FLORA & FAUNA GUARANTEE

FLORA AND FAUNA GUARANTEE - SCIENTIFIC ADVISORY COMMITTEE

FINAL RECOMMENDATION ON A NOMINATION FOR LISTING

Inappropriate fire regimes causing disruption to sustainable ecosystem processes and resultant loss of biodiversity

(Potentially Threatening Process)

Date of receipt of the nomination: 27 May 2003 **File No.: FF/54/0286**
Date of preliminary recommendation: 2 September 2003
Date of final recommendation: 11 November 2003

Validity: The nomination is for a valid item

Prescribed Information: The prescribed information was provided.

Name of the Nominator is adequately provided.

Name and Description of the process:

In the opinion of the SAC the process is adequately defined and described.

The nominated process has been identified as 'Inappropriate fire regimes causing disruption to sustainable ecosystem processes and resultant loss of biodiversity'. This is defined as fires occurring at intervals, intensities, seasons and scales that lie outside the ecological or physiological tolerances of the resident biota. Such tolerances are set by each species' life history characteristics.

Fire has been a part of the Victorian (and Australian) environment for millions of years, largely shaping the richness, composition and distribution of the plants, animals and ecosystems we see today. A substantial proportion of our unique biota has become largely dependent on fire and the attendant variety of fire regimes for its continued existence and development. For species to continue to exist in an area, fires must be at intervals and at the intensities, seasons and scales that lie within the ecological tolerances of the resident biota. Such tolerances are set by the species' life history characteristics (or 'vital attributes'; Noble and Slatyer 1980).

Fire frequency (or fire interval) is a critical determinant of whether a species will persist under a particular fire regime. Fires at too-short or too-long an interval at a site will lead to the extinction of plant species which require a time longer than the interval to reach maturity and set seed, or which become locally extinct in a time shorter than the interval, respectively. It must be noted however that many hollow-dwelling vertebrates and saproxylic invertebrates require fire intervals that are substantially greater than time interval required for the dominant plant species in a community to set seed and that many plant species continue to exist in ecosystems as soil-stored seed for long periods after the plants themselves have senesced and died.

Since the arrival of Aboriginals and Europeans in Australia, fire regimes have been altered significantly, with humans providing new sources and frequencies of ignition and also effectively suppressing fires across the whole landscape.

An inappropriately short fire regime is exemplified by two or more successive fires close enough together to interfere with the ability of plants or animals to recruit new individuals into a population at a sufficient rate to compensate for adult mortality, or to build up a bank of propagules sufficient in size to maintain the population beyond the next fire. Sustained high frequency fire will consequently lead to a loss of plant species and hence a simplification in vegetation structure. For animals, high frequency fire indirectly affects survival of species through modification of habitat and most probably also because life cycle processes are disrupted.

The nominated process potentially ranges across all areas that experience fire in Victoria, although the likelihood of occurrence of high frequency fire is currently greatest in some mallee areas, foothill forest habitats and in forest and grassland areas close to settled areas. No one interval can be used as an acceptable time between fires for the maintenance of biodiversity across Victoria, i.e. it is not possible to nominate a general fire interval across the state. This is because the timing of critical life history processes of communities differs markedly across ecosystems .

The specific frequency of fire that will be detrimental to a species or community will vary from place to place, depending upon the survival mechanisms that the species or community exhibit and local conditions. The number of fires over any set time period that will constitute a detrimental fire frequency will therefore be specific to particular localities and communities.

The range of flora or fauna affected or potentially affected was adequately stated in the nomination.

Significance of the threat which the potentially threatening process poses or has the potential to pose was adequately stated in the nomination.

Eligibility for listing as a potentially threatening process under the Flora and Fauna Guarantee

The nominated item satisfies at least one criterion of the set of criteria prepared and maintained under Section 11 of the **Flora and Fauna Guarantee Act 1988**, and stated in Schedule 1 of the Flora and Fauna Guarantee Regulations 2001.

Evidence that criteria are satisfied:

Criterion 5.1 *The potentially threatening process poses or has the potential to pose a significant threat to the survival of a range of flora or fauna.*

Evidence:

Plants and animals have a variety of mechanisms to survive individual fires but will persist in any given area or habitat over repeated fires (i.e. within a fire regime) only if certain life history requirements (vital attributes) are not breached. These attributes determine how a species lives and reproduces, and with respect to fire, how a species responds to fire and/or persists within a particular fire regime. For plants, these attributes include methods of persistence, the conditions required for establishment and the relative longevity of particular species. For animals, the attributes include the species' dispersal abilities and requirements for shelter, food and breeding, in turn largely determined by habitat composition and structure.

Fires at too-short or too-long an interval at a site may lead to the extinction of species which require a time longer than the interval to reach maturity and produce propagules, or which become locally extinct in a time shorter than the interval, respectively. Sustained inappropriately high or low frequency fire will consequently lead to a loss of plant species, a change or reduction in vegetation structure and a corresponding loss of animal species. An extensive review of this subject was published by Gill and Bradstock (1995) which highlights the extent of the impact of inappropriate fire regimes.

Sub-criterion 5.1.1 *The potentially threatening process poses or has the potential to pose a significant threat to the survival of two or more taxa.*

Evidence:

Low frequency fire has been identified as a threat to a number of threatened and/or listed species and communities. These include:

Heath Mouse (*Pseudomys shortridgei*) - Cockburn (1979), Meulman (1997)
New Holland Mouse (*Pseudomys novaehollandiae*) - Wilson (1996)
Ground Parrot (*Pezoporus wallicus*) - Meredith (1984), Meredith & Jaremovic (1990) CNR (1993)
Buxton Gum (*Eucalyptus crenulata*) - Jelinek (1993)
Yellow Gum, Swamp Gum, Manna Gum (*E. leucoxylon, E. ovata, E. viminalis*) – Withers & Ashton (1977)
some orchid species (including *Diuris fragrantissima, Thelymitra epipactoides, T. matthewsii*) - Calder *et al* (1989)

High frequency fire has also been identified as a threat to a number of threatened and/or listed species and communities. These include:

Glossy Black-Cockatoo *(Calyptorhynchus lathami)*, Eastern Bristlebird (*Dasyornis brachypterus*) and Mallee Fowl (*Leipoa ocellata*).
Spot-tailed Quoll (*Dasyurus maculatus*), Eastern Quoll (*Dasyurus viverrinus*), Southern Brown Bandicoot (*Isoodon obesulus*), Southern Ningaui (*Ningaui yvonneae*), Squirrel Glider (*Petaurus norfolcensis*), Long-nosed Potoroo (*Potorous tridactylus*) and Long-footed Potoroo (*Potorous longipes*).
Eltham copper Butterfly *Paralucia pyrodiscus lucida*

Populations of some currently common animal species could become threatened by high frequency fire. Some examples of mammals include:

Feathertail Glider (*Acrobates pygmaeus*), Yellow-footed Antechinus (*Antechinus flavipes*), Dusky Antechinus (*Antechinus swainsonii*), Eastern Pygmy Possum (*Cercartetus nanus*), Common Ringtail Possum (*Pseudocheirus peregrinus*) and Sugar Glider (*Petaurus breviceps*).

Sub-criterion 5.1.2 *The potentially threatening process poses or has the potential to pose a significant threat to the survival of a community of flora or fauna.*

Evidence:

Some examples of plant communities potentially threatened by low frequency fire include:

Western Basalt Plains grasslands (*Themeda* dominated grasslands that contain several rare/threatened flora including *Diuris fragrantissima* and are habitat for *Delma impar*) - Govanstone *et al* (1992), McDougall (1989)
Sandplain Heathland (Big Desert) - Cheal (1995, 2000)
Banksia ornata heathland (Little Desert) – McMahon (1984)

Some examples of plant communities potentially threatened by high frequency fire include:

Cool Temperate Rainforest, Warm Temperate Rainforest.
Semi-arid Herbaceous Pine - Buloke Woodland Community, Semi-arid Herbaceous Pine Woodland Community, Semi-arid Northwest Plains Buloke Grassy Woodlands Community and Semi-arid Shrubby Pine - Buloke Woodland Community.

Additional Information

- The SAC has previously recommended a similar item for listing under the FFG Act (SAC 2001).
- There is a large literature related to fire and its effects on native biota in Australia (see references).

Advertisement for public comment

In accordance with the requirements of Section 14 of the **Flora and Fauna Guarantee Act 1988**, the preliminary recommendation was advertised for a period of at least 30 days.

The preliminary recommendation was advertised in:
'The Age' - on 1 October 2003
'The Weekly Times' - on 1 October 2003
The *Government Gazette* - on 2 October 2003
Submissions closed on 6 November 2003.

Further evidence provided:

Four submissions were received but no evidence was provided to warrant a review of the Scientific Advisory Committee's preliminary recommendation that the potentially threatening process is eligible for listing.

Documentation

The published information and research data provided to the SAC have been assessed. Based on the available information, the SAC believes that the data presented as evidence for the nature of the threatening process are not the subject of scientific dispute and the inferences drawn are reasonable and well supported. However, the SAC was unconvinced by the evidence presented with the nomination document on an analysis of Victorian fire ecology data (NRE/PV 2002b). Consequently, the committee does not accept the use of this analysis as a source of definitions of "appropriate or ideal fire regimes" for Ecological Vegetation Classes (EVCs) within the state.

Final Recommendation of the Scientific Advisory Committee

The Scientific Advisory Committee concludes that on the evidence available the nominated item is eligible for listing in accordance with Section 11 of the Act because primary criterion 5.1 has been satisfied. The SAC also concludes that sub-criteria 5.1.1 and 5.1.2 have been satisfied and that no evidence exists to suggest that primary criterion 5.1 cannot be satisfied as a consequence of sub-criteria 5.1.1 and 5.1.2 being satisfied.

The Scientific Advisory Committee recommends that the nominated item be supported for listing on Schedule 3 of the **Flora and Fauna Guarantee Act 1988**.

Selected references:

Auld, T.D., Bradstock, R. & Keith, D. (1993) Fire as a threat to populations of rare plants. Final report Australian National Parks and Wildlife Service Endangered Species Program, *Endangered Species Project No. 31*.

Baker, J. & Whelan, R.J. (1994) Ground Parrots and fire at Barren Grounds, New South Wales: a long-term study and an assessment of management implications. *Emu* **94**: 300-4.

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Bradstock, R.A., Keith, D.A. & Auld, T.D. (1995) Management of fire for conservation: imperatives and constraints. In: *Conserving Biodiversity: Threats and Solutions* (eds R.A. Bradstock, T.D. Auld, D.A. Keith, R. Kingsford, D. Lunney and D. Sivertsen), pp.323-33. Surrey Beatty and Sons, Sydney.

Burrows, N.D. & Friend, G.R. (1998) Biological indicators of appropriate fire regimes in southwest Australian ecosystems. In *Fire in Ecosystem Management: Shifting the Paradigm from Suppression to Prescription* (eds. T.L. Pruden and L.A. Brennan) pp. 413-421. Tall Timbers Fire Ecology Conference Proceedings No. 20, Tall Timbers Research Station, Tallahassee, FL.

Catling, P.C. (1991) Ecological effects of prescribed burning practices on the mammals of southeastern Australia, In *Conservation of Australia's Forest Fauna* (ed. D. Lunney), pp. 353-363. Royal Zoological Society of NSW, Mosman.

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---------- (1995b) Fire ecology of invertebrates: implications for nature conservation, fire management and future research. In *"Fire and Biodiversity - The Effects and Effectiveness of Fire Management"* Proceedings of the Biodiversity and Fire Conference, October 1994, Melbourne. pp. 155-62. Biodiversity Series Paper No. 8, Department of Environment, Sport and Territories.

---------- (1999) Fire and faunal response patterns – a summary of research findings. In *"Management of Fire for the Conservation of Biodiversity – Workshop Proceedings"* (eds. G.R. Friend, M. Leonard, A. Maclean and I. Sieler) pp. 39-45. Department of Natural Resources and Environment, Melbourne.

Friend, G.R. & Williams, M.R. (1996) Impact of fire on invertebrate communities in mallee-heath shrublands of south-western Australia. *Pacific Cons. Biol.* **2**: 244-67.

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---------- (1999) (Eds.) *Management of Fire for the Conservation of Biodiversity – Workshop Proceedings.* Department of Natural Resources and Environment, Melbourne.

Friend, G.R., Leonard, M., Sieler, I., & Thompson, B. (1999) *Interim Guidelines and Procedures for Ecological Burning on Public Land in Victoria.* Department of Natural Resources and Environment, Melbourne. 24pp.

Gill, A. M. (1981) Adaptive responses of Australian vascular plant species to fires. In '*Fire and the Australian Biota*', (eds. A.M. Gill, R.H. Groves, & I.R. Noble), pp. 243-72. Australian Academy of Science, Canberra.

Gill, A.M. & Bradstock, R.A. (1995) Extinction of biota by fires. In *Conserving Biodiversity: Threats and Solutions* (eds R.A. Bradstock, T.D. Auld, D.A. Keith, R. Kingsford, D. Lunney & D. Sivertsen), pp.309-322. Surrey Beatty and Sons, Sydney.

Keith, D.A. (1996) Fire-driven extinction of plant populations: a synthesis of theory and review of evidence from Australian vegetation. *Proceedings of the Linnean Society of NSW* **116**: 37-78.

Noble, J.C. (1982) The significance of fire in the biology and evolutionary ecology of mallee Eucalyptus populations. In *Evolution of the Flora and Fauna of Arid Australia* (eds. W.R. Barker and P.J.M. Greenslade), pp. 153-60.Peacock Publications, Adelaide.

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NRE/PV (1999b) *Management of Fire for the Conservation of Biodiversity – Workshop Proceedings.* Fire Ecology Working Group, Department of Natural Resources and Environment and Parks Victoria: Melbourne.

NRE/PV (2002a) *Management of Fire for the Conservation of Biodiversity – Workshop Proceedings, Second series Oct-Nov 2000 and Mt Cole Pilot Study.* Fire Ecology Working Group, Department of Natural Resources and Environment and Parks Victoria: Melbourne.

NRE/PV (2002b) *Analysis of Disturbance by Fire on Public Land in Victoria.* Fire Ecology Working Group, Department of Natural Resources and Environment and Parks Victoria: Melbourne.

SAC (2001) Final recommendation on a nomination for listing: High frequency fire resulting in disruption of life cycle processes in plants and animals and loss of vegetation structure and composition (Potentially Threatening Process) (Nomination no. **565**). Scientific Advisory Committee, Flora and Fauna Guarantee. Department of Natural Resources & Environment: Melbourne.

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Wilson, B.A. (1996) Fire effects on vertebrate fauna and implications for fire management and conservation. In *Fire and Biodiversity: The effects and Effectiveness of Fire Management.* Proceedings of Conf. 8-9th Oct 1994, Footscray, Melbourne (ed. J.R. Merrick), *Biodiversity Series, Paper No. 8*, biodiversity Unit, pp. 131-47. Department of the Environment, Sport and Territories, Canberra.

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York, A. (1996) Long-term effects of fuel reduction burning on invertebrates in a dry sclerophyll forest. In '*Fire and Biodiversity: The effects and Effectiveness of Fire Management*'. Proceedings of Conf. 8-9th Oct 1994, Footscray, Melbourne (ed. J.R. Merrick), *Biodiversity Series, Paper No. 8*. Biodiversity Unit, pp. 163-81. Department of the Environment, Sport and Territories: Canberra.

Relevant websites: (as of August 2003)

Bibliography of Australian fire research - http://www.anu.edu.au/Forestry/fire/FNET/bibliofirenet.html

The International Fire Information Network - http://www.csu.edu.au/firenet/

Australian Museum Factsheets, *Fire in the Australian Landscape* - http://www.amonline.net.au/factsheets/fire.htm

How fires affect biodiversity - http://www.anbg.gov.au/fire_ecology/fire-and-biodiversity.html

Use of fire in ecosystem management (Ecological Society of Australia, position statement) - http://users.chariot.net.au/~rbg/subterrestris.htm

Fire and Biodiversity (NSW EPA) - http://www.epa.nsw.gov.au/soe/soe2000/cb/cb_6.6.htm

Fire in the Australian landscape (Aust. Museum site) - http://www.austmus.gov.au/factsheets/fire.htm

Fire management in Australia: the lessons from 200 years - http://www.forestry.org.nz/conf2003/Jurskis.pdf

Fires and rare or threatened http://www.esb.act.gov.au/firebreak/reslet6.html species -

Australia's Biodiversity - Responses to Fire: Plants, Birds and Invertebrates - http://ea.gov.au/biodiversity/publications/technical/fire/

DSE/NRE *Code of Practice for fire management on public land* – http://www.nre.vic.gov.au/web/root/domino/cm_da/nrecfoe.nsf/0/15108db820550c1f4a256823000608ca?OpenDocument

Wetlands and fire (Western Australia) - http://www.wrc.wa.gov.au/public/WaterNotes/pdf/2.pdf

Wildlife, Fire and future Climate - http://www.publish.csiro.au/samples/WildlifeFireSample.pdf

Endorsement by the Convenor of the Scientific Advisory Committee **Date**

R. S. Clarke 11/11/03

Dr Mike Clarke
Convenor