

# SETTING STRATEGIES TO ACHIEVE FIRE MANAGEMENT OBJECTIVES

*R. Sneeuwjagt*

Department of Conservation and Land Management  
PO Box 104  
Como WA 6152

## INTRODUCTION

In Western Australia fire management knowledge of nature reserves can vary from substantial to insignificant depending on the vegetation types. In the jarrah and karri forests of the south west of the state, fire behaviour, fire ecology and habitat management research has been ongoing since the 1960s and 1970s. As a result it is possible to approach fire management planning scientifically by setting specific, quantifiable objectives, and selecting strategies that have a known impact and are likely to be practical and achievable.

Where knowledge of fire behaviour is sparse or totally absent, such as in the spinifex, mallees and heath vegetation types, fire management decisions have had to be somewhat subjective, and are more likely based on historical experiences and intuition than on scientific facts.

The manager entrusted with the responsibility of conserving the nature reserves under his control must plan and implement fire management strategies that permit the protection of human life and property as well as the conservation values in and around the reserve. Where any of these values are high, he cannot adopt a "do-nothing" approach whilst waiting for data and information to be collected. Management strategies must be selected on the basis of existing knowledge, and be flexible enough to allow for integration of additional information gained in the future through the implementation and monitoring of fire regimes and operational trials.

The task of evaluating and selecting suitable fire management strategies is made simpler if the fire management objectives are quantified. For example, if the fire protection objective is that no single wildfire is to burn out more than, say, twenty-five per cent of the reserve and fire is to be contained within the reserve, it becomes clear that a system of strategically located low-fuel buffers in conjunction with an effective suppression system should be considered amongst other strategy alternatives. Similarly, fire ecology objectives can be quantified in this way. An example is in the draft objective for the Two Peoples Bay Nature Reserve which aims, amongst other objectives, to ensure the persistence of viable populations of every species of rare flora and fauna occurring on the reserve. This objective allows for the development of suitable habitat management strategies as well as fire prevention actions. Objectives that are too broad and nebulous cannot be evaluated for their success or failure, and do not lead to the development of specific and adequate strategies.

## **The Fire Management Planning Process**

A model for the processes that are involved in any systematic development, implementation and evaluation of a fire management plan is proposed in Figure 1. This model works through from the initial determination of the reserve management objectives, through to the evaluation and selection of fire management objectives, strategies and works programmes down to the monitoring and review of the effectiveness and impacts of these works on the Reserve.

The starting point is the development of an overall management objective for the reserve. This must accurately reflect the land-use objective for the reserve which has been identified in either the Regional Management Plan or the Department's Statewide land-use management plan.

The second step is to determine the specific fire management objectives for the reserve. Before these specific fire management objectives can be derived however, it is necessary to conduct an analysis to determine the values required to be managed and those at risk to fire damage or inappropriate fire regimes. One systematic approach for a risk analysis is being devised and tested for forest lands within the CALM estate. This procedure termed a "Wildfire Threat Analysis" permits a comparative determination of the probabilities of such questions as: will a fire start?, will it spread?, what values are threatened by fire?, and what can be done to control it?

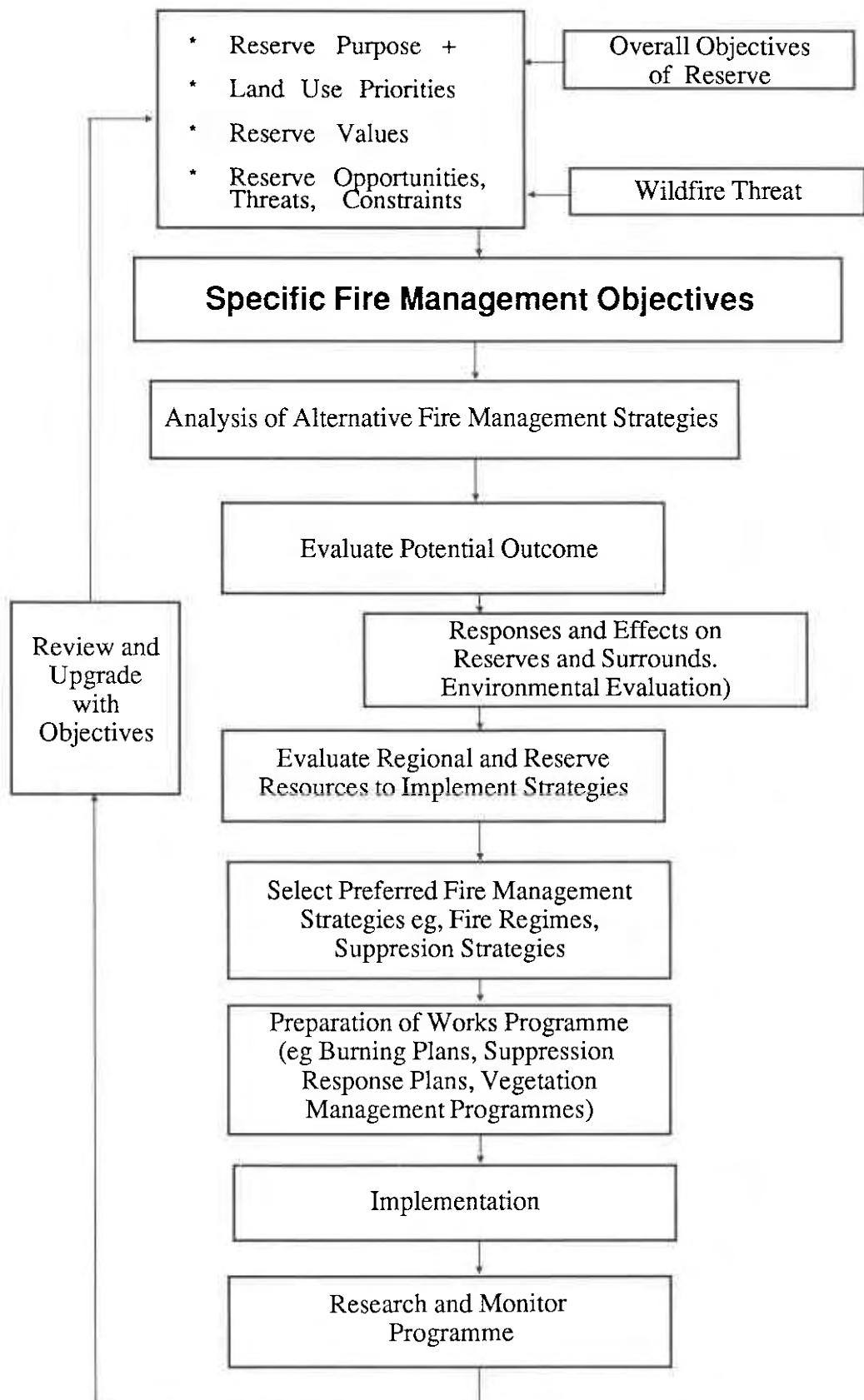
In most State forest areas of W.A. it has been found possible to place weighted values on those attributes that contribute towards each of these probabilities, and therefore to score and map various combinations of risks and values. The weighting assigned to particular attributes is somewhat subjective and can be open to debate. Nevertheless the structured approach ensures that all important factors of both risks and values are considered. It highlights those areas of greatest importance or with greatest need for care, and provides a framework for decisions on the specific fire management objectives and on the alternatives and priorities for the array of fire management strategies that may be available to achieve the selected objective.

An example of the range of factors considered by CALM in the Wildfire Threat Analysis for forest lands is given in Appendix I.

### **Selecting the Fire Management Strategies**

The next step in the process is to consider all the various alternative strategies that are available for each fire management objective.

It is the task of the planner to determine the most suitable alternative by systematic evaluation of the full range of strategies. Even those alternatives which at first glance appear unacceptable or impractical should be considered. By recording these alternatives it permits those responsible for reviewing the plan to judge the merit of the selected options. The planner or planning group should solicit the information, experiences and opinions that may be available from all relevant groups and individuals interested in the Reserve and the surrounding area.



**FIGURE 1**  
**Systematic Process for Preparing and Implementing a Fire Management Plan**

These may include Departmental experts in the various operational and research sections, fire control agencies, Conservation groups and "Friends of the Reserve", local government, neighbouring land holders, and Reserve user groups. Where a detailed management plan is required, participation by representatives from each of these interest groups in a well-structured workshop can provide a suitable forum for recruiting ideas and opinions on the array of fire management strategies. It is then normal procedure to convene a small representative task force of planners and managers to sieve through the alternatives and evaluate their effectiveness and their likely impacts on the other land management objectives.

In fire management there are a variety of component strategies which can be considered for any reserve. These may include education; law enforcement; local liaison and mutual aid arrangements; firebreak construction and maintenance, fuel reduction methods, vegetation/habitat manipulation operations, recruitment and training, and provision of equipment. The degree to which any of these component strategies are adopted will depend on the values and risks, the likely environmental impact on the Reserve values and the surrounding land, the Reserve location and access, the resources available, and the overall purpose of the reserve and its priority within the Region.

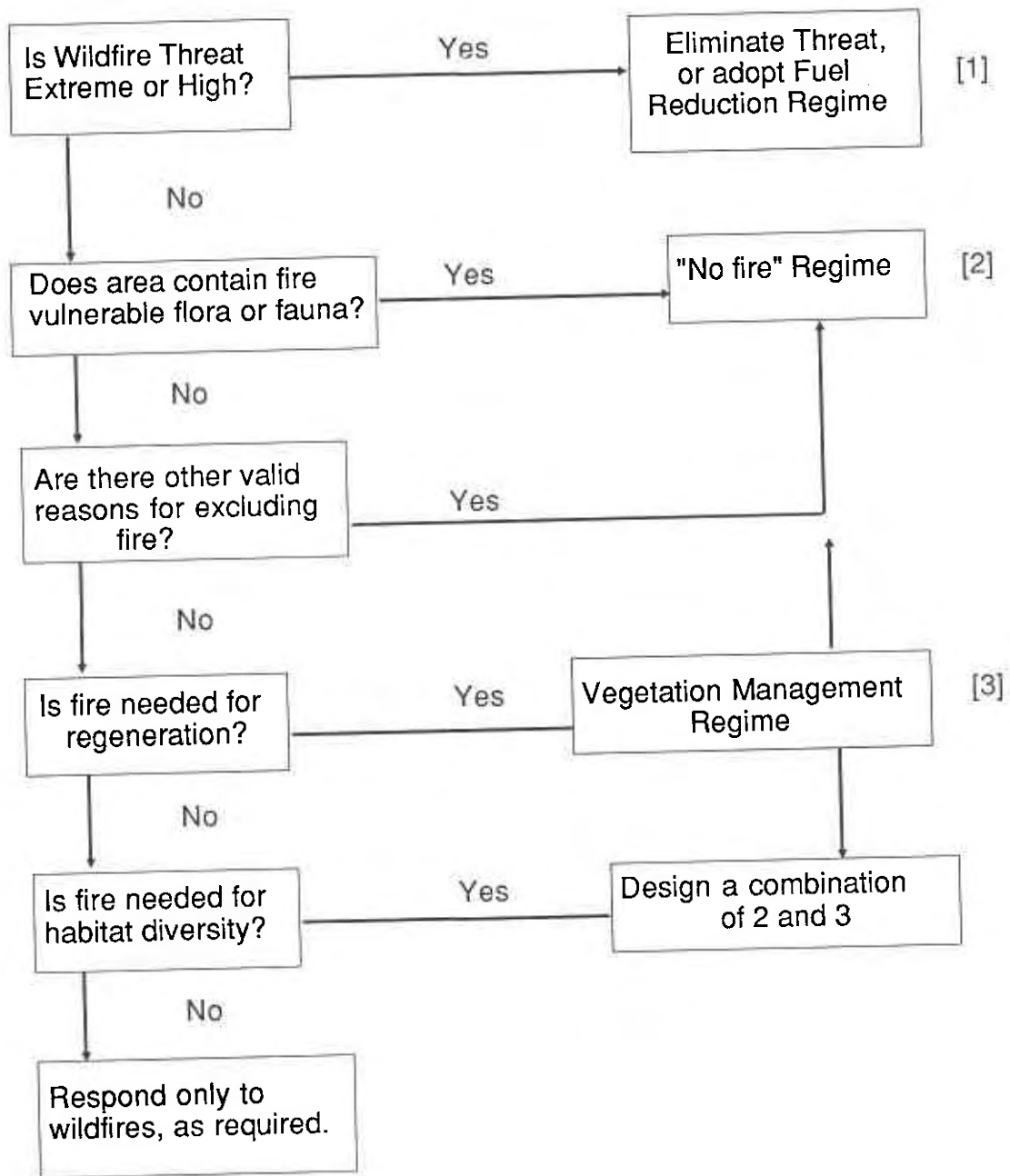
Table 1 lists several examples of the types of fire management strategies that may be applied to achieve some specific fire management objectives and overall management objectives.

The use of prescribed fire as a strategic tool to achieve management objectives is one of the most difficult and controversial issues that need to be addressed by the management organisations. Fire can be used to achieve a number of objectives. Burning for fuel reduction aims to reduce potential fire intensities and rates of spread so the suppression of fires can be facilitated. Fire is also used to regenerate a given ecosystem, or to modify vegetation communities to favour or maintain a vegetation type, seral stage or plant species, or fauna habitats. For a specific unit of land, managers can select and apply the most appropriate fire regime for a particular ecosystem in its social and environmental context. Three different fire regimes are identified by CALM in Western Australia: A "No Fire" Regime; a "Vegetation Management" Regime; and a "Fuel Reduction" Regime. Each of these regimes has a different set of objectives, although frequently their effects overlap. For example, a vegetation management regime can provide adequate fuel reduction and vice versa.

The selection of the appropriate fire regime required for a particular reserve, or part of a reserve can be done systematically through the step-wise approach shown in Figure 2.

**Table 1**  
**An example of Fire Management Objectives and Strategies**

RESERVE MANAGEMENT OBJECTIVES	SPECIFIC FIRE MANAGEMENT OBJECTIVES	FIRE MANAGEMENT STRATEGY ALTERNATIVES (NOT EXHAUSTIVE)
Conservation of Flora and Fauna	<p>Maintenance of diversity in vegetation association and structures in major vegetation.</p> <p>Protect to ensure entire reserve not burnt in single wildfire. <i>Variation</i>: ensure only a predetermined (eg, 30% of reserve burnt by wildfire).</p>	<ul style="list-style-type: none"> <li>◦ Application of variety of burn regimes in each vegetation type (including fire exclusion).</li> <li>◦ Burn to regenerate/maintain specific habitats.</li> <li>◦ Leave reserve unburnt, except strategic low-fuel buffers to allow wildfires to provide variety.</li> <li>◦ Establish and maintain strategically located low-fuel buffers.</li> <li>◦ Burn parts of reserve in large blocks in mosaic pattern (Patch burn).</li> <li>◦ Fire treatments (both narrow buffers/broad blocks) to include variety of frequencies, intensities, seasons etc.</li> </ul>
Protection of Reserve and neighbouring lands	<p>Protect lives (visitors, fire-fighters and staff).</p> <p>Protect private and public assets in an adjoining Reserve.</p> <p>Minimise risks of wildfire starting from human activity.</p>	<ul style="list-style-type: none"> <li>◦ Provide protective buffers around/within high-use areas, picnic sites, facilities, settlements etc.</li> <li>◦ Maintain road network to allow rapid evacuation and access for fire control.</li> <li>◦ Restrict entry of visitors on extreme days.</li> <li>◦ Establish/maintain low-fuel buffers adjacent high value sites.</li> <li>◦ Arrange hazard removal on neighbouring locations/settlements.</li> <li>◦ Maintain fire control access near high risk/high value areas.</li> <li>◦ Restrict use of fire for camping/cooking etc. Provide gas barbeques.</li> <li>◦ <i>Attempt to modify behaviour of neighbours, Reserve visitors (Pamphlets, Noticeboards etc).</i></li> <li>◦ <i>Construct/maintain firebreaks.</i></li> </ul>



**FIGURE 2**  
**Selection of Fire Regimes**

## **Evaluation of Strategy Alternatives**

There will inevitably be conflicts between the various fire management strategies, particularly those associated with fire management for conservation, and fire protection of neighbouring lands and community assets. To help identify the conflicts and possible means of resolving such conflicts, it is necessary to work systematically through the planning procedures outlined in Figure 1.

The evaluation process to determine the suitability of each strategy alternative and its impact on the environment and on other land-use objectives can also be structured to ensure it is systematic and objective. One such systems approach is the Impact Evaluation System for Fire Management Strategies as shown in the Appendix 2. This system enables planners or managers to evaluate potentially adverse or beneficial impacts of a proposed fire management strategy on each of the various components of the reserve ecosystem, as well as on the land-uses in the reserve and on neighbouring lands.

Where the evaluation shows a likely adverse impact, a modified approach should then be considered, and in turn be re-evaluated for its impact. Where there are still likely to be important adverse effects, the proposed strategy (including any modified approaches) may either be rejected, or where it is considered the operation is vital, the decision to proceed will be referred to the appropriate director, or in special cases the Minister responsible. This evaluation system still requires further refinement. Its current emphasis is on the problems and negative factors which prevent or constrain certain strategies and actions, and as a result it may tend to lead to a "do-nothing" decision. A more balanced approach would also include the benefits and opportunities that each strategy may provide to the proper management of the reserve.

## **Implementation**

After the strategies to be applied have been selected, evaluated, perhaps modified, and approved at the appropriate organisational level, the next major process is to spell out the actions, priorities and target dates for each of the strategies. For example where fuel reduction burning is required, the following steps are followed on CALM forest lands:

- 1 A Master Burning Plan is prepared showing those areas in which fuels will be periodically reduced by prescribed fire. Such plans may also show those areas allocated for other fire regimes. The plan should also designate proposed season of burn, and/or fire intensity. Most forest burn plans may also include a prescribed burn area coverage required to achieve an effective buffer to wildfire.
- 2 An annual burn program is derived from the Master Plan, in which individual burn jobs are identified and prioritised.
- 3 Each job is surveyed in detail well in advance of the burn. These assessments include an environmental and safety checklist, fuel type and quantity measurements, and a check of boundaries, problem areas and values requiring special attention.

- 4 A detailed burn prescription is prepared for each burn in which the ideal lighting pattern and weather and fuel conditions are calculated from the fire behaviour prediction tables. These prescriptions are required to be checked and approved by specialist staff. The preparations and burning of job boundaries (or "edges"), and the core ignition either by ground crews or aircraft must follow very strict and well-rehearsed departmental operational instructions and guidelines.
- 5 All completed burns are assessed to check compliance with the burn prescription. Records of the post-burn assessments are stored for future reference by the operations staff and fire research specialists.

## **DISCUSSION**

The planning and implementation of fire management policies requires a comprehensive and systematic approach by managers, planners and operators. In many areas, decisions on fire management strategies are still necessarily intuitive. In recent years, however, the process has become more formal and structured. Bitter and sweet experiences, and the products of research and monitoring programs are constantly providing new information and ideas on the most appropriate means to tackle what are often regarded as very complex fire management problems. This paper provides a number of systematic procedures which can be used today by those responsible for fire management planning and implementation.



## **Appendix 1**

### **Wildfire Threat Analysis**

The Threat Analysis has two components: (i) What are the risks? and (ii) What are the values at stake? Under each heading, a range of factors can be considered. The factors are:

#### **RISKS**

##### **Risk of Ignition**

###### *High*

- Regular path of summer storms and lightning strikes recorded.
- Active land clearing within 3 km of site.
- Fire used/planned on adjoining lands (eg regeneration burns, stubble burns).
- High visitor use on site involving use of fire (eg barbeques, marron fires).
- History of past ignitions from other sources (eg deliberate lightings).

###### *Moderate*

- History indicates little/no past ignition.
- Moderate visitor use, reasonable access for visitors.

###### *Low*

- No history of fires.
- Little/no human activity at or near site, poor access for visitors.
- Summer storms rare. No recorded lightning strikes during the period when fires could start.

##### **Detection Capability**

- Poor - no spotter or tower coverage, sparsely populated.
- Fair - infrequent spotter coverage, few towers, moderately populated.
- Good - regular spotter coverage, good tower coverage.

### **Suppression (attack) Capacity (Crew time to site)**

- No fire crews available.
- Crews available within 2-3 hours travel time.
- 1-2 hours        }     adjust according
- 0.5 to 1 hour   }     to size of
- 0.5 hours        }     available crews.

### **Access around Fire**

- Area poorly roaded. Off-road access difficult (heavily timbered, dense scrub, creeks and gullies, dunes or swamps).
- Access moderate - open forest, moderate scrub density, even slopes.
- Area well roaded. Off-road access easy, open country, flat, heath or grasslands.
- Adjust according to effects of topography on fire behaviour.

### **Fuels**

- Very heavy fuels 2 x standard fuels.
- Heavy fuels 1.5-2.0 x standard fuels.
- Moderate fuels 1.0-1.5 x standard fuels.
- Light fuels 0.5-1.0 x standard fuels.
- Very light fuels 0.5 x standard fuels.

The word "standard" in this context applies to the area or botanical association being considered. Different standards apply in different areas.

### **Dieback Risk from Mechanical Fire Fighting**

- High
- Moderate
- None

## Wind

- Grass or heathlands (wind ratio 1:1)
- Open woodland (wind ratio 3:1)
- Moderate forest (wind ratio 4:1)
- Medium dense (wind ratio 5:1)
- Dense forest (K1 & 2, regrowth, wind ratio 7:1)

## VALUES

### Conservation Values

#### *Flora and fauna*

- High - If gazetted rare species are present.
- Medium - If geographically restricted species are present.
- Low - If neither are present.

#### *Maturity of vegetation assemblage*

- High - If the block is the longest unburnt in its vegetation type in the reserve.
- Medium - If it is the second longest unburnt in its vegetation type in the reserve.
- Low - Otherwise.

#### *Presence of fire vulnerable flora*

- High - If there are species vulnerable to fires over 10 years apart.
- Medium - If there are species vulnerable to fires from 5-10 years apart.
- Low - Otherwise.

#### *Extra value as habitat if left unburnt*

- High - If there are known to be species of fauna requiring mature vegetation for habitat.
- Medium - If it is likely that there are species of fauna requiring mature vegetation for habitat.
- Low - Otherwise.

## Social/Economic Values

### *Life and Property*

- Within 3 km NW to NE of areas where assets/lives concentrated and at potential risk in the event of fire. Eg Townships and settlements. Fixed camps used in summer. Areas where very large numbers of people congregate in summer and cannot be readily evacuated/find refuge in the event of fire.
- Within 3 km (other directions) of above.
- Within 3-6 km of first point above.
- Within 3 km of areas where lesser numbers of people congregate (eg major recreation sites).
- Within 1 km of developed private property.
- Honey, wildflowers, timber, water resources
- Within 3 km generally north-west to north-east of high value production forest susceptible to damage by wildfire. This may include private plantations, regeneration areas and other nominated Red Action areas.
- Within 3 km of lesser value fire sensitive forest (eg smaller patches of regeneration, minor pine areas, important wildflower or honey areas) or is a catchment protection or water production area that would be damaged by wildfire.
- Within 3 km of high value or high quality mature hardwood forest.
- Within 3 km of multiple use forest other than first two points above.

### **Cultural Values**

- The area contains or adjoins areas with important anthropological or historical values which could be degraded by fire.

**APPENDIX 11**  
**NECESSARY OPERATIONS IMPACT EVALUATION CHECKLIST**

1. PARK, RESERVE, DISTRICT INVOLVED.  


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LOCATION WITHIN RESERVE (block, etc)  


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PRIMARY MANAGEMENT OBJECTIVE OF THE RESERVE  


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2. THE WORK PROPOSED - PURPOSE  


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TYPE & EXTENT OF THE WORK  


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3. ANY OTHER OPTIONS AVAILABLE? Specify,  


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4. IMPLICATIONS OF "DO NOTHING" OPTION OR POSTPONEMENT  


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INSTRUCTION: Indicate with (✓) or (x) in Column (1) if proposed work is acceptable or not with respect to the environmental and management issues listed. If not acceptable, consider acceptability of modified proposal in column (2), or 'do nothing' option column (3). Use column (4) for additional comments.	[1]	[2]	[3]	[4]
ISSUE	Proposal Acceptable	Modification Acceptable	Do Nothing Acceptable	COMMENT Indicate action required to overcome/minimize adverse impact.
1. GEOLOGY, SOILS, WATER, AIR	<del>✓</del> x	<del>✓</del> x	<del>✓</del> x	
1.1 Caves, fossils, dunes				
1.2 Soil erosion/damage				
1.3 Streams salinity, sediment, run-off, drainage				
1.4 Air quality, visibility				
2. FLORA, FAUNA AND ECOSYSTEMS				
2.1 Gazetted rare, restricted distributed plants				
2.2 Fire sensitive plants, wildflower display				
2.3 Rare fauna, special habitats				
2.4 Stream, swamps, lakes, gorges, rock outcrops etc.				

ISSUE	[1]	[2]	[3]	[4]
3. ENVIRONMENTAL PROTECTION				
3.1 Disease (eg. dieback, insects)				
3.2 Weeds, feral animals				
3.3 Requirement for gravel, rock, borrow pits				
3.4 Modify fire regime/patterns				
4. CULTURAL HERITAGE, SPECIAL VALUES				
4.1 Aboriginal sites				
4.2 Historic sites, facilities				
4.3 Special reference sites, research plots				
4.4 High value sites, (farms, settlements, plantations etc)				
5. RECREATION, ACCESS, OTHER USES				
5.1 Public access, re-direct public use				
5.2 Increase public mis-use (eg. tracks degrade)				
5.3 Landscape, features, wilderness appreciation				
5.4 Visitor safety				
5.5 Increase demand for facilities and services (eg. rubbish disposal, toilets etc.)				
6. MANAGEMENT CONSIDERATIONS				
6.1 Can proposal pre-empt future Management Plan.				
6.2 Conflict with existing policy				
6.3 Neighbours, local shires, community interests, Apiarists				
6.4 Fulfill legal requirements (eg. Bushfire Act, etc)				
7. ENDORSEMENT/APPROVAL				

PROPOSER \_\_\_\_\_ Date \_\_\_\_\_

DISTRICT/REGIONAL MANAGER ENDORSEMENT/COMMENT \_\_\_\_\_  
 \_\_\_\_\_ Date \_\_\_\_\_

APPROVED/NOT APPROVED \_\_\_\_\_  
 \_\_\_\_\_ Date \_\_\_\_\_