earlier management plans (e.g. Forestry Commission 1982), the unnatural phase is likely to be the dominant forest phase for most of the logged coupes in the woodchip forests of the region. Thus, while retention of old-growth forest, such as in national parks, has dominated the woodchip debate so far, the next phase must include the management of the regrowth. Its characteristics as fauna habitat have yet to be carefully studied over the long-term, and this problem is not peculiar to the Eden region of south-eastern NSW. Rackham concluded his observations with the question: "Did English coppices pass through a stage like this in their prehistoric evolution from wildwood?" One could rephrase the question and ask whether the current regrowth forest in Mumbulla State Forest is in a prehistoric evolutionary phase? A point that such a question throws up is that the phases of the regrowth will take a period of time that far exceeds any current knowledge of the faunal attributes of regrowth eucalypt forests.

The guidance that Rackham provides is to see each forest as a unique entity, with its own history, including its pre-European history, and each deserving of special study. This may seem to be a bizarre challenge for those managing our forests, including those in national parks and nature reserves and on private land, but by comparison with England, where each old forest is precious in a landscape that has been so modified by millennia of cultural change, we are hardly in time to begin such an exercise here in Australia. The dedication of a piece of forest as a national park is an admirable approach to conservation as it is one that prohibits commercial use of forest products, but it is not the only useful approach to the conservation of forests

or their fauna, or its many other values. If Rackham is right in describing Australia as a miniature planet, then we have the responsibility of determining the future of this miniature planet. We cannot go elsewhere and start again if we fritter away this opportunity, an ethic that lies behind such apparently different chapters as those by Belcher (2004), Coughlan and Pearson (2004), Lemckert and Slatyer (2004), Parnaby and Hamilton-Smith (2004), Paton *et al.* (2004), Penna (2004), Recher (2004) and Winter (2004).

## A touch of shameless idealism

On the opening page of the final chapter in *Our forests...our future* (Salim and Ullsten 1999) is a quote from *Tomorrow Magazine*: "A touch of shameless idealism may yet prove to be the most pragmatic launch-pad for building a sustainable future". This was the guiding spirit as the report came to grips with the recognition by the World Commission on Forests and Sustainable Development (Salim and Ullsten 1999) that forests are used as if they had only limited purposes. The report noted that, in doing so, forest lands are being squandered through subsidised activity and wholly marginal uses without concern for sustaining the human need for a stable environment. It is evident, the report concluded, "that societal values, economic policies, political realities, governance arrangements, and ethics – or lack thereof – underpin and permit that wastage". The report added that there is reason for hope, and that the Commission was impressed by the work and range of initiatives by individuals, community groups, forest scientists and managers, and by civil society organizations, and that governments were doing some things, if not enough, and that some corporations are adjusting to a new threshold of performance. The report urged that we exercise the will and exert the effort to take the radical steps needed to develop a whole new culture and ethic of sustainability.

The report presented 10 resolutions that call for more than technical adjustments in forestry practices and concluded that we may not have a second chance, so the fate of the forests is in our hands. In identifying the importance of forests, the report noted that, despite the emphasis on the economic value of forests and their local and ecological importance, forests are universally significant for their planetary functions. Not surprisingly, the report stressed that the benefits of global environmental services are shared by all societies, collectively and indivisibly. Forests, the report noted, contained at least two-thirds of the earth's terrestrial species. This second edition of *the Conservation of Australia's Forest Fauna* focuses on Australia's rich share of that international heritage and seeks to conserve Australia's forest fauna as part of a larger enterprise of conserving Australia's natural legacy.

## Acknowledgments

I am indebted to many friends and work colleagues over decades for enthusiastic discussions, information and support. I am grateful for comments on a draft of this chapter by Shelley Burgin, Irina Dunn, Clive Hamilton, Alison Matthews and Bob Pressey.

## References

(Note: those references in the text with a 2004 date that are not in listed below are chapters in this book and they can be found on the contents page.)

- Ananda, J. and Herath, G. 2003.** The use of Analytic Hierarchy Process to incorporate stakeholder preferences into regional forest planning. *Forest Policy and Economics* 5: 13-26.
- Archer, M. 2002.** Confronting crises in conservation: a talk on the wild side. Pp. 12-52 in *A Zoological Revolution. Using native fauna to assist in its own survival*, edited by D. Lunney and C. Dickman. Royal Zoological Society of NSW, Mosman, NSW, Australia.
- Archer, M. and Beale, B. 2004.** *Going Native. Living in the Australian environment.* Hodder Headline, Sydney, Australia.
- Archer, M., Hand, S. J. and Godthelp, H. 1991.** Back to the future: the contribution of palaeontology to the conservation of Australia's forest faunas. Pp. 67-80 in *Conservation of Australia's Forest Fauna*, edited by D. Lunney. Royal Zoological Society of NSW, Mosman, NSW, Australia.
- ANZECC. 1988.** *National Koala Conservation Strategy.* Environment Australia, Canberra, ACT.
- ANZECC/BDAC. 2001.** *Biodiversity Conservation Research: Australia's Priorities.* Environment Australia, Canberra, ACT, Australia.
- Backhaus, R., Bock, M. and Weiers, S. 2002.** The spatial dimension of landscape sustainability. *Environment, Development and Sustainability* 4: 237-51.
- Bierregaard, R. O. Jr, Laurance, W. F., Sites, J. W., Lynam, A. J., Didham, R.K., Andersen, M., Tocher, M. D., Smith, A. P., Viana, V. M., Lovejoy, T. E., Sieving, K. E., Kramer, E. A., Restrepo, C. and Moritz, G. 1997.** Key Priorities for the study of fragmented tropical ecosystems. Pp. 515- 526 in *Tropical Forest Remnants. Ecology, management, and conservation of fragmented communities*, edited by W. F. Laurance and R. O. Bierregaard Jr. University of Chicago Press, Chicago, USA.
- Bonyhady, T. 1997.** Primeval forests in Australia. Pp. 24-34 in *Australia's Ever-Changing Forests III*, edited by J. Dargavel. CRES publications, Australian National University, ACT, Australia.
- Bonyhady, T. 2000.** *The Colonial Earth.* Melbourne University Press, South Carlton, Victoria.
- Borschmann, G. (ed.). 1999.** *The People's Forest. A living history of the Australian bush.* The People's Forest Press, Blackheath, NSW, Australia.
- Bradstock, R., Auld, T. D., Keith, D. A., Kingsford, R. T., Lunney, D. and Sivertsen, D. P. (eds). 1995.** *Conserving Biodiversity: threats and solutions.* Surrey Beatty and Sons and National Parks and Wildlife Service, Chipping Norton, NSW, Australia.
- Bradstock, R. A., Williams, J. E. and Gill, A. M. (eds). 2002.** *Flammable Australia: fire regimes and biodiversity of a continent.* Cambridge University Press, Cambridge, UK.
- Brissenden, R. and Brissenden, R. 1982.** *The Gift of the Forest.* Currey O'Neil, Australian Conservation Foundation Publishers, South Yarra, Victoria.
- Brooks, T. M., da Fonseca, G. A. B. and Rodrigues, A. S. L. 2004.** Protected areas and species. *Conservation Biology* 18: 616-18.
- Bunnell, F. L. 1999.** Foreword. Let's kill a panchreston. Giving fragmentation meaning. Pp. vii-xiii in *Forest Fragmentation: wildlife and management implications*, edited by J. A. Rochelle, L. A. Lehmann and J. Wisniewski. Brill, Leiden, Netherlands.
- Carron, L. T. 1985.** *A History of Forestry in Australia.* Australian University Press, Pergamon Press, Rushcutters Bay, NSW, Australia.
- Carron, L. T. 1988.** The state of knowledge of the history of public forests and forestry in Australia. Pp. 217-21 in *Australia's Ever Changing Forests. Proceedings of the First National Forest History Symposium*, edited by K. Frawley and N. Semple. Australian Defense Forces Academy, Campbell, ACT, Australia.
- Cary, G., Lindenmayer, D. and Dovers, S. 2003.** Research and policy priorities: a synthesis. Pp. 252-65 in *Australia Burning: fire ecology, policy and management issues*, edited by G. Cary, D. Lindenmayer and S. Dovers. CSIRO Publishing, Collingwood, Victoria, Australia.
- Chikumbo, O., Spencer, R. D., Turner, B. J. and Davey, S. M. 2001.** Planning and monitoring forest sustainability: an Australian perspective. *Australian Forestry* 64: 1-7.
- Commonwealth of Australia. 1991.** *Ecologically Sustainable Development Working Groups. Final Report – Forest Use.* November 1991. Australian Government Publishing Service, Canberra, Australia.
- Commonwealth of Australia. 1992.** *National Forest Policy Statement. A new focus for Australia's forests* (second edition). Australian Government Publishing Service, Canberra, Australia.
- Cowling, R. M. and Pressey, R. L. 2003.** Editorial. Introduction to systematic conservation planning in the Cape Floristic Region. *Biological Conservation* 112: 1-13.
- Craig, J., Mitchell, N. and Saunders, D. A. (eds). 2000.** *Nature Conservation in Production Environments: Managing the matrix.* Surrey Beatty and Sons, Chipping Norton, NSW, Australia.
- CSIRO. 2004.** <http://www.ecosystemsproject.org/html/aboutus/index.htm>, accessed 15 July 2004.
- Cubit, S. 1996.** *Recollections from the forest: 75 years of forest service in Tasmania.* Forestry Tasmania, Hobart, Tasmania, Australia.
- Dargavel, J. 1995.** *Fashioning Australia's forests.* Melbourne University Press, South Melbourne, Victoria, Australia.
- Dargavel, J. 1998.** Replanning the forests. *Australian Journal of Environmental Management* 5: 24.
- Dargavel, J. 1998a.** Politics, policy and process in the forests. *Australian Journal of Environmental Management* 5: 25-30.
- Dargavel, J., Gaughwin, D. and Libbis, B. (eds). 2002.** *Australia's Ever-changing Forests V: Proceedings of the Fifth National Conference on Australian Forest History.* Centre for Resource and Environmental Studies, Australian National University, Canberra, Australia.
- Davey, S. M., Hoare, J. R. L. and Rumba, K. E. 2002.** Science and its role in Australian regional forest agreements. *International Forestry Review* 4: 39-55.
- Dovers, S. R. 2000.** On the contribution of environmental history to current debate and policy. *Environment and History* 6: 131-50.
- Dovers, S. R. (ed.). 2000a.** *Environmental History and policy. Still settling Australia.* Oxford University Press, South Melbourne, Victoria, Australia.
- Ferrier, S., Pressey, R. L. and Barratt, T. W. 2000.** A new predictor of the irreplaceability of areas for achieving a conservation goal, its application to real-world planning, and a research agenda for further refinement. *Biological Conservation* 93: 303-25.

- Flannery, T. F.** 1994. *The Future Eaters*. Reed Books, Port Melbourne, Victoria, Australia.
- Foran, B. and Poldy, F.** 2002. *Future Dilemmas. Options to 2050 for Australia's population, technology, resources and environment*, available as a 61-page summary, "Dilemmas distilled" or as the full 337-page report ([www.cse.csiro.au/futuredilemmas](http://www.cse.csiro.au/futuredilemmas)).
- Forestry Commission of NSW.** 1982. *Eden native forest management plan*. Forestry Commission of NSW, Sydney, Australia.
- Gee, H.** 2001. *For the Forests. A history of the Tasmanian forest campaign*. Wilderness Society, Hobart, Tasmania, Australia.
- Griffiths, T.** 2001. *Forests of Ash. An environmental history*. Cambridge University Press, Cambridge, UK.
- Grigg, G.** 2002. Conservation benefit from harvesting kangaroos: status report at the start of a new millennium. A paper to stimulate discussion and research. Pp. 53-76 in *A Zoological Revolution. Using native fauna to assist in its own survival*, edited by D. Lunney and C. Dickman. Royal Zoological Society of NSW, Mosman, NSW, Australia.
- Hamilton, C.** 2001. *Running from the storm. The development of climate change policy in Australia*. University of NSW Press, Sydney, NSW, Australia.
- Hamilton, C.** 2003. *Growth Fetish*. Allen & Unwin, Australia.
- Hamilton, C.** 2003. The Resource Assessment Commission: lessons in the venality of modern politics. Pp. 117-32 in *Managing Australia's Environment*, edited by S. Dovers and S. Wild River. The Federation Press, Annandale, NSW, Australia.
- Hamilton, C. and Glyde, P.** 1991. Management of Australia's forest fauna: the contribution of new economic approaches. Pp. 41-51 in *Conservation of Australia's Forest Fauna*, edited by D. Lunney. Royal Zoological Society of NSW, Mosman, NSW, Australia.
- Hannah, H.** 1986. *Forest Giants. Timbergetting in the New South Wales forests 1800-1950*. Forestry Commission of NSW, Sydney, NSW, Australia.
- Harris, E. and Harris, J.** 1991. *Wildlife Management in Managed Woodlands and Forests*. Basil Blackwell, Oxford, UK.
- Hnatiuk, R., Tickle, P., Wood, M. S. and Howell, C.** 2003. Defining Australian forests. *Australian Forestry* 66: 176-83.
- Hunter, M. L.** 1990. *Wildlife, Forests and Forestry: principles of managing forests for biological diversity*. Prentice Hall, Englewood Cliffs, New Jersey, USA.
- Keith, D.** 2004. *Ocean Shores to Desert Dunes: The Native Vegetation of New South Wales and the ACT*. Department of Environment & Conservation (NSW), Hurstville, Australia.
- Kirkpatrick, J.** 1994. *A Continent Transformed. Human Impact on the Natural Vegetation of Australia*. Oxford University Press, South Melbourne, Victoria, Australia.
- Kirkpatrick, J. B.** 1998. Nature conservation and the Regional Forest Agreement process. *Australian Journal of Environmental Management* 5: 31-37.
- Knott, T., Lunney, D., Coburn, D. and Callaghan, J.** 1998. An ecological history of Koala habitat in Port Stephens Shire and lower Hunter on the central coast of New South Wales, 1801-1998. *Pacific Conservation Biology* 4: 354-68.
- Lane, M. B.** 1999. Regional Forest Agreements: resolving resource conflicts or managing resource politics. *Australian Geographical Studies* 37: 142-53.
- Lane, M. B.** 2003. Decentralization or privatization of environmental governance? Forest conflicts and bioregional assessments in Australia. *Journal of Rural Studies* 19: 283-94.
- Laurance, W. F. and Bierregaard, R. O. Jr. (eds).** 1997. *Tropical Forest Remnants. Ecology, management, and conservation of fragmented communities*. University of Chicago Press, Chicago, USA.
- Lindenmayer, D.** 1996. *Woodchips and Wildlife*. University of NSW Press, Sydney, NSW, Australia.
- Lindenmayer, D. B. and Franklin, J. F.** 2002. *Conserving Forest Biodiversity: a comprehensive multiscaled approach*. Island Press, Washington, USA.
- Lindenmayer, D. B. and Franklin, J. F. (eds).** 2003. *Towards Forest Sustainability*. CSIRO publishing, Collingwood, Victoria, Australia.
- Lindenmayer, D. B. and Recher, H. F.** 1998. Aspects of ecologically sustainable forestry in temperate eucalypt forests – beyond an expanded reserve system. *Pacific Conservation Biology* 4: 4-10.
- Lindenmayer, D., Claridge, A., Hazell, D., Michael, D., Crane, M., McGregor, C. and Cunningham, R.** 2003. *Wildlife on Farms. How to Conserve Native Animals*. CSIRO publishing, Collingwood, Australia.
- Lombard, A. T., Cowling, R. M., Pressey, R. L. and Rebelo, A. G.** 2003. Effectiveness of land classes as surrogates for species in conservation planning for the Cape Floristic Region. *Biological Conservation* 112: 45-62.
- Lunney, D.** 1990. Editorial. Nature conservation debate: bats, national parks and state of the nation. *Australian Zoologist* 26: 101-107.
- Lunney, D. (ed.).** 1991. *Conservation of Australia's Forest Fauna*. Royal Zoological Society of NSW, Mosman, NSW, Australia.
- Lunney, D.** 1991a. The future of Australia's forest fauna. Pp. 1-24 in *Conservation of Australia's Forest Fauna*, edited by D. Lunney. Royal Zoological Society of NSW, Mosman, NSW, Australia.
- Lunney, D.** 1992. The Resource Assessment Commission loses its nerve: the Forest and Timber Inquiry sidesteps an evaluation of the impact of forestry operations on forest fauna. *Australian Zoologist* 28: 23-7.
- Lunney, D.** 1998. The role of national parks and nature reserves as a field for science. Pp. 140-49 in *National parks: new visions for a new century*, edited by Peter Prineas. Nature Conservation Council of NSW, Sydney, Australia.
- Lunney, D.** 1999. A changing land-use ethic: the inheritance and the legacy. *Habitat* 27 (6): 19.
- Lunney, D.** 2002. *Future dilemmas* for argumentative conservation biologists. *Pacific Conservation Biology* 8: 145-6.
- Lunney, D.** 2003. Thoughts on good writing and the recent CSIRO Report Future Dilemmas. *Australian Zoologist* 32: 203-6.
- Lunney, D. and Leary, T.** 1988. The impact on native mammals of land-use changes and exotic species in the Bega District (New South Wales) since settlement. *Australian Journal of Ecology* 13: 67-92.
- Lunney, D. and Matthews, A.** 2002. Ecological changes to forests in the Eden region of New South Wales. Pp. 289-310 in *Australia's Ever-changing Forests V: Proceedings of the Fifth National Conference on Australian Forest History*, edited by J. Dargavel, D. Gaughwin and B. Libbis. Centre for Resource and Environmental Studies, Australian National University, Canberra, Australia.
- Lunney, D. and Moon, C.** 1988. An ecological view of the history of logging and fire in Mumbulla State Forest on the south coast of New South Wales. Pp. 23-61 in *Australia's Ever Changing Forests. Proceedings of the First National Forest History Symposium*, edited by K. Frawley and N. Semple. Australian Defense Forces Academy, Campbell, ACT, Australia.

- Lunney, D. and Moon, C. 1997.** Flying foxes and their camps in the remnant rainforests of northeastern New South Wales. Pp. 247-77 in *Australia's Ever-Changing Forests III*, edited by J. Dargavel. CRES publications, Australian National University, ACT, Australia.
- Lunney, D. and Recher, H. 1986.** The living landscape. An ecological view of national parks and nature conservation. Pp 294-328 in *A Natural Legacy. Ecology in Australia*, edited by H. Recher, D. Lunney, I. Dunn. Pergamon Press, Rushcutters Bay, Australia.
- Lunney, D., O'Neill, L., Matthews, A. and Sherwin, W. B. 2002.** Modelling mammalian extinction and forecasting recovery: koalas at Iluka (NSW, Australia). *Biological Conservation* 106: 101-13.
- Lunney, D., Gresser, S.M., Mahon, P.S. and Matthews, A. 2004.** Post-fire survival and reproduction of rehabilitated and unburnt koalas. *Biological Conservation* in press.
- Mabey, R. 1994.** *Landlocked. In pursuit of the wild.* Sinclair-Stevenson, London.
- Margules, C. R. and Pressey, R. L. 2000.** Systematic conservation planning. *Nature* 405: 243-53.
- Martin, R. and Handasyde, K. 1990.** Translocations and the re-establishment of koala populations in Victoria (1944-1988): the implications for New South Wales. Pp 58-64 in *Koala Summit. Managing koalas in NSW*, edited by D. Lunney, C.A. Urquhart and P. Reed, National Parks and Wildlife Service (NSW), Sydney, NSW, Australia.
- McAlpine, C.A. and Eyre, T.J. 2002.** Testing landscape metrics as indicators of habitat loss and fragmentation in continuous eucalypt forests (Queensland, Australia). *Landscape Ecology* 17: 711-28.
- McAlpine, C. A., Lindenmayer, D. B., Eyre, T. J. and Phinn, S. R. 2002.** Landscape surrogates of forest fragmentation: synthesis of Australian Montreal Process case studies. *Pacific Conservation Biology* 8: 108-20.
- McDonald, R. C., Isbell, R. F., Speight, J. G., Walker, J. and Hopkins, M. S. 1990.** *Australian Soil and Land Survey Field Handbook* (second edition). Inkata Press, Melbourne, Victoria, Australia.
- Melzer, A., Carrick, E., Menkhorst, P., Lunney, D. and St John, B. 2000.** Overview, critical assessment, and conservation implications of koala distribution and abundance. *Conservation Biology* 14: 619-28.
- Merrick, J. R. (ed.). 1995.** *Proceedings of the Forest Resources '95 Conference.* Graduate School of the Environment, Macquarie University, North Ryde, NSW, Australia.
- Mobbs, C. 2003.** National forest policy and Regional Forest Agreements. Pp. 90-114 in *Managing Australia's Environment*, edited by S. Dovers and S. Wild River. The Federation Press, Annandale, NSW, Australia.
- National Forest Inventory. 2003.** *Australia's State of the Forests Report 2003.* Bureau of Rural Sciences, Canberra, Australia.
- Norton, T. W. and Dovers, S. R. (eds). 1994.** *Ecology and Sustainability of Southern Temperate Ecosystems.* CSIRO, Australia.
- Pressey, R. L. 1990.** Reserve selection in New South Wales: where to from here? *Australian Zoologist* 26: 70-75.
- Pressey, R. L. 2004.** Conservation planning and biodiversity: assembling the best data for the job. In review.
- Pressey, R. L., Ferrier, S., Hager, T. C., Woods, C. A., Tully, S. L. and Weinman, K. M. 1996.** How well protected are the forests of north-eastern New South Wales? – Analyses of forest environments in relation to formal protection measures, land tenure, and vulnerability to clearing. *Forest Ecology and Management* 85: 311-33.
- Pressey, R. L., Hager, T. C., Ryan, K. M., Schwarz, J., Wall, S., Ferrier, S. and Creaser, P. M. 2000.** Using abiotic data for conservation assessments over extensive regions: quantitative methods applied across New South Wales, Australia. *Biological Conservation* 96: 55-82.
- Pressey, R. L., Whish, G. L., Barrett, T. W. and Watts, M. E. 2002.** Effectiveness of protected areas in north-eastern New South Wales: recent trends in six measures. *Biological Conservation* 106: 57-69.
- Pressey, R.L., Watts, M.E. and Barrett, T.W. 2004.** Is maximizing protection the same as minimizing loss? Efficiency and retention as alternative measures of the effectiveness of proposed reserves. *Ecology Letters*, in press.
- Rackham, O. 1997.** European ideas of the age of forests. Pp. 11-23 in *Australia's Ever-Changing Forests III*, edited by J. Dargavel. CRES publications, Australian National University, ACT, Australia.
- Rackham, O. 2003.** (new edition). *Ancient Woodland: its history, vegetation and uses in England.* Castlepoint Press, Colvend, UK.
- Recher, H. F. 1999.** The state of Australia's avifauna: a personal opinion and a prediction for the new millennium. *Australian Zoologist* 31: 11-27.
- Recher, H. and Ehrlich, P. R. 1999.** Editorial. The essence of science: the social responsibility of communicating. *Pacific Conservation Biology* 5: 161-2.
- Recher, H. F., Hobbs, R. J. and Saunders, D. A. 2003.** Vision for a sustainable future. *Pacific Conservation Biology* 9: 1-2.
- Recher, H.F., Lunney, D., Smith, P. and Rohan-Jones, W. 1981.** Woodchips or Wildlife? *Australian Natural History* 20: 238-44.
- Reed, P. 1991.** An historical analysis of the changes to the forests and woodlands of New South Wales. Pp. 393-406 in *Conservation of Australia's Forest Fauna*, edited by D. Lunney. Royal Zoological Society of NSW, Mosman, NSW, Australia.
- Reed, P. and Lunney D. 1990.** Habitat loss: the key problem for the long-term survival of koalas in NSW. Pp 9-31 in *Koala Summit. Managing koalas in NSW*, edited by D. Lunney, C.A. Urquhart and P. Reed, National Parks and Wildlife Service (NSW), Sydney, NSW, Australia.
- Resource Assessment Commission. 1992.** *Forest and Timber Enquiry Final Report.* Volumes 1 and 2A. Australian Government Publishing Service, Canberra.
- Resource Assessment Commission. 1992a.** *A survey of Australia's forest resource.* Australian Government Publishing Service, Canberra, Australia.
- Rochelle, J. A., Lehmann, L. A. and Wisniewski, J. (eds). 1999.** *Forest Fragmentation: wildlife and management implications.* Brill, Leiden, Netherlands.
- Rowland, M. (ed.). 1992.** *Sustainable forest management.* Board of Environmental studies, Occasional paper no. 18. University of Newcastle, Department of community programmes, Newcastle, NSW, Australia.
- Routley, R. and Routley, V. 1973.** *The Fight for the Forests.* Research School of Social Sciences, Australian National University, Canberra, ACT, Australia.
- Rule, A. 1967.** *Forests of Australia.* Angus and Robertson, Sydney, NSW, Australia.

- Ryan, M. F., Spencer, R. D. and Keenan, R. J. 2002.** Private native forests in Australia: what did we learn from the Regional Forest Agreement program. *Australian Forestry* 65: 141-52.
- Salim, E. and Ullsten, O. 1999.** *Our Forests, Our Future. Report of the World Commission on Forests and Sustainable Development.* Cambridge University Press, Cambridge, UK.
- Saunders, D. A., Craig, J. L. and Mattiske, E. M. (eds). 1996.** *The Role of Networks.* Surrey Beatty and Sons, Chipping Norton, NSW, Australia.
- Seddon, G. 1997.** *Landprints. Reflections on place and landscape.* Cambridge University Press, Oakleigh, Victoria, Australia.
- Slee, B. 2001.** Resolving production-environment conflicts: the case of the Regional Forest Agreement process in Australia. *Forest Policy and Economics* 3: 17-31.
- Smith, R. 1980.** *Australia's Eucalypts.* Currey O'Neil, Melbourne, Victoria, Australia.
- Stratford, E., Mazur, N., Lunney, D. and Bennett, D. 2000.** Managing the koala problem: interdisciplinary perspectives. *Conservation Biology* 14: 610-18.
- Specht, R. L., Roe, E. M. and Broughton, V. H. 1974.** Conservation of major plant communities in Australia and Papua and New Guinea. *Australian Journal of Botany* Supplementary series 7:1-667.
- Stubbs, B. J. and Specht, A. 2002.** Historical records of tree density in the 'Big Scrub'. Pp 253-73 in *Australia's Ever-changing Forests V: Proceedings of the Fifth National Conference on Australian Forest History*, edited by J. Dargavel, D. Gaughwin and B. Libbis. Centre for Resource and Environmental Studies, Australian National University, Canberra, Australia.
- Taylor, P. 1994.** *Growing up: forestry in Queensland.* Allen & Unwin, St Leonards, NSW, Australia.
- Terbough, J. 2004.** Reflections of a scientist on the World Parks Congress. *Conservation Biology* 18: 619-20.
- Tribe, J. 1998.** The law of the jungles: Regional Forest Agreements. *Environmental and Planning Law Journal* 15: 136-46.
- Wallace, W. R. 1971.** *Forestry in Western Australia.* William C. Brown, Government Printer, Western Australia, Australia.
- Watson, D. 2003.** *Death Sentence: the decay of public language.* Knopf. Random House, Milsons Point, NSW, Australia.
- West, C. 2002.** Contemporary issues in managing flying-fox camps: a publicly-documented conflict from Maclean on the north coast of NSW. Pp. 176-95 in *Managing the Grey-headed Flying-fox as a threatened species in NSW*, edited by P. Eby and D. Lunney. Royal Zoological Society of New South Wales, Mosman, NSW, Australia.
- Williams, J., Read, C., Norton, A., Dovers, S., Burgman, M., Proctor, W. and Anderson, H. 2001.** *Biodiversity, Australia State of the Environment Report 2001 (Theme Report).* CSIRO publishing on behalf of the Department of the Environment and Heritage, Canberra, Australia.
- Williams, J. D. and Woinarski, J. C. Z. (eds). 1997.** *Eucalypt ecology: individuals to ecosystems.* Cambridge University Press, Oakleigh, Victoria, Australia.
- Williams, M. 2003.** *Deforesting the Earth: from prehistory to global crisis.* University of Chicago Press, Chicago.
- Worrell, E. and Sourry, L. 1967.** *Trees of the Australian bush.* Angus and Robertson, Sydney, NSW, Australia.