PLANNING THE USE OF FIRE ON CONSERVATION LANDS IN SOUTH-WESTERN AUSTRALIA

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Introduction

A number of papers in these proceedings provide a summary of much of what is known about the effects of fire on the biota in Western Australia. Obviously there is much more to learn; indeed we are never going to be in a position of complete knowledge and understanding. Management programmes that make best use of existing knowledge and, at the same time, allow for additional information to be collected must thus be developed for it is through an iterative process that management will be refined.

The planning process is the major vehicle for interpreting knowledge and having it applied. But the process needs to be structured in order to deal effectively with conflicting objectives. In this paper I outline a planning process suitable for use in developing fire management plans for nature conservation lands.

Fire Management Objectives

The planning and management process is generally structured in a heirarchical way starting with overall aims and objectives and working through specific objectives and strategies to tactics and actions. Table 1 illustrates a part of this heirarchy as it relates to the use of fire on conservation lands. For example, for conservation, it is important to avoid having any isolated reserve completely burnt out by a single fire event because local extinction of wildlife species could ensue; immigration and subsequent recolonisation would be restrictd by the reserve's isolation. Strategies for achieving this objective involve dividing the reserve up in some way that incorporates low-fuel areas and application of fire suppression measures where necessary.

The concept of maintenance of process requires special explanation. Basically, all plant and animal communities have evolved under a regime of various disturbance types (volcanoes, rockfalls, landslips, fires, floods, ... frequent to rare, intensive to mild, extreme to small, etc.). These disturbances trigger off regenerative processes that contribute to the character of the communities. Thus the conservation of the communities may involve ensuring that the disturbance regimes are continued. Likewise, it may be necessary to ensure that a new regime is not put in place. This is maintenance of process.

Fire was one of the disturbance types affecting Western Australian plant and animal communities during their evolutionary histories. Some of the fires were of natural origin; others were lit by Aboriginal people. But for most conservation lands the regimes of fire now prevailing differ from those of pre-European times. Thus management of those conservation lands may involve deliberate application of the previous regime over certain areas to conserve the biota through maintenance of the processes associated with that type of fire.

Table 1. Management objectives for conservation lands as they might translate into actual fire management strategies.

Overall Management Objectives	Fire Management Objectives	Fire Management Strategies
1. Conservation of indigenous biota.	a) Protection to ensure whole reserve not burnt by a single fire. b) Fire exclusion from selected areas.	Mosaic burning. Construction of strategic fuel reduced zones. Fire suppression.
	c) Maintenance of process.	Ecological burning.
2. Protection of neighbouring property.	a) Fire protection. b) Fire suppression.	Construction of firebreaks. Fuel reduction burning. Fire fighting.
(3, 4, 5 ... Education, Research, Recreation ....)		

In the event that it becomes necessary to impose a fire for the purpose of maintenance of process, then the prescription is likely to differ from that for a fuel reduction burn for the same area. This is because the two management objectives invariably involve quite different fire regimes. The point is exemplified in Table 2. Note in this table that I have added a spatial consideration to the list of factors indentified by Gill (1975) as being necessary to characterise a fire regime. Spatial factors (areal extent and patterning or mosaic) have a major bearing on post-fire changes such as invasion, recolonisation and grazing.

As indicated above, one input into the fire behaviour model is information on the fuel array. This can either be sampled directly in the field or modelled. The models are calibrated using empirically derived data and incorporate estimates of litter fall rates, decomposition rates and proportions of fuel reduction resulting from any prescribed fires or wildfires. Some such models are available for wheatbelt vegetation types at Tutanning Nature Reserve (Fig. 1) but more will be required to complement any new fire models.

Table 2. Summary of typical fire regime characteristics for fuel reduction burns and ecological burns for a semi-arid woodland site in south-western Australia.

	Fire Management Objective	
	Protection	Maintenance of Process
Type of Prescribed Burn:	Fuel Reduction Burn	Ecological Burns
Regime characteristics:		
frequency	regular & frequent	irregular, infrequent (pseudo-random)
intensity	cool	hot
season	spring	late summer-autumn
spatial factors	patchy, often of limited areal extent	more uniform, often extensive

Fire Prescriptions

Once the objective for any management fire has been clearly defined then it is necessary to develop a prescription for achieving that objective. This necessitates the use of a fire behaviour model by which the dynamic properties of the fire (rate of spread, intensity, energy profile) might be predicted for the particular fuel array, terrain configuration and meteorological conditions. Models that are available for use in Western Australia at present are contained in the Modified McArthur Grasslands Meter (McArthur 1966) and the Forests Department Red Book (Sneeuwjagt & Peet 1979). Without doubt these models can provide some useful guidelines for fire management in some natural grasslands and non-forest vegetation types, but their general applicability to the many fuel and vegetation types occurring on conservation lands throughout the State is limited. There is an urgent need to develop new fire behaviour models that are appropriate for these conservation lands. The 3-strata Rothermel model, as adapted for Australian conditions and being used in New South Wales (Kessell 1985), warrants examination for its suitability for use in Western Australia.

Two features of the fuel accumulation curves given in Figure 1 deserve special mention. Firstly, the maximum standing crop of fire fuels in Wandoo communities at Tutanning is unusually low at around 9 tonnes/ha. It is possible this may reflect the high level of termite activity in this community. Secondly, the shapes of the curves for communities dominated by *Allocasuarina huegeliana* suggest that effective fuel reduction is difficult to achieve. *A. huegeliana* is extremely fire sensitive - trees are killed by even very mild fires - but they are rarely consumed. The dead trees begin to topple over after 3-5 years and then contribute to available fuels for a further 10-15 years. These two features, the naturally low fuel loading in Wandoo communities and the high post-fire fuel loadings in *Allocasuarina* communities, have important implications for the development of a fire management plan for Tutanning.

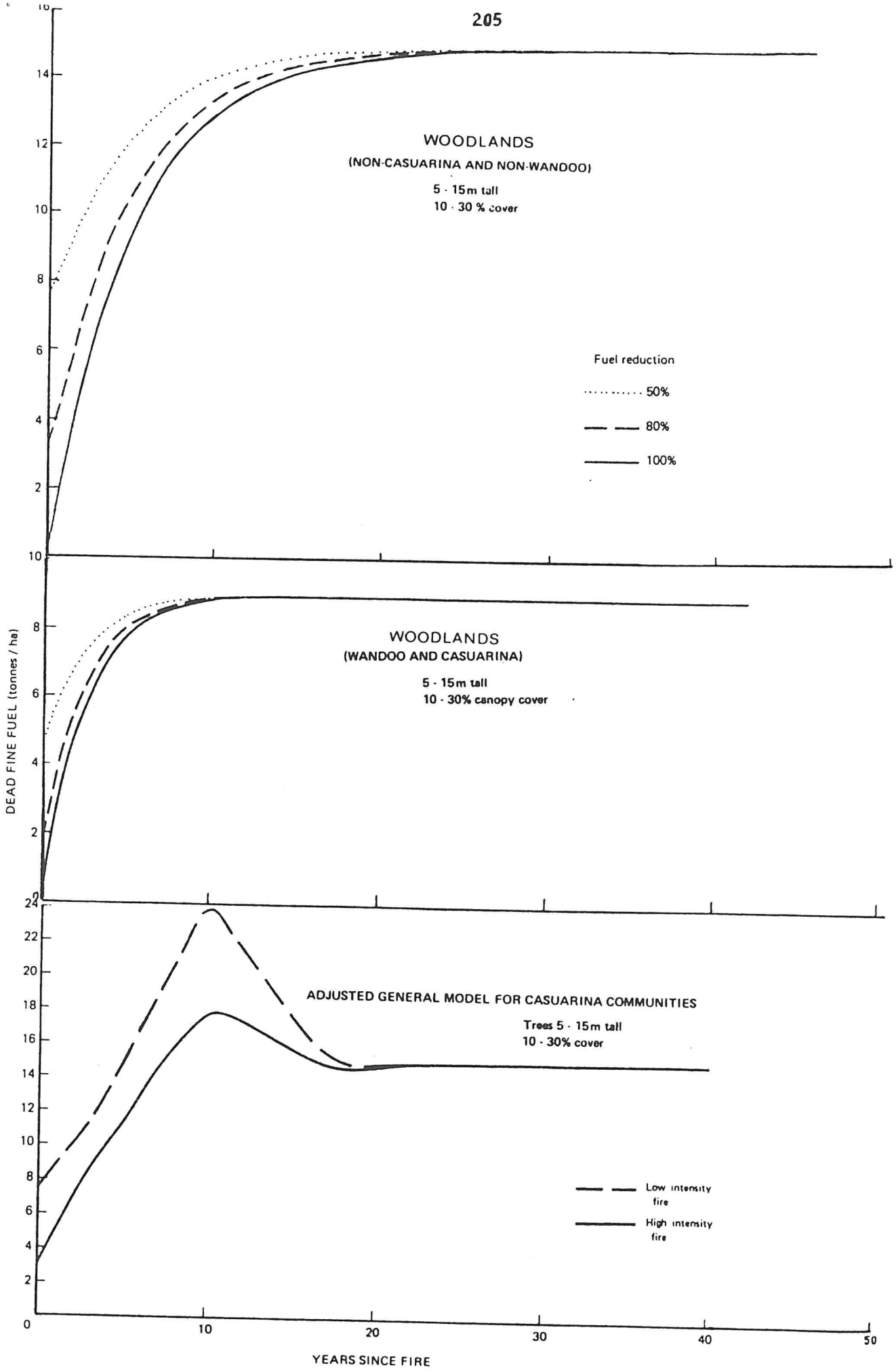

Figure 1. Fire fuels accumulation curves for some vegetation types at Tutanning Nature Reserve (Kessell et al. 1984).

A Systematic Approach to Planning the Use of Fire on Conservation Lands

There will inevitably be conflicts to be resolved in the development of fire management plans for conservation lands. Perhaps the most fundamental conflict is between fire protection for neighbouring lands and conservation: complete protection can require fuel reduction over much of the reserved area but the principal components of the fire fuels, the litter and shrub layers, are also important components of the biota and provide important faunal habitat and nutritional resources. Litter and shrub foliage invertebrates are major dietary items for vertebrates.

To facilitate resolution of conflicts such as this, I have developed a step-by-step process for planning the use of fire on conservation lands (Table 3). I illustrate this process using the fire management plan drawn up in 1976 for the Two Peoples Bay Nature Reserve, some 30 km east of Albany. The reserve is described in Hopkins (1985).

Table 3. A systematic procedure in planning for fire management on nature conservation lands in Western Australia.

1. Define aims/objectives for area.
2. Identify sources, risks.
3. Collate fire history data in conjuction with climatic data.
4. Examine ways to manage sources/risks without impact on biota.
5. Survey area for vegetation, fuels, natural low-fuel areas, important biota requiring special attention.
6. Redefine objectives if necessary.
7. Assess management capability for both planned and unplanned fire.
8. Examine simple methods for isolating sources from risk areas (strategic).
9. Plan other essential fire control measures.
10. Plan ecological burning requirements.
11. Undertake modelling where possible.
12. Plan and implement monitoring programmes.
13. Reassess plan regularly.

1. Aims and Objectives for the Management of the Reserve include:

   1.1 Conservation of the Noisy Scrub-bird.

   1.2 Conservation of other rare speces of wildlife including the Western Whipbird and the Western Bristle-bird.

   1.3 Conservation of the plant and animal communities represented on the reserve.

   1.4 Public education.

   1.5 Research

   1.6 Public recreation (there is an established picnic area and fishing is very popular).

   1.7 Protection of human life and property values (reserve users and neighbours).

2. Sources of fire include the barbeques in the picnic area, marron fishing areas around Moates Lagoon, other public use areas, roads, and farming areas to the north and west of the Reserve.

   The population of Noisy Scrub-birds, at that time concentrated around Mt Gardner was the greatest risk. Next was the public, particularly those members concentrated in the picnic area.

3. Fire history data indicated that major fires in the previous 15 years had come from the west and northwest.

4. An important initiative was to replace the wood-fired barbeques in the picnic areas with gas-fired ones and ban fires from elsewhere in the reserve.

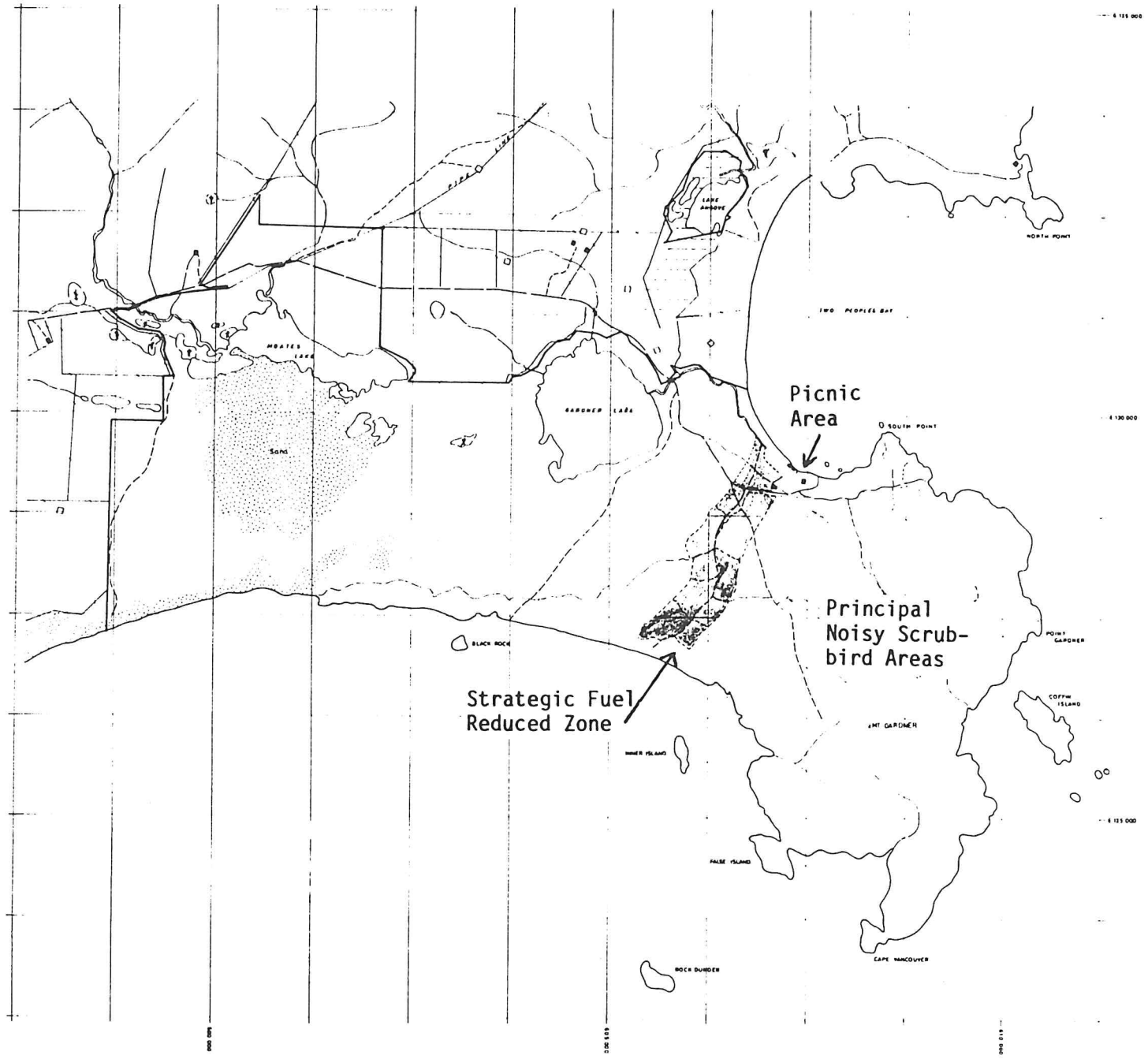

Figure 2. Map of Two Peoples Bay Nature Reserve illustrating features of the 1976 Fire Management Plan.

5. Natural firebreaks include the two lakes and the sand dunes at the western end of the reserve, and the large expanses of bare granite around Mt Gardner. There were no species other than the rare birds that were known at that time to require special attention.

6. Objectives were maintained.

7. There was a resident Ranger on the reserve equipped with two mobile units. Fire fighting assistance was available from the local Bush Fire Brigade and from departmental staff throughout the south-west.

8. A strategic, fuel reduced zone was designed through the isthmus with the objective of isolating major Noisy Scrub-bird habitat areas from the major sources of fire to the west (Fig. 2). This buffer was divided into 12 manageable blocks to be fuel reduced.

9. All boundary and internal firebreaks were maintained and/or upgraded. A programme of fuel reduction burning along road verges was instituted.

10. No burning for maintenance of process was planned.

11. A version of PREPLAN (Kessell et al. 1984) is being developed.

12. A detailed study of effects of fire and subsequent regeneration was initiated in September 1976. This is continuing.

13. The plan is due for re-evaluation in 1986. All research and monitoring are being collated at present.

The resulting Fire Management Programme satisfied the needs for internal and external protection, it enables large areas to be left unburnt for conserving the rare birds without causing undue danger and it has provided opportunities for research so that the next plan in 1986 will be substantially better than the 1976 one.

Concluding Remarks

In this paper I have focussed on concepts and decision making processes: concepts that I regard as being central to planning the use of fire on conservation lands and processes that may be used to translate these concepts into management actions. For example, it is an essential discipline to define objectives for a particular fire before developing the prescription - it leads to better decisions and elevates the level of debate should one ensue.

I have also drawn attention to some deficiencies in knowledge about the use of fire on conservation lands. The major deficiency is the lack of appropriate fire behaviour models. Many aspects of information on fire effects are lacking, and most of these will not be addressed by research in the foreseeable future. In the absence of this information it is highly desirable that managers keep good records of the fires they deal with and monitor results of those fires systematically. It is only through such a reporting - monitoring - re-evaluation process that management will improve in the long-term.

Finally, I want to raise the issue of public attitudes to fire. Much has been done in recent years to make people aware of fire safety. A major thrust has been towards fire prevention by fuel reduction burning. This has generated some rather casual attitudes towards fire, including the view that it is a tool that has been completely mastered. I believe that a little more circumspection is justified and warranted; public education programmes should now focus more on the environmental effects of deliberate or accidental incenduarism in order to develop a more thoughtful attitude to the use of fire.

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