

Wildlife management in New South Wales public forests: a personal history 1974-2004

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ABSTRACT

In my view, the wildlife in the State Forests of NSW in 2004 has the best and most secure management regime of any production forests in the world. The support for this view is based on the following account. Over the past 30 years I have been directly involved with the management of forest wildlife in NSW, North America and more recently on a global basis. Beginning with a background in wildlife management acquired through undergraduate studies and volunteer work in the field, I have been lucky enough to experience the changes in reality and paradigm with regard to the values of - and actions required for - successful management of forest wildlife. My experiences include membership of the Scientific Committee of the *Threatened Species Conservation Act 1995* in New South Wales and managing wildlife in the remaining 2 million hectares of native forest and 50 000 hectares of plantation for State Forest in NSW. Over that time I participated in the Spotted Owl *Strix occidentalis* issues of the 1980s and 1990s in the Pacific Northwest, the rainforest debate in Queensland and NSW in the early 1980s, and establishing early work on the distribution and abundance of vertebrates in southern NSW in the late 1970s and early 1980s. Most recently, I have participated in the writing and development of the National Forest Policy (early 1990s), the consequent Comprehensive Regional Assessments (CRAs), and the negotiations for the resultant Regional Forest Agreements (RFA). Finally, I have participated in the implementation of these RFAs in NSW, and tried to develop an economic force to deliver on global biodiversity management. In this brief and data free paper, I try to summarise those experiences in terms of the results for forest wildlife management and the delivery of biodiversity on a permanent and useful basis for future generations.

Key words: sustainable, wildlife, hollows, Threatened Species Legislation, Environmental Impact Statement, Forest Policy

Introduction

I intend to relate a personal account of the past 30 years of forest wildlife management in NSW in terms of my own experience. Of necessity, I present some background material from other Australian States, North America and elsewhere around the world, but the scope of this chapter is largely limited to the management and conservation of forests and woodlands of NSW. These experiences have led me to the conclusion that active, adaptive management which embraces diversity in nature is the most rational path for natural resource management, rather than attempts to stabilise, preserve and maintain selected biota and seral stages deemed to be "better" or "more at risk" than others. The experiences which give rise to this view follow in chronological order. This debate - preservation versus management - is not resolved by my account. However, by purposefully mentioning the people, authors, places and events I have been privileged enough to encounter, I hope to shed some light on the development of principles, practices and questions that will lead to the successful resolution of the challenges that face natural resource managers in the future.

Learning About Forest Wildlife 1973-77

Many readers of this chapter will not recall the time when there was little or no controversy about forest management with regard to wildlife in Australia, North America or Northern Europe, but such were the circumstances when

I began undergraduate studies at Kansas State University, Manhattan, Kansas, in 1970. Major threats to biodiversity (then an unknown term) were the use of insecticides (DDT and others exposed in "Silent Spring" by Rachael Carson 1963), human population growth (threats described in "The Population Bomb" by Paul Ehrlich (1968, 2nd ed. 1971) as a young professor at Stanford), whaling, and industrial pollution of the rivers, oceans and atmosphere.

My first exposure to forest wildlife management came when I received a grant to compare the avifauna of wilderness areas managed by the United States Department of Agriculture Forest Service in Wyoming to those used for forest production. My professor, Dwight D. Spencer, was intrigued with my choice of subject, obscure though it was at the time, and highly encouraged me. My studies found that more species of birds occurred in areas managed for forest production, as opposed to the mono-cultures of Lodge Pole Pine *Pinus contorta* that occurred in the Jim Bridger wilderness area of Wyoming. The forest openings created by disturbance were used by a wide variety of insectivores, birds of prey and game birds, while the lodge pole pine stands were home to a limited suite of mainly kinglets (2 species), chickadees (2 species) and the Grey Jay *Perisoreus canadensis*. This fitted with ecological theory of the time - diverse habitats support greater species richness (Odum 1969, Lack 1954). My findings were well received and I was encouraged to continue. There was little controversy with regard to the results and, indeed, little interest in the seminar

I presented, when compared with the passion to save the last few Whooping Cranes *Grus americana* from bombing by the US Navy (their sole wintering ground was partially within a bombing range), stopping the Japanese from harpooning the last few whales, and preventing multinational companies from continuing the broad scale use of DDT that threatened the Bald Eagle *Haliaeetus leucocephalus*, the Peregrine Falcon *Falco peregrinus* and almost every other species of carnivorous or piscivorous bird on the continent. Forest management had long been perceived as a simple matter of Smokey the Bear stamping out forest fires. It was not this simple, of course, and the beginnings of controversy were evident.

Wildlife management in forests over the past century had seen a concentration on game species, particularly deer (Family Cervidae) and game birds (Order Galliformes), which were well suited to the USDA Forest Service adage: "Good forest management is good wildlife management" (see Adams 1926). That is, deer and game birds find abundant resources in the open areas and regrowth stands managed for timber. Initial ventures into "non-game" wildlife management, such as my Lodge-pole Pine *Pinus contorta* study, gave credence to this theory in the coniferous forests that made up most of the Western estate managed by that agency. Species richness or related measures (the Shannon Weaver index, for instance) were taken as an indicator of high positive attributes for forests (Bernstein *et al.* 1991). Disturbance and openings were well suited to increasing species richness of these coniferous forests, which are known for their lack of diversity in the static and stable later stages of succession (Baur 1990, Andrewartha and Birch 1984). All would seem well in the world of forest wildlife management.

But there was something wrong with the old adage, as shall shortly be seen when I encounter some real-time challenges in managing and studying wildlife in production forests. In brief, the adage failed to consider long-term sustainability not only of (desirable) species diversity and richness, but with regard to specialists such as the Northern Spotted Owl *Strix occidentalis coarctata* (Bart and Porsman 1992). It also failed to consider the inherent value of whole ecosystems, and their global importance as a functional part of all life, particularly human society, on the planet. The dogma concerning wildlife and forestry was about to be severely challenged.

Wider exposure and a more complex view: 1977 - 81

The focus of my undergraduate interests was birds and ecology, and I started a Masters Degree centred on bird communities. In 1977, however, I received an offer I couldn't refuse: my old friend Walter Boles (now Collection Manager, Birds, Australian Museum) returned to Kansas from Australia, where he was working as a technical officer in the department he now heads. He asked me if I would be interested in coming to Australia to look for a new species of bird, a honeyeater, in the Clarke Range near Mackay, Queensland. I had a life long interest in travel in general and Australia in particular and accepted immediately.

This led to two things that were formative for me in regard to forest wildlife management. One was extensive travel and field work in the rainforests of eastern Australia, which were at the time subject to commercial logging in both NSW and Queensland. The other was association with the Curator of Birds at the Australian Museum, the inimitable John Disney and the manager of the then Environmental Studies department at that institution, Dr. Harry F. Recher. John Disney was investigating the bird populations in pine (*P. radiata*) plantations near Lithgow (Sunny Corner State Forest) and adjacent native forests. Harry Recher was involved in a study of the flora and fauna of the "Eden Woodchip Management Area" (FCNSW 1976, Recher *et al.* 1975). At the time, the major controversies over forest issues in Australia were rainforest logging, the conversion of native forest to pine plantations and the establishment of woodchip industries in Eden, Tasmania and Western Australia.

In search of the new honeyeater, I travelled to and from far north Queensland four times between 1978 and 1980. I met Hugh and Nan Nicholson and stayed at their newly established home and rainforest nursery when they were beginning to take an interest in the logging of nearby rainforests in the Kyogle area of northern NSW. With the Australian Museum, we camped at the Red Scrub, and were visited by the local forester, Col Nicholson, who was also an avid birdwatcher and former research forester. All three Nicholsons would play key roles in forest management over the next two decades. It became obvious that the logging of rainforest, certainly in northern New South Wales, was extremely controversial.

In November 1979 we found the undescribed species of honeyeater on private property and in Eungella National Park. Described by Boles and Longmore as the Eungella Honeyeater *Meliphaga hindwoodi* (now *Lichenotomus hindwoodi*), it is now well known from a limited area in that region (Longmore and Boles 1981, Shields 1984). Today, rainforest logging on public land has virtually ceased in Queensland, and habitat on private property is protected to some extent by state and federal legislation. The species features prominently in local ecotourism for bird watching. At about the same time, John Disney and Tony Stokes published their seminal paper on birds of pine and eucalypt forest, showing that bird species richness was limited in pine plantations (Disney and Stokes 1976). This paper was important because it addressed the assertion that "good forestry was good wildlife management" with regard to establishing pine plantations on former native forests in Australia. From their results, it was clear that species richness and numbers were lower in the pine plantations, particularly for specialists that require hollows for nesting or eucalyptus-related foraging resources, or both. Due to this and other similar studies, the environmental argument against clearing native forest to plant pine was won, and State Forests policy has been to establish pine plantations on previously cleared land since that time. Harry Recher's initial studies at Eden were used as a basis for establishing multiple use forests in that region, and the concept of "prescriptions to maintain wildlife" were introduced. It resulted in a decrease in the size of logging coupes (the area felled at one time) from 1000 hectares to much smaller areas (100 ha) (Recher *et al.* 1980).

The first protest rallies against rainforest logging were held in northern NSW at this time. Routley and Routley published their book, "The Fight for the Forests" (1974), detailing their objections to the pine plantation program, the woodchip industry, and harvesting of native forests in general. I obtained a job with State Forests - then the Forestry Commission of NSW - to work on a collaborative project with the Museum (Harry Recher and Greg Gowing) and NSW National Parks and Wildlife Service (Dan Lunney and Peter Smith), who were working on a NSW Cabinet directive to study the effects of woodchip logging on the fauna in the coastal forests near Bega. (Note - the Forestry Commission of NSW officially changed its trading name to State Forests after 1995, and I will use that name throughout this paper).

We were to further investigate the ecology of terrestrial vertebrate communities at Eden, and derive management guidelines for multiple use forests. The State Forests team of "wildlifers" comprised Wyn Jones, Rod Kavanagh and me. The State Forests research effort was not confined to wildlife. The Wood Technology and Forest Research Division, affectionately or not known as Wet Fred, contained silviculturists R.A. "Dick" Curtin and Ross Horne, hydrologists Peter Cornish and Steve Mackay, fire ecologist Bob Bridges, and soil scientists John Turner and Marcia Lambert. We were soon to be joined by botanist Doug Binns and herpetologist Gary Webb. Our task was to investigate what would now be termed the "landscape" effects of forestry operations.

The results of these initial investigations, with regard to wildlife, were published in the little green book known widely in NSW as Research Note 42 (Recher *et al.* 1980). Our results documented the distribution and abundance of birds, reptiles, amphibians and arboreal marsupials in the south-east forests, from Bega-Bermagui in the north to the Victorian border in the south and west up the escarpment to Bombala. The effects of logging were investigated, and found to be severe in the short term, with a relatively rapid recovery for most species - the notable exception being the arboreal marsupials. Our recommendations were to spread the operations in time and space (e.g. log alternate areas, with a return cycle of 20 years), put in place wildlife corridors, and cease conversion of native forests to pine plantations. We tried to incorporate other conservation measures, particularly the use of "buffer strips" for water quality protection into our recommendations, in what would today be termed "synergistic recommendations". These recommendations were taken up before the research note was published, and our new task was to investigate the efficacy of our recommendations and the long-term effects of logging. In effect, we were entering into the active adaptive style of management, and putting in place monitoring programs.

Other recommendations were made informally, and not taken up so quickly by the State Forests in NSW. In particular, we recommended that a wildlife ecologist should be part of the management team at Eden and other areas where operations were intense. Surveys for species particularly affected by logging, such as the arboreal marsupials, were recommended to occur ahead of

operations so that particular management initiatives could be taken to protect important populations. Investigations were recommended for little known species, such as the recently described Long-footed Potoroo *Potorous longipes*, as well as research into bats, amphibians, fish and other aquatic taxa. Retaining "habitat trees" within the net logging area (that is, within the area of forest that is harvested) at a greater rate was recommended (the standard of the day was 1 large seed tree per 15 ha) (FCNSW 1976), and we introduced the concept of recruit trees - younger trees retained to replace the habitat trees on a perpetual basis. Of note was the fact that, after consideration, we did not include the Koala in these recommendations, as the heuristic information and research current at the time indicated that the Koala may be compatible with native forest logging, although the species had not been studied in depth in the south-east forests (from discussion in litt., November 1980, H.F. Recher, D. Lunney, P. Smith, R. Kavanagh, J. Shields, W. Jones, Bondi Camp, southern NSW).

During this period, of course, research and management initiatives were being undertaken in other states. Victorian forest management was particularly relevant because of its proximity to the Eden operations. Few if any of our recommendations were taken up at the time by Victorian forest management for a variety of reasons (including political reality and intent). In some cases, different forest types (Mountain Ash *Eucalyptus regnans* in particular) meant different and more intense silvicultural regimes were highly efficient means of harvesting and growing wood (Lindenmayer *et al.* 1989). The effects of Victorian operations on fauna were studied intensively by Andrew Smith and later David Lindenmayer (Lindenmayer *et al.* 1989, 1990, 1991, 1993). Their results, and the effects of operations in Victoria, are often confused with the studies and management effects in NSW forests, a situation which continues to the present (2004).

At this time, I also reviewed legislation regarding wildlife in NSW, which seems trivial today, but it was seldom done in any detail in the early 1980s. The *Forestry Act 1916* (NSW) clearly stated that one purpose of the Act was to protect the natural values of forests, and "the birds and animals thereon". I found that it was illegal to "kill, take, disturb or pick" species listed as protected or threatened (on Schedule 12) of the *NSW National Parks and Wildlife Act 1974*. Through earlier work at the Australian Museum, I had contributed to the review of the threatened species Schedules, which were compiled in an *ad hoc* manner by experts at the time. The requirement to prepare environmental impact statements for developments that significantly affected the environment was introduced by another piece of NSW legislation (*Environmental Planning and Assessment Act 1979*). This was a new regulatory requirement which had not been used by government departments or private developers in NSW, although there were some precedents from the United States. I noted dutifully that State Forests might need a licence under the NPW Act - with regard to the provision that it is illegal to take, pick or kill flora and fauna, and that State Forests operations probably required some sort of Environmental Impact Statement (EIS) under the EPA Act.

Putting theory into practice 1982 - 87: lessons in reality

From 1982 to 1987, the research in State Forests continued to focus on the Eden Region, with some incursions into northern NSW and the rainforest debate. Wyn Jones moved on to become a ranger naturalist with NSW NPWS, where he took part in the discovery of the Wollemi Pine *Wollemia nobilis*. Rod Kavanagh, Gary Webb and I continued on in the Research Division. A wide range of other scientists started or continued work in the region too, particularly Wayne Braithwaite from CSIRO and Dan Lunney from NSW NPWS. Many publications resulted on the distribution and abundance of wildlife. The following studies are those I was particularly involved with in one way or another (egoism aside, these studies were the ones that I can most accurately describe).

Buffer strip study

My interests in ecology and birds, now augmented with an interest in making forest management work, led me along two different paths. Firstly, I was interested in solutions to the problems of maintaining wildlife populations in perpetuity across landscapes. This manifested in State Forest's first Wildlife Policy, co-written with Dick Curtin (FCNSW 1981). It became obvious that economics were involved; how much is wildlife worth compared to timber values? Secondly, I was interested in investigating how one could maintain populations of vertebrates in areas where the population size was severely reduced.

To investigate these questions, I enrolled in a graduate course at the Forestry Department of the Australian National University, under the supervision of Mick Tanton and Wayne Braithwaite (then a Principal Research Scientist at CSIRO Division of Wildlife and Ecology). My research assignments were two fold: write a 10 000 word essay on the economic value of wildlife in production forests, and investigate the necessary size and dimensions for wildlife corridors to maintain populations of sensitive vertebrates. Completing the former assignment led me to the clear understanding that wildlife has a real value, particularly in forests, but that this is seldom recognised in explicit economic terms. Completing the latter led me to investigate populations of arboreal marsupials remaining in buffer strips left primarily for hydrological purposes in the pine plantations at Bombala in southern NSW, adjacent to the Victorian Border.

In particular, I was interested in the survival and persistence of the Greater Glider *Petauroides volans* in the (relatively) thin strips of eucalypts through a young pine plantation. The Greater Glider is hollow dependent for dens during the day, and an obligate nocturnal folivore on eucalyptus leaves. There was no chance that individuals could survive in the young (2-8) year old pine plantations adjacent to the buffers strips, hence populations measured there would reflect true survivorship and persistence without bias from animals in adjoining native forests. I also undertook censuses of birds, Rod Kavanagh investigated small mammals and Gary Webb studied frogs and reptiles. This work was planned in 1981, and the field work was completed in the calendar year of 1982, with some spill over into the summer of 1983.

Analyses revealed that strips, 80 metres total width or greater, had populations of Greater Gliders that were not significantly different than similar areas of native forest in high quality habitat at Waratah Creek (Shields 1985, Recher *et al.* 1987). These results have been used to develop prescriptions for riparian vegetation to the present day (Shields and Johnson 1983).

The buffer strip study ended with a field trip in January 1983. Shortly thereafter, the northern edge of the Ash Wednesday fires burnt the entire plantation. A post-burn survey revealed only 3 Greater Gliders, where a total of 100+ had been recorded before the fire. Brush-tailed Possums *Trichosaurus vulpecula* and Mountain Possums *T. caninus* were present on most plots, however, they were feeding on grass and grass seeds that had sprouted after the fires (Shields pers. obs.). This observation was to be critical in explaining explosions in the possum populations within the pine plantation some 15 years later.

Waratah Creek

Around 1982, it became obvious that we needed to investigate the long-term effects of forestry operations in the Eden area. Wayne Braithwaite was also carrying out regional surveys to look at distribution and abundance of wildlife, in particular arboreal marsupials, on a landscape basis at this time. One of the difficulties with all of our studies was that we had no control for the purposes of comparison; all our studies were inherently *a posteriori*. That is, we looked at the effects in logged areas, or areas as they were being logged, without a prior knowledge of the fauna populations or their habitat before logging.

To address this difficulty, an area of high quality habitat was located in Coolangubra State Forest. Populations of arboreal marsupials were exceptionally high, the bird community was rich in species, and there were abundant frogs. The area was scheduled for logging in the period from 1983 to 1985. We established a site there for the purpose of long term ecological research, as had occurred and is still occurring, in the nearby Nadgee Nature Reserve. Birds, gliders, small mammals, frogs, reptiles and invertebrates were sampled before and after logging. Three different logging intensities were sampled: full scale integrated woodchip logging; and two lower scales: 75% logging and 50% logging.

The results were published in a variety of theses and refereed scientific journal articles. One of the most interesting, and obvious in hindsight, results was that there were clear differences in distribution and abundance BEFORE logging took place (Kavanagh 1987a, Webb 1991, Shields 1990), which confounded the results of the logging trial. In the catchment at Waratah Creek, our control grid was located on the confluence of two small creeks, in flat undulating topography with deep moist soils. The trial logging compartments were located on steeper slopes, with drier and less fertile soils. Fauna density and diversity were significantly greater on the control grid, and in similar areas close to creeks, than on the net harvest areas proposed for logging. Similarly, the vegetation was more complex and the trees were taller in these riparian areas.

The results indicated that survival and persistence of fauna in areas actually logged were functions of logging intensity, i.e. that selective logging had less impact than intense logging. An exception was the small reptiles, which generally increased in areas with more intense logging due to the increased sunlight penetration once the tall dense canopy was removed (Webb 1991). Over the entire catchment, however, the most diversity and abundance were clearly in the creek flats (reserved in buffer strips) and on the flat, fertile control grid.

Owls and arboreal marsupials

At the time, arboreal marsupials were a major focus of research for my colleague Rod Kavanagh. He located the area of high quality habitat described above at Waratah Creek and initiated in-depth studies on home range and foraging requirements. From the results, it became clear that management prescriptions could be initiated which would lessen the impact on these species. Heuristic thought indicated that predators of these species might also be at risk, particularly if they required hollows for nesting. The most obvious predators were large forest owls, and Australian forest owls nest in hollows. In 1983, we put forward a proposal to management that owls should be a major focus of forest research. In 1985, we summarised our thoughts and principles behind wildlife research in State Forests, as well as current research projects on this topic (Shields and Kavanagh 1985). Since that time, Rod Kavanagh has devoted large portions of his research time to the study of both owls and arboreal marsupials, and is now regarded as one Australia's foremost researchers in this area (see relevant publications Kavanagh *et al.* 1987-95).

From the work of Kavanagh, John Turner and Wayne Braithwaite, the distribution pattern of arboreal marsupials in the Eden area was described accurately - about 80% of the possums and gliders occurred in 9% of the landscape, selecting for fertile soils and gentle topography (Kavanagh 1983, Braithwaite *et al.* 1983). Near the coast, these areas were concentrated in "Monkey Gum Flats" (*E. cypellocarpa*). On the slopes and tablelands, pockets of high fertility soil on flat areas could be identified (such as Waratah Creek). A system of reserves protecting these areas was put in place at the time by Regional Forester Ross Dobbins (Dobbins and Ryan 1983).

Bird foraging and insects

While we were developing principles for wildlife research and management, it also became obvious that bird communities had a large proportion of insectivores, and that their prey base might be of interest with regard to the effects of forest logging. With Harry Recher and Greg Gowing from the Museum, we initiated research into invertebrate populations in the tablelands forests of south-eastern NSW. CSIRO's Division of Entomology studies have formed the background work on invertebrates in Australia - "the other 99%" that comprise the great majority of biodiversity in Australian forests. Our studies were some of the first to make a link between diversity of invertebrates and the management of all wildlife in the forests of south-east NSW.

To understand how birds use this resource, a group of ornithological ecologists studied bird foraging on our study sites in the south-east forests. This included Museum staff (Harry Recher and Greg Gowing, with input from David Milledge, Sandy Gilmore, Walter Boles, Wayne Longmore, Graham Pyke and David Paton), Peter Smith from NSW NPWS, Martin Schultz from Victoria, Dick Holmes from Dartmouth University, Ted Davis from Boston University, and John Woinarski, now in the Northern Territory. Of course, these studies were not limited to insectivory, but the great majority of the 80 000+ foraging observations we gathered were of this type of feeding. In particular, we collected information on the foraging habitats upon which forest birds rely. We established the importance of forest features such as woody debris, hanging bark and standing dead wood as bird foraging resources. For instance, we found that the Varied Sitella *Daphenositta chrysoptera* foraged almost exclusively on moths found on small dead branches (Recher *et al.* 1983). This information provided a data-rich environment in which to develop logging prescriptions and forest management principles.

EPA Act and State Forests' first Environmental Impact Statements

In the early 1980s, the requirement to undertake an Environmental Impact Statement was imposed on those who conducted developments that resulted in a "significant impact on the environment" (*Environmental Planning and Assessment Act 1979* NSW). The decision within State Forests at the time was that at least four demonstration EISs would be conducted on operations which had or might have significant impacts. These were at Eden (woodchipping), Narooma on the south coast (harvesting in unlogged forest in the Wandella-Dampier area), Bathurst (establishment of pine plantations), and the Upper Hastings River (rainforest logging). Our wildlife team in the Research Division conducted field work on arboreal marsupials and bird communities for the Narooma and Upper Hastings River EIS projects in 1982-83. The Wandella-Dampier EIS was completed in 1983 (FCNSW 1983). The Eden EIS was completed in late 1988 using our already established database and publications, which was possibly due to the research and survey efforts described above (FCNSW 1988). It has been subsequently updated to comply with regulations (State Forests of NSW 1994). The Bathurst EIS was to my knowledge never developed beyond the planning stage.

As will become apparent, events overtook the completion of the rainforest EIS, but our team completed the research for a chapter in *Birds of Eucalypt Forests and Woodlands* (Keast *et al.* 1985), based on the Hastings River Work. Our censuses in four forest types (cool temperate rainforest, sub-tropical rainforest, warm temperate rainforest, and moist sclerophyll forest) indicated a clear effect of logging in the eucalypt or "hardwood" operations, but it was hard to find differences in logged and unlogged rainforest (Shields *et al.* 1985). We also found a much wider distribution than previously thought for the very rare Rufous Scrub-bird *Atrichornis rufescens*. This complemented the work on the Rufous Scrub-bird by Simon Ferrier (Ferrier 1984). I decided to do a PhD on rainforest pigeons and their foraging habits to investigate ecosystem function in the context of disturbance.

Rainforest issues

Logging in rainforest has many forms, but there are key factors that are unique to harvesting this forest type. Rainforest logging can be selective and economic at the same time, in the sense that creating large gaps is not beneficial for silvicultural reasons, and that individual stems are quite valuable. That is, eucalypts, and many commercial coniferous species in the northern hemisphere, are most easily and profitably grown by creating large gaps (clear felled areas) where the seed bed (eucalypts) or planted seedlings (conifers) respond to the solar exposure with rapid growth. Rainforests seedlings, on the other hand, sprout and grow rapidly in low light conditions. Later in the seral stage, growth proceeds slowly but steadily, accelerating when there is a light gap to exploit. Eucalypts and conifers are valuable because they produce large volumes of (relatively) low value timber, whereas rainforest timber is extremely valuable for fine timber uses (furniture, turning, exposed interiors) and for specialty uses such as marine plywood. Due to the selective nature of rainforest logging, possible due to high value-low volume marketing, it was difficult to find effects with regard to wildlife, which also had the pesky habit of occurring in a variety of other forest types (eucalypts with rainforest understorey in particular). Doug Binns, Bill Chapman and Alex Floyd complemented our fauna work with impact studies on flora with similar results (for instance, Binns and Chapman 1993).

State Forests carried out, or supported, a wide variety of research projects into the effects of rainforest logging on vertebrate fauna. Doug Binns conducted a mist netting study of birds in Yabra State Forest, west of Casino, which found no effect of 50% canopy removal logging in the course of the study (Shields and Binns 1983). Ian Barnes, working for Col Nicholson at Kyogle, studied small mammals in logging areas in the Border Ranges on Paddy's Mountain (Barnes 1983). Ian could not find any difference between plots, because all of his traps filled up with animals (e.g. close to 100% capture rate) in both logged and unlogged sites. Rod Kavanagh and I "helped" by designing a once-off "saturation" trapping session, wherein we put out 5 times the number of traps that Ian was using. The problem persisted, and we decided this was not a fruitful path to follow in the pursuit on knowledge about the effects of logging. Simon Ferrier completed a PhD at University of New England on the Rufous Scrub-bird, finding the species frequently in logged rainforest, and communicated the results directly to State Forests (Ferrier 1983). An early version of "wildlife prescriptions" was developed for the Rufous Scrub-bird, where territories were mapped and excluded from logging. Gary Webb investigated the Southern Angle-headed Dragon *Hypsilurus spinipes*, one of the few reptiles that are rainforest specialists (Webb 1983), and found that high intensity burning, and clearing, near Gosford, and high intensity logging were threats, but not low intensity (50%) rainforest logging.

Nonetheless, there was a political decision to stop rainforest logging, and all rainforest logging operations on

State Forests in NSW ceased in the mid-80s. At the time, this was generally considered as the end of the controversy in the north. A relatively wide definition of rainforest was accepted, and many forests dominated by eucalypts with rainforest understorey were included in the logging exclusion. When the decision was announced, I was living in bush barracks (Cameron's Camp) west of Wauchope with a group of loggers who worked in rainforest, which provided a unique perspective on the process. The logging crew there would have to change their plans about work. I decided to do my PhD on bird communities at Eden.

Westward Ho

Also during this period, I began a continuing interest in the forests and wildlife of the western parts of NSW. Growing up on a wheat and cattle property in Kansas, I felt quite at home in the big sky country out west. Notable events of the time were significant successes in managing the Regent Parrot *Polytelis anthopeplis*. I was (by default) the Chair of the Regent Parrot Steering Committee, which was convened by Joe Forshaw, then of the Australian National Parks and Wildlife Service (today's version is Environment Australia). Working with the Victorian wildlife authorities, we determined the major cause of decline - the loss of mallee within flying distance of the River Red Gum *E. camaldulensis* forests where it nests (Beardsell 1985) and put in place processes to deal with this threat with some success (Burbidge 1985). The species remains on the Vulnerable list in NSW, but the dramatic decline to extinction, which seemed imminent at the time, did not occur and the species remains stable. If all of our recommendations had been taken up at the time (1985-88), problems with salinity may have been somewhat less severe in the area at present.

We then moved on to the mid-western version of the same genus, the Superb Parrot *Polytelis swainsonii*. Aside from a general decline in numbers, one of the mysteries of the day was whether or not there was a population in the north, as well as the well known breeding centres from the Murrumbidgee River south to the Murray River. Rick Webster and I travelled throughout north-central NSW to the Queensland border in the winter of 1985, and finally located four birds near Wee Waa (Shields and Crome 1992). Very recent information from property managers in the area (2003) indicates that there still is a breeding population within 20 km of where we found those four birds. Rick Webster has since become an authority on the species, and works out of Deniliquin, where he continues to have input to recovery actions. The Superb Parrot has been a flagship for the forests and woodlands of the west since that time, and efforts to successfully manage this species have proved useful in highlighting the importance of remnant woodlands, Travelling Stock Routes and individual trees in paddocks.

All of this is of some note in that very little attention and no money was spent on wildlife issues in the west until very recently (1999), while east coast forests were the subject of intense social debate, news coverage and scientific investigations as early as the 1970s.

Ferals, pests and critical weight range mammals

In 1984, I became State Forests' representative on the NSW Pest Animal Council, an inter-agency working group which co-ordinates policy and action with regard to recognised pests. I developed an interest in fox and cat predation as a threatening process and followed with interest developments elsewhere in the field, particularly the Western Australian success with rock wallabies and fox control (Kinnear *et al.* 1984). This was before there was wide publicity about "critical weight range" species' susceptibility to fox predation. The experience provided a regional and historical background into positive wildlife management through pest control and was crucial in providing advice to State Forests. The organisation has since been proactive in developing environmentally sound pest control operations. I was lucky enough to visit Western Australia in 1985, and was highly encouraged by the success of their forest wildlife management program, centred on the real threat from fox predation, which saw the Numbat *Mymecobius fasciatus* and Chuditch *Dasyurus geoffroii* recover from low numbers.

Old growth and the ontogeny of tree hollows

In State Forests it was clearly recognised that old trees with hollows were essential to the management of arboreal marsupials and at least 20% of birds, as well as bats, frogs and some snakes. The management and maintenance of this resource was written into the original Wildlife Policy (see Curtin 2004). Research Forester Charlie Mackowski conducted experiments to determine the length of time it takes to develop tree hollows in Blackbutt *Eucalyptus pilularis*. This work remains the sole relevant reference on the subject, some 20 years after its publication (Mackowski 1984). Aside from this, Charlie conducted broad-scale mammal surveys in the north-east forests (Mackowski 1986), and Research Forester Gary King (King 1984) completed a Masters Degree on the Hastings River Mouse. Both Gary King and Charlie Mackowski contributed significant primary data to the early understanding of wildlife management principles in eucalypt forest (Mackowski 1983) and small mammals and fire (King 1983). However, the main State Forests research effort in wildlife continued to focus on Eden and the southeast.

Overseas, the forestry adage that "good forest management is good wildlife management" was being challenged on the grounds that it did not consider the special conditions of late seral stage coniferous forests. Although only a few species of fauna are dependent on this seral stage, it is clearly a true climax community, quite stable, and considerably endangered due to the extremely long time it takes to establish and the very long history of exploitation by clearfelling in both North America and Northern Europe. The flagship species for its conservation in the Pacific Northwest became the Northern Spotted Owl (Shields and King 1990), and in the south, although not so famously, the Red-cockaded Woodpecker *Picoides borealis*.

The principles and passion from the old growth debate were soon to be exported to Australia, with its fireprone and thus disturbance-adapted forests.

The Northern Alliance in NSW

During the late 1970s and 1980s, a cadre of ecologists and environmental advocates moved to northern NSW, mostly from Victoria. Ecologists included Andrew Smith, David Milledge, Sandy Gilmore, Harry Parnaby and Mark Fitzgerald. The leading environmental advocate in the area, Dailan Pugh, also came from Victoria. A group called the North East Forest Alliance (NEFA) was formed, and it was actively and ably led by John Corkhill for a number of years. Residents with environmental interests, such as the Nicholsons, provided background and local area knowledge. The principles of old growth stability, wildlife dependence on old growth, and detrimental effects of harvesting were actively pursued by NEFA.

Other Victorians only made it as far north as Canberra, where forest ecologists Tony Norton and David Lindenmayer joined Henry Nix at the Australian National University. Academic input from overseas was actively sought by this group, and Jerry Franklin, Paul Ehrlich and David Suzuki all made guest appearances to advise on forestry matters. In particular, the similarity between old growth coniferous forests in the Northern hemisphere and old growth in Australia was emphasised at that time.

1987-1990 the Seattle years: spotted owls, statistics and trouble with EISs

Planning a PhD in Wildlife Management

In 1986, I attended the International Ornithology Congress in Ottawa, Canada and made inquiries about doing a PhD at various institutions. During the 1980s, statistical rigour had been introduced to ecology, and vice versa. Frequently, the acquaintance caused difficulty between the disciplines. I was determined to become free of the "statistics police" who controlled all experimental design, and settled on the University of Washington in Seattle for a place to carry out my graduate studies. "UW" has an internal department associated with Fisheries and Forestry, called Quantitative Science, and all PhD students are required to do two years of graduate level statistics (essentially a masters by coursework in the subject). I took my bird census and foraging data from Waratah Creek on 5-1/2 inch floppy discs on the plane and set out in September 1987. The first thing I found was that the experimental design at Waratah Creek was not sound (no randomisation, no replication, $n=1$ for each logging treatment). I designed a true experiment based on Waratah Creek as a trial (the Tablelands Logging Experiment) and returned to Australia to carry out the fieldwork in December.

NSW EIS programs

While doing my fieldwork in NSW in the southern summers of 1987-89, I participated in the Land and Environment court case with regard to the validity of the 1988 Eden EIS. State Forests based its case on the large amount of ecological work done in the area and won with little legal controversy. Meanwhile, in the north of the state, it was maintained by State Forests that logging in regrowth forests did not have a significant impact on the environment. A series of court cases ensued about the operations in the north, most initiated by John Corkhill

and NEFA. Unlike Eden (where the courts operated in a data-rich arena), the cases in the north were based on very limited data with regard to wildlife, the most emotive issue involved, and certainly an important one in the eyes of the court. State Forests lost each case, and it agreed to prepare EISs for all native forest operations in NSW. In the throes of finishing my PhD in Seattle, I was not aware of the extent or nature of the controversy, and did not return to Australia to participate in court cases or debate. The key points here are that wildlife had become an issue which must be addressed in legal, social, environmental and economic terms, wildlife research was important for deciding controversial issues, and that someone was going to have to complete the work required to produce EISs for northern NSW forestry operations.

Finishing an education in forest wildlife management

While working in Australian forests, I had noticed that land managers and politicians regularly turned to scientists who carried out research on the basic biology and natural history of the taxa concerned. Frequently, those scientists are skilled in disciplines which are not useful for making decisions with regard to operational matters or successful biodiversity management. I wanted to acquire graduate qualifications in the management of populations of free-living organisms, which requires not only fundamental ecological research but the ability to design solutions to problems with threatened, declining or pest species. My research was therefore aimed at determining if there was a long-term effect on bird communities from woodchip logging at Eden. I had a robust statistical design to test the effects of normal (heavy) woodchip logging against control plots and against a selective treatment (50% of normal logging). This allowed the development of a mathematical function which described the relationship between the distribution and abundance of bird species and populations with regard to the intensity of logging. Simply put, there was little effect one year after logging on bird communities at the 50% level of logging intensity, but a significant effect in the normal logging treatment during the same period. This was not surprising or inexplicable in the light of information already acquired at Waratah Creek and the buffer strips which indicated that riparian areas held most of the local biodiversity (Shields 1990). Armed with this information (and large amounts of data from colleagues previously mentioned), I felt sure that a system for wildlife management could be devised with little controversy. My design was sound, my probability values clear, I had considered Type Two Error, and the tests used were appropriate (Type Three Error). When I returned to Australia, and presented these results at a seminar (State Forests Research Division, West Pennant Hills, in December 1990), they were not accepted at all by the ecologists in the audience. The objections were not well elucidated, but there was general feeling that “something was wrong”; the sample size was too small, and the time frame too short. Since these objections can be made about almost any ecological experiment, it was a revealing moment - a new dogma had apparently come into place. I decided that it was better to do wildlife management than try to convince the scientific community that it could be done.

1990 - 1995: Research leads to management

EISs in the north

As a result of the court cases above, State Forests was committed to delivering EISs for all areas of native forest logging. When I arrived back from my sabbatical in Seattle, there was literally a 4WD with the engine running waiting for me to start the process of designing impact studies. In collaboration with Alan York and Doug Binns, we designed a replicated, randomised experiment to determine the effects of logging (York, Binns and Shields 1991). Through the extensive use of consultants, and the resultant huge investment, we accomplished this task over the next seven years. Our results showed no long-term or significant impact from logging practices in native forests around the state of NSW at the time (1991-96), although decreases in species richness and abundance were detected directly after harvest events. This was not acceptable to either the scientific community (the findings clearly went against scientific dogma of the day (Milledge 1998)), or to the public (no significant part of the voting public has ever liked logging - or abattoirs - but you do not have to deal with the loss of timber at meal times), but it was fairly robust with regard to legal requirements. Logging operations continued generally unaffected around the state, despite increasingly vehement demonstrations by the NEFA and their less well organised colleagues in the south.

Research management in Sydney

After arriving back in NSW, I took on the job of managing the Ecology and Silviculture Section of Forest Research Division. Although these duties effectively prevented me from pursuing any new research, or publishing any of my old data, it did provide the opportunity to carry out a recruitment program to fill the gaps in State Forests ecology unit. We acquired expertise in invertebrates, bats, frogs, GIS and biometrics during that time and made some cross linkages with silviculture that remain effective today. I acquired expertise in managing people, consultants, EISs, and the legal system.

Judgement on the 22nd Floor

It was during this period (1991-96) that serious changes to legislation regarding wildlife occurred in NSW. The Green movement no longer could stop operations by requiring that EISs be prepared; State Forests had agreed to carry out those processes after losing in the courts, and proceeded to deliver on that agreement with rigour and promptness (see EIS reports 1992-5). The only legal recourse available was through the *National Parks and Wildlife Act 1974* provision that it was illegal to “disturb” wildlife - a scenario I had envisioned since my early reviews of the legislation some 15 years before. In 1991, a case was brought by John Corkhill before the Land and Environment court, which sat on the 22nd floor of the American Express building in Sydney, regarding three controversial logging Compartments in Chaelundi State Forest, near Dorrigo, in which it was alleged that State Forests was in the process of disturbing animals on Schedule 12 (Endangered Species) of the Act.

Rather than argue a potentially “winnable” ecological case (populations of animals were not disturbed, although individuals might be), State Forest’s barrister chose to argue the case on legal and technical grounds. Justice Stein rendered the “Chaelundi Decision” in favour of the plaintiff, and henceforth State Forests was required to obtain licences from the NPWS before any operation could proceed.

At this point, serious consideration was devoted to giving up all native forest operations as too difficult. Instead, State Forests decided to take on wildlife management as a part of core business and has proceeded to do so by becoming competent, compliant and comprehensive in this part of our corporate profile (Meek 2004). This is of course my personal view - but it is a view that has withstood vigorous legal challenges, internal audit, external audit, and delivered on both biodiversity and wood products as agreed in each Region.

In 1991, the NSW Parliament passed an “Interim” threatened species act – the *Endangered Fauna (Interim) Protection Act 1991* - which was replaced by the *Threatened Species Conservation Act 1995* (NSW), under whose provisions State Forests currently operate.

Wildlife management and education in the south

To take on the requirements dictated in the NPWS licences from 1992 onward, we were required to conduct surveys of wildlife and report on the mitigating factors that were to be put in place; NPWS would review these proposals and grant a licence subject to their further requirements for conservation. This situation was greeted with various degrees of despair by most forest managers of the time. One in particular, Steve Dodds at Narooma, called me for advice, and I convinced him that wildlife management was an achievable part of his business. He decided to take on the new requirements in a scientific and practical manner. Through a series of Wildlife Schools, his staff acquired the skills to survey and report on flora and fauna. This approach was gradually taken up throughout the southern districts and the rest of the state, endorsed at a senior level by Col Nicholson - the birdwatching forester from Kyogle - who was then manager for the Southern Region of State Forests.

Forest policy in Canberra

The Commonwealth Government, and other state Governments, were dealing with similar forest controversy across Australia, and needed to develop a National Forest Policy (1992) to cope with the issues. I was seconded to a group of scientists who developed this policy, which was simple and straightforward; it required a series of Comprehensive Regional Assessments (CRAs), which would accurately describe the environmental, social and economic factors for each major region in Australia. Based on this assessment, a Comprehensive, Adequate and Representative (CAR) reserve system would be put in place, and viable forest industries would be tailored in each region. As they say, the devil is in the detail. How to create such a reserve system, while still maintaining industries?

To address the first part of the question, another group of scientists was called together under the auspices of the joint Australian-New Zealand “Standing Committee” on forest issues to set out criteria for a Comprehensive, Adequate and Representative Reserve system. I was the NSW representative on this working group. Over a period of 12 months (1992-3), we developed what became known as the “JANIS Criteria” for forest reserves (*Nationally agreed criteria for the establishment of a Comprehensive, Adequate and Representative Reserve System for forests in Australia*). A report by the joint ANZECC/MCFFA National Forest Policy Statement Implementation Sub-committee, JANIS 1997).

With these two policy documents endorsed by all states and the Commonwealth, the scene was set for carrying out Comprehensive Regional Assessments and conducting negotiations for Regional Forest Agreements. In 1995, I was offered a job as the Wildlife Manager for Southern Region, State Forests, and moved from research work in Sydney to full time wildlife management in Eden. Col Nicholson, the Regional Manager, had decided that there was enough work to employ a full time wildlife manager - the first such position created in State Forests in NSW.

Research and management in other states

I have made mention of research in other states, particularly Victoria. I would reiterate that my experiences from NSW are not indicative of the entire Australian situation with regard to forest fauna management, and other researchers and states have their own approach. In particular, David Lindenmayer and his colleagues in Victoria (1985-95) and later at the Centre for Resources and Ecological Science (CRES) at the Australian National University, have contributed vast volumes to the literature based on research in Victoria, and more latterly in the pine plantations of southern NSW. However, the forest types, regulations and forest operations of NSW are different than those they studied in Victoria, and only have some similarities to the status quo in NSW. (Most of the research carried out by this group has been done in Mountain Ash where very intensive logging is followed by hot fires). Despite this, their results and recommendations have been used repeatedly to develop conservation guidelines for forest managers in NSW. Their research is impeccable, but often not useful to management of NSW forests, particularly under the regulatory system imposed in this state. This is clearly shown in the most comprehensive work done on habitat trees in wood production forests (Phil Gibbon’s PhD studies) with regard to both states. Phil Gibbons looked at the retention rate and survival of hollow trees in logging operations in similar forest types in both states. There was a significant difference between the survival and retention rates across the borders (Gibbons 1999) - with more trees surviving longer in NSW than in Victoria.

Tasmanian operations are very much unique to that state. The approach taken in the Apple Isle causes considerable difficulty in the international arena, as they are intensive and clearly not designed around long-term sustainability for ecosystems.

1995 - 2003: Paying the price and calculating the biodiversity credits

Managing the CRA-RFA process

The first step in carrying out my new job was to ensure that past requirements (the Eden EIS, Threatened Species Licences) were met, and ensuring that the CRA and RFA left us with a truly viable wildlife management network and a native forest industry in the Southern Region of State Forests of NSW. The first part was relatively easy, given the amount of data available and the staff training that had already taken place. The second was a venture into the unknown. In NSW, the process for CRA was to carry out surveys for flora and fauna, determine minimum viable population sizes (using a formula developed for NPWS by Hugh Possingham) and then create habitat models based on the data collected, where available, and expert opinion. To complete the RFA process, negotiations were then entered into, based on the results of C-Plan, a conservation planning tool developed by Bob Pressey and Simon Ferrier, NSW NPWS, and timber schedules developed by State Forests. C-Plan is a computer program which “solves” a mathematical problem created in GIS space to achieve the best conservation outcome, based on target variables entered into the program - these targets being 15% of the modelled fauna habitat, in the case of wildlife (NPWS and EA 1998). C-Plan would tell how much habitat for each threatened species was available in each option proposed for the new CAR reserve system, and the timber schedules would tell how much timber was available. A negotiated position would be reached, and an acceptable option agreed amongst all stakeholders. Or so the theory went.

There were two major problems with the CRA-RFA process with regard to the reserve system in NSW. One was that only Crown lands, i.e. state-owned lands, were considered; the option of making reserves on private land was far too controversial to consider, although that might have been the only place where habitat was available. An example of this situation is Koala *Phascolarctos cinereus* habitat at Eden. The Koala was a common species in the forests and woodlands of the Bega Valley at the end of the 19th century; at one point there was an industry based around tanning hides at Wyndham, NSW (Lunney and Leary 1988). However, most of this highly productive forest/woodland country is now in private hands, used for grazing, and not readily available for reservation. Nonetheless, there was pressure from RFA processes to create an adequate reserve for the Koala out of the much lower quality Koala habitat on Crown land, because that was the only land available (NSW NPWS and EA 1998). The scenario was rather like a drunk looking for his car keys underneath the street lamp, because the light was better there than where he had dropped them.

The second problem was with the models themselves. Although GIS capabilities make it possible to create models of habitat, these models are only as good as the data that go into them - the GIGO Principle (Garbage In, Garbage Out). For threatened species, in particular, data were limited or unavailable. In the latter case, expert workshops were convened where researchers entered the habitat variables they considered most appropriate

into the model, e.g. chose the natural history features that were best suited to the animal under consideration. The resultant maps were displayed to the expert panel, which then “tweaked” the model to get the map to appear reasonable (in many cases, the first attempts resulted in maps that were clearly unacceptable, with frogs on dry ridges, koalas in swamps). Some of the models, expert and data driven, were actually quite good, but many ended up covering the landscape because they were so general. Models were made for threatened fauna, flora and “forest ecosystems”. The 15% level of reservation set out in the JANIS criteria was taken as the “target” in C-Plan for each model. If that target was reached, the reserve system was considered adequate, if not, the reserve system was inadequate - and subject to further controversy.

I once asked Mark Burgman, a highly skilled modeller from Melbourne University, about basing land management and wildlife management decisions on maps created through models. His reply was “Maps from models aren’t for managing land; they’re for frightening politicians” (Burgman, pers. comm. ANU 1995). He was of course overstating the case to make a point (and a joke), and there are many useful wildlife applications for modelling wildlife values (Lindenmayer *et al.* 1991). There is, however, a definite core of reality to the statement, which was well manifested in the CRA-RFA process.

A further part of the problem with targets was the concept of “Minimum Viable Population” - which comprised the quantum in the target - calculated using the work of Hugh Possingham (in an unpublished report commissioned by NSW NPWS). This quantum - while serving the purpose of giving a number of hectares per species - was not intended to solve all threatened species management problems, or to be exact or realistic, but was intended to be conservative in terms of area required. The published details cover the limitations of the approach (Lindenmayer *et al.* 1993). Consequently, the largest possible area was put in reserves to maintain that minimum viable population, regardless of whether or not the population occurred on the land, or if reservation was the best management system for the relevant taxon. The subsequent land tenure arrangements saw large portions of the NSW State Forest estate changed to reserve status (over 1 million ha at June 2004) and the introduction of a Threatened Species Licence system that covers all State Forest operations (Drielsma 1999). These licences incorporated into each regional forest agreement, and were a part of all negotiations. All provisions were formalised by the NSW Parliament through the Integrated Forestry Operations Approval (IFOA) legislation and subsequent regulations for Eden, Upper North-East, Lower North-East and South Coast (which includes Tumbarumba-Tumut area native forests). These Acts bundled together all provisions of the RFA process (including factors other than biodiversity, e.g. water, soil, timber supply agreements and standards).

The threatened species licences that are part of each IFOA have three basic components. The first is landscape scale reservations, where important conservation features are reserved across the forest estate. These include riparian reserves (reserved areas along drainage lines), habitat trees

and recruits (old trees with hollows and recruits to replace them through time) in the logging area of each compartment, stags (large dead trees), rocky outcrops (for rare plants, fauna dens), cliff lines, wetlands, heaths, rainforests, “old growth”, ground cover (woody debris), burning, and cross-ridge connecting corridors (to ensure connectivity across the landscape). All of these habitat elements are protected from operations by prescriptions put in place to maintain flora and fauna populations across the landscape.

The second component of the licences concerns species-specific prescriptions - operational requirements where threatened or target species are recorded on or near the area proposed for logging. These include special prescriptions for tree retention in areas with high populations of Greater Gliders *Petaroides volans*, (a State Forests initiative, based on research and policy), retention of at least 25 % of modelled habitat for large forest owls, exclusion zones for Spotted-tail Quoll *Dasyurus maculatus* dens and latrine sites, and others to deal with bats, frogs and rare plants. A special Koala prescription is in place, which varies according to region; in Eden where the Koala is rare or uncommon, a high level of protection is devoted to each individual Koala (IFOA Eden 1998, IFOA UNE-LNE1999, IFOA Southern 2000, Threatened Species Licence Dubbo Management area, 2003). The third component of the licences is comprised of survey requirements, which ensure that records are located in data bases (desk-top survey) or found in the field. The application and efficacy of these licences is discussed by Paul Meek (2004).

Education and human resources in the forest

In 1998, I became Divisional Wildlife Manager, based at Coffs Harbour. One of the major tasks during this time was to recruit and train personnel who would be capable of carrying out the wildlife management tasks in a post-RFA environment. With our research division staff, notably Frank Lemckert and Brad Law, our program of Wildlife Schools had been expanded and virtually all field staff received adequate training to carry out the survey and monitoring tasks required. In addition to our staff, NPWS, Rural Lands Protection Board, Department of Land and Water Conservation (now Infrastructure, Planning and Natural Resources), NSW Police, Department of Defense and a variety of consultants have paid to attend these schools (see Lemckert and Slatyer 2004). Most recently, the wildlife schools have formed the basis for a Masters of Wildlife Management Program at Macquarie University. We have made a point of including Aboriginal views, knowledge and personal input to these schools.

In the process of restructuring State Forests to meet new challenges, the position of Regional Ecologist was created in each land management unit (region) of Native Forest Division. Many ecologists had worked with State Forests on contract basis, and there were several internal candidates, either foresters with a background in wildlife, or natural sciences graduates, employed as foresters or planners. An active recruitment phase ensued and a team with considerable talent was assembled; candidates with graduate qualifications included Paul Meek (MSc), who was convinced to return from Christmas Island, Mike Crowley (science teacher and naturalist) incorporated

into the south coast operations at Batemans Bay, Pat Tap (PhD, Wollongong University) returned from academia in South Australia to our Dubbo office, Justin Williams used his natural resources skills at Wauchope, and Adam Fawcett did the same at Hunter region in Newcastle (both University of New England graduates who had studied under Harry Recher). With Brett Cann (former forester) in Taree, David Leslie (Masters degree on water birds and flow in the Murray) in Deniliquin, Ken McCray (master of all trades, Honours from Southern Cross University in Ecology) at Casino and Research Division's Chris Slade at Eden, the team of regional ecologists was complete. Doug Binns served as Flora Manager for Native Forest Division at Coffs Harbour, with a statewide charter. More recently, John Willoughby has been recruited to the Ecologists position with the Planted Forest Division.

The assembly of this team was the final element in completing the “wish list” that Harry Recher, Dan Lunney and Wyn Jones expressed in discussions in 1980-81. That is, there are now regulated prescriptions for wildlife, including pre-harvest survey. There are broad-scale prescriptions for habitat on the logging area (habitat trees, rainforest, old growth, feed trees, ground cover, grazing, pests) and across the landscape (riparian zones, cross ridge connections). There are wildlife ecologists on the regional and corporate management teams in State Forests. Wildlife management is also a part of core business for plantation as well as native forests in NSW.

Managing for success

The wish list generated by ecologists in the early eighties has now been more than fulfilled and this will provide security in the short and medium terms for flora and fauna in the land managed by State Forests of NSW. What are the challenges for success in the long-term?

Much of the effort and timber resources necessary for exclusion zones, is not used wisely (Meek 2004) and there is no coherent plan for monitoring the long-term effects of wildlife management efforts now in place (Law 2004). To move forward, we need to employ sound principles of management and science, incorporated into regulations such that society responds to true conservation needs, rather than vested interests or the political force of advocate groups in metropolitan centres, or anywhere else, for that matter.

Successful wildlife management in forests will result in stable ecosystems (with complete species representation and richness). Sustainable harvest of forest resources by people should be part of the culture and wealth-creation system, because this means that people will actively work to maintain the ecosystem. Using the tools of science and communication, it is possible to take actions to achieve this vision of success for forest wildlife.

In summary

I have learned that success in wildlife management is possible as a result of vision, action, research and funding. In some cases, I have been lucky enough to participate in developing wildlife management as a deliverable process in Australian forests. This wildlife has its own intrinsic value,

but it is also of great importance to society and the economy. The times and events I have described have often been highly charged and emotive; State Forests has often learned slowly and argued hard for points that in hindsight might have been best conceded at the outset. However, learning and change have occurred, and State Forests of NSW is now the only forest service remaining in Australia. State Forests may continue to survive a little longer with its charter to grow wood for the people of NSW on State Forests and also “preserve the birds and animals thereon”.

Where to from here?

Over the past 15 years it has become obvious to me, and a large number of other natural resource managers, that success can easily be achieved in managing biodiversity successfully - if the necessary economic resources are devoted to the task (Gibbons *et al.* 2002). In the past, biodiversity and wildlife management has been regarded as a “cost” to development or natural resource use, but this cost has never been explicitly defined or incorporated into

economic systems. Similarly, the benefits of ecosystems services have seldom been calculated, or even expressed lucidly. One reason for this is that, although well defined, biodiversity has never been expressed in a functional way that can be measured. Another reason is that there are no market processes or institutions that allow the biodiversity “costs” incurred by human development to be paid for by those who benefit from it.

Working with ecological economists, other ecologists, multi-national corporations, and primary producers, I have been trying to develop a useful way to account for biodiversity (Gibbons *et al.* 2002), and to develop markets and processes that will allow biodiversity to become a positive and powerful driver to human endeavour, with positive financial rewards for successful management of natural resources. In this way, wildlife management of forests, and other habitats, will soon be seen as a growth industry, and many dilemmas regarding positive biodiversity management will disappear. The alternative does not bear thinking about.

Acknowledgements

I would like to apologise for what I have had to omit in the process of condensing 30 years into this chapter, for I have had to leave out as much as I have told, wherein danger from sins of omission lies. I would like to acknowledge Walter Boles and Wayne Longmore for their friendship, science, and help over 30 years. I would like to acknowledge the editor, Dan Lunney, who improved the manuscript immensely and two anonymous referees (who were kind and brutal simultaneously – thanks for both). I have mentioned most of my colleagues in the text and I acknowledge you all again. I would like to acknowledge

the good times and good spirits of these people, and also Ian Bevege, Madeline King, Sybil Townsend, Jo Ann Edney, Ann Conway, Leong Lim, Sandy Ingleby, Stan Gessel, Doug Hoese, Mike Dingley, Hans Drielsma, Basil Marlow, Gail Russell, Judy Recher, Eric, Miguel, Audrey and Hal Heatwole, William McFall, Dean Metcalf, Peter Rankin, Wal Gentle, Debbie Kent, Pete Catling, Elisabeth Cameron, Hal Cogger, Mike Bullen, David Brand, Sue Briggs, Ross Sadlier, Steve Overmeyer, Terry Lindsay, Phil Ryan, the Hazel family, and Graham Grey. Finally, Elisabeth Larsen and Jake Tanner made this manuscript possible.

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APPENDIX I



In the Clark Range camp and field studio where we photographed the Eungella Honeyeater. Wayne Longmore, author; Claire Lindsay, Terry Lindsay, Glen Ingram and Walter Boles, 1999.



In northern NSW in 1979 - on the way north to Queensland. Wayne Longmore, Terry Lindsay, author and Walter Boles.



Author with Azure Kingfisher, Clark Range, 1979, at site of first capture of the Eungella Honeyeater.

Photos: Ann Lindsay

APPENDIX I



“Ah, the halcyon days when we were all young and the world was simpler.” (Greg Gowing on seeing the photo in July 2004). Photo taken in the summer of 1980-1981 in Bondi State Forest work camp near Bombala, south-eastern NSW. Sitting or standing on the stump of a large brown barrel *Eucalyptus fastigata* are, from left to right, Eve Kavanagh, Peter Dostine, Dick Holmes, Jim Shields, Wyn Jones, Greg Gowing, Harry Recher (front row with axe), Martin Schulz (back row), Rod Kavanagh, John Woinarski and Kristin Bardsley.

Photo: Greg Gowing on a self timer.