

In Conservation's Name.

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Abstract

In 1992 Australia's National Forest Policy Statement aimed to establish a Comprehensive Adequate Representative (CAR) reserve system and Ecologically Sustainable Forest Management (ESFM) in reserves and multiple use forests. During the ensuing 15 years Regional Forest Agreements (RFAs) have transferred substantial areas of multiple use forests into reserves. The development of ESFM has concentrated on multiple use forests and less attention has been given to managing than establishing the CAR reserves.

There appears to have been a general assumption that non-intervention in reserves is more likely to achieve ESFM than active management in multiple use forests, and therefore requires less scrutiny. However this assumption is now being questioned within the scientific community and more widely. For example, a recent, multi award winning 'country' song has the theme "lock it up and let it burn in conservation's name".

The performance of the two different styles of management can be tested against specific objectives of the National Forest Policy including conservation of: soil and water, endangered species, the full range of pre-European ecosystems, oldgrowth forests, cultural heritage, carbon stores and wilderness. Protection of forest health against diseases, weeds, pests and wildfire is also important in all public forests whilst socioeconomic indicators may be generally more applicable to multiple use forests.

A range of examples from Australia and North America suggests that active management for multiple uses may be preferable to non-intervention in terms of ESFM. It may be appropriate to place less priority on establishing new reserves and more priority on management in all public forests. Active management may be particularly effective in maximising the ecological and socioeconomic values of some new ecosystems such as cypress forests and river red gum forests that have been created as a consequence of European settlement.

Environmental impacts of 'protection'

Non-intervention in reserves is often assumed to either maintain a stable environment or have positive impacts. For example, the Australian Concise Oxford Dictionary (3rd Edition) defines a wilderness area as "a tract of land that is largely undisturbed by humans and where indigenous plants and animals flourish in their natural environment". On the other hand, active management, especially logging, prescribed burning and grazing are assumed to adversely affect natural ecosystems and reduce biodiversity. This paradigm ignores Australia's pre-European history and the environmental changes that occur in 'protected' areas.

For example, Tasker & Bradstock (2006) found that logging had little impact, but that grazed and ungrazed forests had quite different understoreys. They claimed that burning by graziers "simplified" understoreys and "reduced" shrub layers, however they did not compare fire regimes and vegetation against any benchmark (e.g. Jurskis 2002, 2005a). Birk & Bridges (1989) have been cited to support this proposition (Keith 2004, Tasker & Bradstock 2006) because they compared frequently burnt areas against areas that had remained unburnt for decades and reported that burning changed the shrub understoreys to grass. However the shrub understoreys, largely dominated by the exotic *Lantana*, were clearly not indicative of the pre-European condition and Birk and Bridges (1989) investigated biomass rather than

species composition. Biomass can be confused with biodiversity (Jurskis *et al.* 2003) when common native shrubs are used as indicators of biodiversity (e.g. Keith & Henderson 2002).

Grazing and burning have supposedly depleted shrubs and biodiversity in the New South Wales northern tablelands escarpment (Keith & Henderson 2002, Tasker & Bradstock 2006) because dense understoreys of native shrubs are associated with exclusion of fire and/or grazing (e.g. Gleadow and Ashton 1981, Birk & Bridges 1989, Rose 1997, Lunt 1998, Jurskis 2000, Jurskis and Turner 2002).. Keith & Henderson (2002) proposed that currently grassy forests in this area contained dense shrubbery before they were changed by graziers but this contention is not logical because graziers originally sought out grassy forests (e.g. Keith 2004), and periodically burnt them “to maintain an open grassy understorey” (Tasker and Bradstock 2006). It also ignores historical and contemporary observations of fire regimes and vegetation.

The area was traversed by Oxley (1820) who referred to open grassy eucalypt forests, abundant kangaroos, aboriginal fires and burnt grass. Oxley’s men and horses generally made easy progress and often had expansive views of the landscape. Occasionally they were hindered by dense shrubby and viney understoreys associated with “deep valleys”, “frightful precipices” and “the steeper ascents” (Oxley 1820). When the horses could no longer progress Oxley (1820) remarked that there was not a blade of grass nor room to lie down. It is clear from descriptions by Oxley (1820) and other early observers of surrounding regions (e.g. Dawson 1830, Hodgkinson 1845) that graziers took up open grassy forests, used by Aboriginal people, where grassfires and kangaroo were prevalent. Frequent fire and grass were interdependent (Mitchell 1848). There is “unequivocal evidence” that frequent fires prior to European settlement maintained open savanna woodlands by killing shrub seedlings (Noble 1997). Graziers used fire to *maintain* open forests (Mackenzie 1851, Tasker & Bradstock 2006), doing so by “ancient authority” (Townsend 1849) as had their Aboriginal predecessors. They did not, could not and had no reason to simplify, reduce or deplete the dense shrubby understoreys whose distribution was governed by the physical environment just as the distribution of grass and grassfires were governed by the physical environment before European intervention (Dawson 1830, Jurskis 2005a). Forests with dense understoreys on steep terrain remained as they were.

Howitt (1891) observed that European settlement reduced the frequency and increased the intensity of fires in Gippsland, creating dense shrub understoreys in formerly open forests. However the density of understoreys in the Darling Downs, described as sumptuous pastoral country by Cunningham in 1827, apparently was not affected by grazing over a century and a half (Fensham & Fairfax 1997). Jurskis (2002) suggested that grazing practices prevented the development of unnaturally dense shrub understoreys in north-eastern NSW where the fire regimes have remained similar to the pre-European fire regimes (Christensen 1998).

Hessburg *et al.* (2005) documented changes since European settlement in the forests of inland north western U.S.A. where the forests “no longer appear or function as they once did”. They concluded that current management was not sustainable because the forests were set up for extensive severe fires and plagues of pests. In contrast, Keith and Henderson (2002) in Australia, denounced historical analyses as dogma that demands moot choices of benchmarks and unproductive speculation about pre-European conditions. However, RFAs use the pre-European condition as the benchmark for assessing the adequacy of reserve systems, and this benchmark should also be used to compare the outcomes of ‘protection’ against those of more active management in achieving the other objectives of the National Forest Policy.

Conservation of Soil and Water

Aboriginal people frequently gathered in the Australian alps and lit extensive fires (Clarke 1860, Wesson 2000). Graziers displaced them, but continued to use fire. From the early 20th Century, when concerns about erosion prompted restrictions on grazing and burning, severe wildfires increased erosion in the alps (e.g. Blair circa 1950, Jurskis *et al* 2006). Between 1951 and the late 1970’s, maintenance of fire trails and prescribed burning under the Hume Snowy Bushfire Prevention Scheme moderated the impacts of wildfires even though there were many severe and some extreme fire seasons. After prescribed burning

was progressively reduced and the Scheme disbanded, wildfire damage and erosion increased. Unprecedented erosion and siltation were caused by the fires of 2003 though the climatic and weather conditions were not unprecedented (Jurskis *et al* 2006).

Extensive high intensity fires increase erosion and siltation because they virtually eliminate evapotranspiration, increase hydrophobicity and remove any protective cover from the mineral soil so that there is minimal and maximum runoff (e.g. Croke *et al.* 1999). Riparian areas and gullies typically burn very patchily in prescribed burns, but very intensely and uniformly in wildfires providing direct access for sediment into watercourses (e.g. Croke *et al.* 1999). Intense wildfires in alpine catchments have caused up to a thousandfold increase in sediment loads over more than a year Good (1981). Management plans for reserves often do not realistically assess the risk to soil and water resources of 'protection' compared to active management with access trails and burning or grazing. For example, Leaver and Good (2004) suggested that heavy fuel loads were needed to stabilise steep slopes in Kosciuszko National Park and suggested that an interval of 150 years between fires could be achieved in most of the park. However experience has shown that this scenario is unrealistic. Active management can influence the mix of low intensity and high intensity fire regimes in the landscape and achieve better protection of soil and water resources than 'protective' management (Jurskis *et al* 2003).

Predictions of reduced long term water yields if there were to be timber production in the Melbourne catchments are based on unrealistic assumptions that all unlogged mountain ash forests are yielding their maximum possible streamflows, and that fire can be excluded indefinitely from these catchments (e.g. Gippel *et al.* 1991). Wildfires will inevitably occur, but their impacts on water quality and yield can be moderated by prescribed burning and thinning. Changes in water yields as a result of changes in vegetation can be accurately predicted (Bosch and Hewlett 1982, Vertessy *et al.* 1996, Bi *et al.* 2001) therefore likely impacts of various silvicultural and fire regimes can be compared. Thinning and prescribed burning have the potential to increase yields from domestic water supply catchments, and an extensive medium term trial in the Wungong Catchment near Perth is expected to increase water yield by 6 billion litres per annum (Anon. 2005). The thinnings will be mostly non-commercial, and treatments will cost 20 million dollars over 12 years, but these treatments appear to be politically acceptable only because there is a long history of multiple use management in the catchment. There will be some commercial timber produced in some treatments.

Rare and Endangered Species

Rare, fire sensitive flora and fauna live naturally in situations, such as swamps or rock outcrops, which are usually not affected by lower intensity fires because they are physically protected by low fuel levels or moisture and shade (e.g. Burrows and Friend 1998, Burrows 2005). They were rare before European settlement because their habitats are naturally restricted, but even so, they survived tens of thousands of years of Aboriginal management. Burning reinforces their physical protection by maintaining discontinuous fuels. On the other hand, extensive, high intensity fires after deliberate long term 'protection' from fire can affect all the 'fire refuges' across tens of thousands of hectares. For example, there were no unburnt refuges within the entire 18,000ha wildfire area when the Monadhocks Conservation Park in Western Australia burnt in 2003 after 20 years of deliberate fire protection (Burrows 2005). Thus rock outcrops which had a range of vegetation ages produced by occasional small fires of moderate to high intensity now carry a single age class across the whole area. Similarly, after decades of 'protection' from grazing and burning, the alpine fires of 2003 affected most sphagnum bogs and rock outcrops, pushing their corroboree frogs and pygmy possums closer to the brink of extinction (Mitchell 2005).

Tasker & Dickman (2004) reported that *Pseudomys oralis*, the only endangered small mammal in their study area on the escarpment of New South Wales' northern tablelands, was found only at grazed and burnt sites, which had an open, grassy and floristically diverse understorey. This rare mouse was not found in 'protected' areas where there were "extremely high numbers" of the common and widespread *Antechinus stuartii* and *Rattus fuscipes* in the dense understoreys of common and widespread shrubs

(Tasker & Dickman 2004). Webb *et al.* (2005) suggested that shading by native shrubs and saplings proliferating with suppression of fire, was causing the decline of endangered species including a snake, a rock wallaby and some plants in a “pristine...wilderness area” in south eastern New South Wales. The snakes benefited from habitat created by removing undergrowth (Webb *et al.* 2005). In East Gippsland, frequent burning is likely to conserve a “critically endangered” orchid in remnant eucalypt woodland (Coates *et al.* 2006) and scientific evidence suggests that frequent burning may have a critical role in the continued existence of rare species in north-eastern NSW (Christensen 1998).

Fire history has as large an influence on the distribution of vertebrate fauna in north east New South Wales as the major environmental variables including rainfall and temperature, whereas logging has much less influence (Kavanagh and Stanton 2005). The opportunity to manage fire in multiple use forests is greater than in reserves because there are more resources and infrastructure, and more favourable policies (e.g. Jurskis *et al.* 2003, Scherl 2005). Thus there is more opportunity for positive management of rare species in multiple use forests than in reserves.

Legislation in recent decades, and RFAs have seen large areas of public forest added to conservation reserves, and increasing regulation of activities in multiple use forests. If these developments were having a positive impact on populations of rare and endangered species, this should be reflected in classifications and listings of species under the relevant legislation. However in New South Wales, no species has improved in its official conservation status as a result of increased population nor as a result of increased representation in reserves. Thus there is no evidence that increased reservation or reduced intervention has improved wildlife conservation.

Protecting the full range of pre-European ecosystems

Wet sclerophyll eucalypt forests and rainforests in Australia have been successfully managed for multiple uses including timber production or primarily for conservation (McKinnell *et al.* 1991). On the other hand, many of the grassy ecosystems that have been most depleted by clearing for agriculture and urbanisation since European settlement appear to be declining in health as a result of ‘protection’ from burning and grazing (Jurskis *et al.* 2003, Jurskis 2005b). Tuart woodland in south western Australia is an example. About three quarters of the original tuart woodland has been cleared and much of the remainder is declining in health (Haswell and Walker 2003). The declining area is centred on Yalgorup National Park, and was grazed and frequently burnt for a century before the park was created in 1968 (Bradshaw 2000). Dense understorey developed in the formerly grassy woodland and decline became apparent about 25 years after the tuart was protected in the park (Bradshaw 2000, Haswell and Walker 2003). There are many similar examples across Australia demonstrating that it is not possible to conserve fire dependent ecosystems unless fire or some substitute such as grazing or slashing is used to manage them (Jurskis 2005a). Multiple use forests provide greater opportunities than reserves for positive management of this type.

Oldgrowth Forest

Logging or high intensity fire can destroy oldgrowth forests and create regrowth forests which may take one or two centuries to regain their oldgrowth characteristics. In multiple use, timber producing forests oldgrowth stands can be identified and protected from logging. In native forests generally, broad area prescribed burning can protect the oldgrowth character of drier forests and ensure that extensive high intensity fires do not reset all the wet oldgrowth forests across substantial areas to a single young age class. However Good (1978) argued for very limited burning at the fringes of Kosciuszko National Park because the majority of subalpine woodland had been burnt in 1939 and it should have been allowed to develop into oldgrowth. As a result of such arguments prescribed burning was substantially reduced, and the extensive 2003 fires subsequently converted most of the subalpine woodlands to a single young age class (Jurskis *et al.* 2006).

Non intervention has homogenised the age class of native vegetation across most of Victoria (Fire Ecology Working Group 2002) and the extensive high intensity fires in recent years have reset much of

this to a young age. A similar process has occurred in some North American forests, but there are still good opportunities to use various combinations of logging thinning and burning to restore stand structures more closely resembling 'oldgrowth' conditions (Hessburg *et al.* 2005). Opportunities for this type of restoration appear to be very limited in 'protected' forests in Australia.

Existing oldgrowth stands often occur in gullies and creeks where eucalypt decline is prevalent and active management is discouraged or proscribed by regulation, particularly in public forests. For example, 14 declining stands in Bega Valley Shire were identified by the RFA as oldgrowth (Jurskis and Turner 2002). Eight of these oldgrowth stands comprised or extended into private lands where there are opportunities to deal with decline by burning, grazing and/or slashing (e.g. Jurskis 2005 AF). In State forests these opportunities are not available in creeks or identified old growth stands which are effectively reserved under RFAs and other approvals. Old growth forests in gullies on public lands will inevitably be lost to decline and/or wildfires under current management.

Cultural Heritage

Use of fire was a major part of Aboriginal culture that has been lost from most of Australia except some traditional lands in the north. Relics of Aboriginal culture have also been lost because of consequent 'woody thickening' of vegetation. Howitt (1891) remarked on the quantity of Aboriginal artefacts discovered when clearing dense scrub which had invaded open forests. A century later Aboriginal communities in western New South Wales are complaining that they can't use their sacred sites "because the scrub's too bloody thick to get near them" (Ryan 2006) and farmers say that millions of hectares of woody weeds are protected by legislation, threatening their livelihoods and heritage (Coulthart 2006).

Post – European cultural heritage has also been lost or destroyed as a result of the anti-human approach to nature conservation in the Snowy Mountains. It is unclear how nature conservation was assisted by the demolition of the historic gold mining village of Kiandra, or by the demolition of the 'Queen's Lookout' which was constructed for an official opening of the Snowy Mountains Scheme.

The "Man from Snowy River" is no longer permitted to ride horses there and in any case would now be hindered by dense scrub and regrowth. In his multi award winning bush ballad - "In Conservation's Name"- Ernie Constance "mourns for the stockmen forced out by winds of change". He considers that non intervention policies have also caused erosion, destruction of flora and fauna and release of huge quantities of greenhouse gases.

Carbon Storage

The accumulation of organic matter as forests grow is recognised as a major sink for carbon (Brown 1997, Harrison *et al.* 1995). It is often assumed that there is long term continued accumulation of carbon within the forest biomass and soil and this is achieved by leaving the forest undisturbed. However forests reach an upper level of carbon sequestration and remain in a relatively steady state for some period after which there may be net losses of carbon as decay outstrips growth (Burrows *et al.* 2002, Gifford and Howden 2001). 'Protected' forests are set up for extensive severe fires (Hessburg *et al.* 2005, Jurskis *et al.* 2003) that release large quantities of carbon, followed in some cases by vigorous regrowth that rapidly stores carbon, that is, high amplitude fluctuations in carbon storage. They are also set up for insect outbreaks and tree decline that are a source of carbon but are not followed by rapid carbon sequestration because vigorous regrowth of the dominant tree species does not occur (Hessburg *et al.* 2005, Jurskis *et al.* 2003).

In forests where there is frequent low intensity burning, small quantities of carbon will be emitted when litter and dry vegetation burns and small quantities will be stored as ground vegetation regrows and trees have 'flushes' of growth. That is, the losses and gains fluctuate with low amplitude. Timber harvesting can transfer a proportion of the carbon stored in forest into wood based products and make way for rapid accumulation in regrowth forest. Prescribed burning in multiple use forests can help to minimise extreme episodes of carbon release whilst timber harvesting can be scheduled to take into account carbon sequestration, water yields, and other 'outputs' (e.g. Bi *et al.* 2001). In contrast, the inevitable large fluctuations in carbon storage within protected forests can neither be managed nor satisfactorily

accounted. For example, carbon cycling is still affected by the impacts of the 1939 Victorian fires, and the impacts of the 2003 alpine fires will similarly continue long into the future.

Wilderness

The National Forest Policy Statement acknowledges the significance of wilderness areas to the Australian community because of their very high aesthetic, cultural and nature conservation values and their freedom from disturbance. Contrary to the National Forest Policy and the dictionary definition given above, it can be argued that wilderness is a purely social rather than a 'natural environmental' value because ESFM should be judged against the benchmark of pre-European ecosystems including a rich 'tapestry' of human management. Its cultural value is very recent compared to conflicting Aboriginal cultural values and other conflicting post-European cultural values such as seasonal grazing. The cultural base for wilderness values is in the cities and mostly far removed from the landbase. What is seen as "freedom from disturbance" may actually be a disturbance in terms of the pre-European condition. For example, exclusion of prescribed burning is a fundamental disturbance to fire adapted ecosystems (Hessburg *et al.* 2005, Jurskis 2005). It is ironic that a socially held value has a high cost but provides tangible benefits for an extremely small and privileged section of society, *i.e.* the few that have the fitness, resources, leisure time and inclination to 'experience' wilderness.

By definition, non intervention is the only suitable approach to managing wilderness values. Thus there is a conflict with the other values that are better served by active management. For example, protection of life and property took precedence over wilderness values when lightning strikes ignited fires in the Brogo Wilderness in south east NSW under drought conditions in January 2007. Although there were only four small fires burning in relatively mild weather and eventually totalling less than 400 ha in area, the direct cost of suppression was about a quarter of a million dollars per day for more than a week (Stark 2007), because there was no access for conventional fire suppression or fire management activities. Wilderness values conflict with all other socioeconomic and environmental values, so there are large opportunity costs in comparison to small social benefit and nil environmental benefit. It is clear that active intervention cannot protect or enhance wilderness values however the priority placed on these values appears to be disproportionate given the high cost benefit ratio associated with managing for wilderness.

Protection against Wildfire, Pests and Diseases

Reduced occurrence of low intensity fire, development of dense shrub layers, declining forest health and extensive intense wildfires have become increasingly common with increasing 'protection' and reducing multiple use management of forests in Australia (Gleadow and Ashton 1981, Rose 1997, Lunt 1998, Jurskis 2000, Jurskis and Turner 2002, Jurskis *et al.* 2003, Jurskis 2005). Extensive severe fires and forest decline are consequences of 'protecting' fire dependent ecosystems from fire (Hessburg *et al.* 2005, Jurskis 2005). For example extensive areas of heavy and continuous fuels as well as extensive decline including 'koala overbrowsing', 'mistletoe infestations' and 'phytophthora dieback' have developed in the dry forests of Brisbane Ranges National Park and adjoining water supply catchments near Melbourne (Jurskis 2004). In 2006 a severe fire burnt 7,000 ha in the area, destroyed livestock, property and homes and damaged water supply catchments and natural environmental values. Non intervention has diminished natural and socioeconomic values in this area, and has been criticised in Federal Parliament by the local member (McArthur 2006).

In northern New South Wales, a group including farmers, conservationists, government agencies and academics was formed in 2001 to discuss, research and manage forest decline in about 20,000 ha of dry and moist forests west of Kyogle (Billyard 2003). After several years of operation, and considerable expenditure of public monies, the group has endorsed some small management trials. The trials in multiple use State forest will involve various combinations of harvesting, planting and/or burning at a compartment scale (*i.e.* hundreds of hectares), whereas the trials in National Park involve pulling lantana at a site scale (tens of hectares) (P.J. St Clair pers. comm.). It is apparent that there are limited opportunities in reserves to manage this landscape problem at an appropriate scale.

Recent 'protective' management in inland northwestern USA has homogenised the regional landscape and set it up for extensive severe fires and pest problems (Hessburg *et al.* 2005). There are great opportunities there for managers to use thinning and burning to restore functional landscapes but it is unlikely that sustainable management can be developed through social consensus because values differ amongst sectors of society and consensus usually favours the status quo (Hessburg *et al.* 2005). Nevertheless, the Healthy Forests Restoration Act provides opportunities for managers in the USA to use thinning and burning for restoration. In Australia active intervention of this type is unlikely in reserves, and will be contentious even in multiple use forests. For example, thinning will be excluded from reserves comprising 38% of the Wungong Catchment Area (Anon. 2005). Similarly, RFAs and other approvals mostly act to constrain active management in multiple use forests and do little to encourage restoration of functional landscapes.

Socioeconomic

It has been suggested that socioeconomic losses as a result of withdrawn timber production can be balanced by increases in inputs from ecotourism and recreation in expanded National Parks, however examples have not been provided. There are many cases where socioeconomic losses have occurred. For example, the Border Ranges National Park in northern New South Wales was State forest managed for timber production, conservation and recreation before it was converted to National Park, resulting in the closure of the sawmill at Grevillia. The land use decision by the NSW Government assumed no losses of employment, however population declined, unemployment rose and people at Grevillia suffered financially and emotionally as a consequence of the decision (Lugg 1988).

The social cost borne by the people of Grevillia was not compensated, but Australia's National Forest Policy now provides for assistance to communities and industries that are affected by reservation of former multiple use forests (Lugg 1988). Structural adjustment packages have been used in several cases to mitigate the short term financial and employment impacts (Lugg 1988) but they appear unable to mitigate the population declines and contraction of local economies that affect 'timber towns' such as Grevillia.

Cypress and Redgum Forests

White cypress (*Callitris glaucophylla*) forests in NSW developed after European settlement in areas that naturally carried open eucalypt and cypress woodlands with a grassy ground layer maintained by Aboriginal burning and natural fires (Noble 1997). Aboriginal culture was disrupted and droughts and overgrazing removed fuels so that fire was effectively removed from the environment. Subsequently, destocking followed by wet seasons allowed dense cypress scrubs to develop. Silvicultural treatment turned these scrubs into a valuable timber resource, providing employment and industry for many communities with otherwise limited economic opportunities. These artificial forests also provided environmental benefits and helped to conserve native flora and fauna.

A large proportion of the cypress forests have now been formally reserved. This will have substantial socioeconomic impacts on some small and remote communities even though compensation and adjustment packages are available. For example, 9 sawmills, mostly in small towns, will close. Benefits in terms of conservation are not apparent since measures were in place to conserve all social and environmental values except wilderness which by definition doesn't exist in the artificial forests. Management of the multiple use forest was regulated by licence from the Department of Environment and Conservation, and this will continue. There has been no change in the 'legal' conservation status of any species despite the creation of about 350, 000 ha of formal reserves.

There would have been great opportunities to use thinning and burning to restore some of the artificial forests to woodlands more closely resembling the natural condition (e.g. Hessburg *et al.* 2005) whilst at the same time producing commercial timber to sustain industry. These opportunities would now appear to be lost, and the 69 new jobs in 'conservation' that will be created at a cost of 29 million dollars over 5 years are unlikely to create a sustainable landscape in the sense of Hessburg *et al.* (2005), nor to sustain local communities and economies in the medium or long term.

Forests of river red gum also developed as a consequence of European settlement on floodplains where the native vegetation was open woodlands grasslands and reedbeds (Jacobs 1955). Silvicultural treatments have been applied since the late nineteenth century to create and maintain productive multiple use forests, with a rich cultural history, supporting many small rural communities. A process has commenced in Victoria to review the land use and management of these forests, and there have been calls from Green parliamentarians in NSW to commence such a process. In addition to perceived tension between economic and conservation values in the red gum there is an additional complication of competing water uses including irrigation, domestic water, timber production and conservation of wetlands. This issue involves four States, and the Prime Minister has offered a ten billion dollar package to induce the States to agree to Federal control of the water resources of the Murray Darling Basin.

Formal reservation of river red gum forests does not appear to offer any benefits in nature conservation, that cannot be achieved under current multiple use management. In contrast, continued multiple use management can provide opportunities to use thinning and burning to restore some of these forests to a more natural woodland condition. These opportunities are not generally available in formal reserves in Australia and, even if they became socially acceptable, would carry a high cost. Multiple use management can reduce costs of restoration or return profits that can be applied to restoration, including development of infrastructure to maximise efficiency of water use for multiple purposes (e.g. Barrie Dexter). Multiple use management can also use growth modelling and yield scheduling technology to accurately predict inputs and outputs of water, carbon, timber and habitat trees under various management scenarios (e.g. Bi *et al.* 2001).

Management of Reserves

It is apparent that more extensive, active fire management will be required to restore or maintain functional landscapes in formal reserves containing open forests if ESFM is to be achieved.

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