Mallee fires and malleefowl – seeking a balance

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Abstract

Fire is a natural part of the mallee landscape. Mallee ecosystems exhibit adaptations to fire, with many species being either fire dependant or fire tolerant. So why has fire become a key threatening process for some of the endemic mallee species, such as the malleefowl?

The presence of fire in the mallee landscape is not in itself the problem. However significant changes have occurred in mallee fire regimes – the sequence of successive fires – particularly in relation to fire frequency, intensity, size and patchiness. Large and/or frequent fires can have significant negative impacts upon local malleefowl populations, through direct impact and through reduction in habitat suitability in subsequent years. The effects of undesirable fire regimes have been exacerbated by broad-scale land clearance, which has fragmented and isolated areas of suitable remnant habitat.

Most mallee fires are started by lightning, which cannot be prevented. Malleefowl require long unburnt mallee vegetation. So how can this paradox be resolved? Fire management strategies should define an acceptable range of fire regimes, which meet the requirements of vegetation communities and key groups of animal species. Fire management actions should seek to promote variability in habitat in both time (age structure) and space (distribution and patch size), while ensuring that adequate areas of long unburnt mallee are retained.

While this may not maximise the abundance of malleefowl at any one point in time, it will help to ensure that malleefowl (and other species with similar habitat requirements) persist within an area at all points in time, thus avoiding extinction.

Introduction

Within the context of malleefowl conservation, fire is often perceived in negative terms such as threat or impact. Fire has been an integral part of the formation of mallee ecosystems, so why is it now seen as a problem?

This paper discusses the role of fire in mallee ecosystems and the importance of understanding the concept of fire regimes. Threats to malleefowl conservation are summarised and the risks associated with undesirable fire regimes are described. Contemporary challenges for mallee land managers are examined, with particular emphasis on managing fire regimes for mallee fauna.

Fire management strategies tailored to achieve conservation outcomes are discussed. The conclusion is drawn that clear conservation objectives designed to meet the habitat requirements of mallee fauna (including malleefowl), integrated with a pro-active fire management program, will minimise the risk of species extinction in the future.

Malleefowl and fire in the mallee landscape

Fire is a natural part of the mallee landscape. Mallee ecosystems have, in part, been shaped by fire. Many mallee plants exhibit adaptations to fire, broadly divided into “sprouters” and “seeders” (Gill & Catling 2002, Bradstock & Cohn 2002). Species that resprout following fire include spinifex (*Triodia scariosa*), mallee eucalypts and the distinctive mallee poplar (*Codonocarpus cotinifolius*). Species which release seed following fire include desert banksia (*Banksia ornata*) and needlewood (*Hakea leucoptera*). Additionally many species have soil-stored seed that germinates following fires – notably the wattles (*Acacia* spp) and many other legumes (NSW NPWS 2002). For many of the “sprouters” and “seeders”, fire provides the best opportunity for recruitment of new individuals into the population (Keith et al. 2002a, Bradstock & Cohn 2002).

Fire does not however treat the landscape with an even hand. Flammability varies between vegetation communities and with season, promoting variability in the size and pattern of fires. For example, the highly flammable spinifex (*Triodia scariosa*) is usually found on sand dunes (Bradstock & Cohn 2002). Resulting fires generally conform to dune crests, leaving the swales unburnt. This creates a mosaic of different vegetation age classes, which may become even more diverse following successive fires (Woinarski 1999).

The impact of spinifex fires on biodiversity depends upon a range of factors including intensity, size and patchiness (Allan & Southgate 2002). Broad scale spinifex fires can disadvantage many species including malleefowl, particularly where it forms part of a mallee-spinifex vegetation association. However, small spinifex fires increase the range of vegetation age classes, which may be beneficial to malleefowl (and other mallee species with similar habitat requirements).

In contrast, extensive growth of spear grass (*Stipa* spp) may occur after successive wet years (Willson 1999, Gill 1997). Spear grass grows extensively in dune swales and open flats. Together with spinifex on the dune crests, this creates an almost continuous fuel bed that results in landscape-scale fires (Gill 1997, Willson 1999). Biodiversity impacts of such fires is usually severe.

Optimal habitat for malleefowl is generally regarded as long-unburnt mallee between 30 and 60+ years (Benshemesh 2000, Benshemesh 1997, Bradstock & Cohn 2002, Woinarski 1999). However this varies between regions and local vegetation characteristics. Malleefowl will tolerate fire at a higher frequency, if fires are patchy and areas of long-unburnt mallee remain (Benshemesh 1997, Benshemesh 1994, Woinarski 1999). Malleefowl will forage in recently burnt areas, particularly adjacent to areas of unburnt habitat (Benshemesh 2000, Woinarski 1999).

The malleefowl is considered to be an indicator species for healthy mallee habitat. Consequently, if an effective fire management program is implemented that successfully conserves malleefowl, then many other mallee species will benefit (Benshemesh 2000, Benshemesh 1994).

Fire events vs fire regimes

Fire is commonly viewed in terms of a single event – the "emergency" that requires immediate control (Gill 1999). The perception of fire as a short-term event is reinforced in daily television reports and newspaper headlines such as "the most devastating one-day fire in Australia's history" (The Daily Telegraph, Monday 20 January 2003). Biodiversity conservation outcomes do not however result from a single fire event, but from a longer-term fire regime (Gill et al. 2002).

Fire regimes are the sequence of successive fires, including variables such as fire frequency, intensity, seasonality, size and patchiness (Gill et al. 2002, Watson 2001). Fire regimes are complex, as these factors operate in both time (including pre and post-European settlement) and space (across and within the landscape) (Noble & Grice 2002, Woinarski 1999).

Inappropriate fire regimes often have negative, although sometimes unintentional, consequences. For example, frequent burning to reduce a perceived fuel hazard may reduce perennial vegetation and increase the growth of annual vegetation (such as grasses), resulting in an increased fuel hazard (Keith et al. 2002b).

The effects of inappropriate fire regimes have also been demonstrated in mallee ecosystems. Mallee eucalypts experience low mortality at a fire interval of 5-10 years. However, higher mortality resulted from more frequent fires, particularly autumn fires (Bradstock & Cohn 2002).

Threats to malleefowl conservation

The National Recovery Plan for Malleefowl (Benshemesh 2000) describes the following major threats to malleefowl populations:

- vegetation clearance: the better habitat areas have been almost entirely cleared
- fragmentation and isolation: little opportunity for dispersal/recolonisation, increased risk of local extinction
- stock grazing: significantly reduces habitat quality for malleefowl
- predation: "fox predation is the greatest single cause of malleefowl mortality" (Priddel & Wheeler 2003)
- wildfire/intentional burning

The grazing effect of feral goats and native herbivores in mallee vegetation communities is not well documented, but may contribute to the degradation of habitat quality for malleefowl (Noble & Grice 2002, Benshemesh 2000).

The significance of fire as a threatening process becomes more apparent when it is considered in context with the other threats to malleefowl, particularly habitat clearance and fragmentation. Prior to broad-scale land clearance, fire operated as a largely natural ecosystem process, and was unlikely to cause significant long-term negative impacts to biodiversity (Benshemesh 2002).

Habitat clearance and fragmentation has exacerbated the effects of fire, by changing fire regimes (particularly frequency and extent) and therefore increasing the likelihood of negative consequences (Priddell & Wheeler 2003, Benshemesh 1992). Fragmentation may lower fire frequency, but it also increases the possibility that a single fire can entirely burn an isolated habitat remnant and consequently the possibility that local extinction of malleefowl may occur (Benshemesh 2000, Seager 2001). In these cases, recolonisation is unlikely (Benshemesh 1994).

Where deliberate burning is undertaken a higher fire frequency is likely. While deliberate burning may not burn the entire habitat remnant, it is likely to increase the younger age classes and decrease the long-unburnt mallee resources that malleefowl require, such as leaf litter for nesting (Benshemesh 2000, Benshemesh 1997).

Excessive post-fire grazing by native and introduced herbivores may have serious and long term negative impacts on malleefowl habitat (Willson 1999, Benshemesh 2000).

However, fire also has positive effects for malleefowl. Young vegetation may provide greater food resources, particularly in terms of seed production (Woinarski 1999, Benshemesh 1994). Benshemesh (2002) states: “many plants that provide food for malleefowl are dependant on, or at least benefit from, occasional fire”.

Managing mallee fire regimes for mallee fauna

So, how can remnant habitat areas and fire be managed in ways that promote the ongoing survival of malleefowl and other mallee species with similar habitat requirements?

To address this challenge, we must:

- develop an understanding of flora and fauna responses to fire regimes and fire frequency thresholds
- develop an understanding of fire regimes and fire history
- evaluate risks to biodiversity from undesirable fire regimes
- identify desirable fire regimes for biodiversity management (even in the absence of comprehensive information)
- develop clear conservation goals and objectives, including strategies for managing high priority risks
- implement a pro-active fire management program
- monitor and evaluate against the stated goals and objectives, on an ongoing basis (both fire regimes and malleefowl populations)

- use an adaptive management process to redefine goals and objectives and re-target management actions as required

(Seager 2003, Gill et al. 2002, Keith et al. 2002b, Willson 1999)

The principal conservation goal for remnant habitat/management areas is to avoid the extinction of species. A specific objective may be to ensure that malleefowl persist and breed within the management area over a 10-year period.

In order to achieve this objective, suitable malleefowl habitat must exist within the management area at all points in time over that 10-year period. If at any stage suitable habitat is not available, malleefowl may become locally extinct.

The major risks to malleefowl from fire are from large fire events that burn the entire remnant habitat/management area, or from multiple fires events of high frequency that collectively burn all areas of long-unburnt mallee (Seager 2001).

To ensure that suitable habitat is always available, strategies need to ensure that the entire management area cannot be burnt in a single large fire and that the desired area of long unburnt mallee is retained.

Fire management actions should promote variability in habitat in both time (age) and space (distribution and patch size), maximising opportunities for species with differing fire responses and fire frequency thresholds (Bradstock & Cohn 2002, Willson 1999).

Within the acceptable range of fire regimes, actions may include:

- strategic burning, to limit the spread of wildfire (by interrupting fuel continuity)
- strategic burning, to promote patchiness during wildfire (by interrupting fuel continuity)
- strategic burning, to increase habitat diversity (by increasing range of vegetation age classes)
- actively controlling wildfire, to limit the amount of long-unburnt habitat affected
- passive containment – if a wildfire is unlikely to exceed the acceptable range

(Bradstock 2001, Willson 1999)

Regular assessment of vegetation age classes will help to determine the most appropriate fire management strategies (ie active control/passive containment/active burn) (Bradstock & Cohn 2002, Bradstock 2001).

Active control (fire suppression) seeks to limit the spread of wildfire and therefore increases older age classes (ie maintains long unburnt habitat). If active control is always undertaken and is always successful, long-unburnt habitat will increase and age class diversity will decrease.

Alternatively, active burning introduces fire into the landscape, decreasing older age classes (ie reduces long unburnt habitat). However, the areas burnt through the prescribed use of fire are usually relatively small.

In addition, an appropriate monitoring program measuring malleefowl breeding densities must be undertaken, to measure the effectiveness of the fire management program and to guide future strategies and actions (Keith et al. 2002a).

The pro-active fire management program described above requires effective communication with stakeholders, particularly where public relation risks are perceived to be higher (for example in association with increased prescribed burning or less "active" fire suppression) (Seager 2003).

The relative merits of various fire management strategies are examined in the following figures. Three different scenarios relating to a fire in a hypothetical habitat remnant are presented:

- fire in a habitat remnant containing a single vegetation age class (40+ years old)
- fire in a habitat remnant containing multiple vegetation age classes
- fire in a habitat remnant containing multiple vegetation age classes and with a pro-active fire management program

Scenario 1: Habitat remnant with single vegetation age class

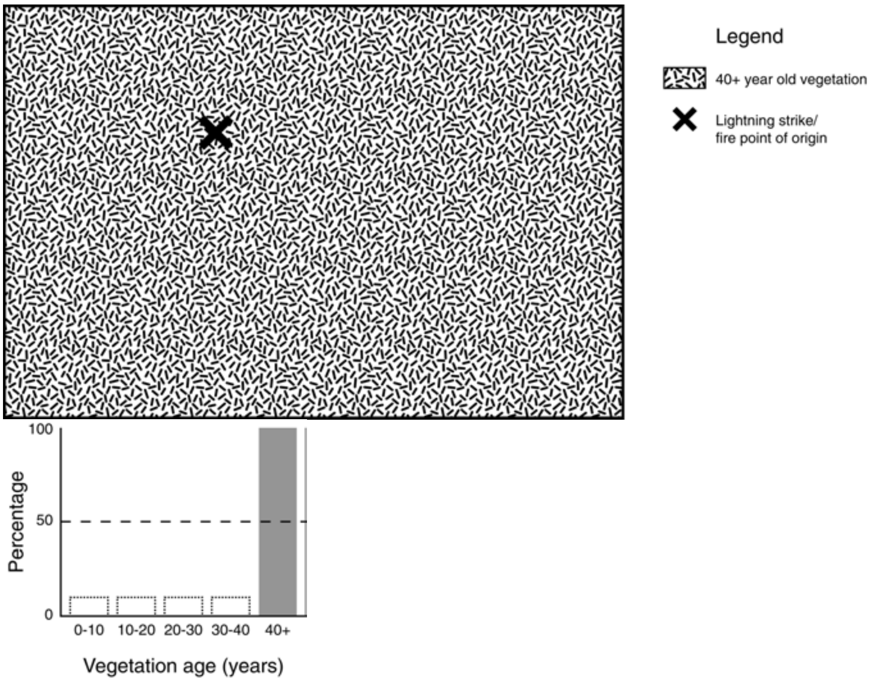

Figure 1a: Hypothetical habitat remnant of approximately 5,000 hectares. Single vegetation type (mallee-spinifex). All relatively long-unburnt (40+ years old, as shown in adjacent vegetation age class graph). X shows a lightning strike and subsequent fire ignition.

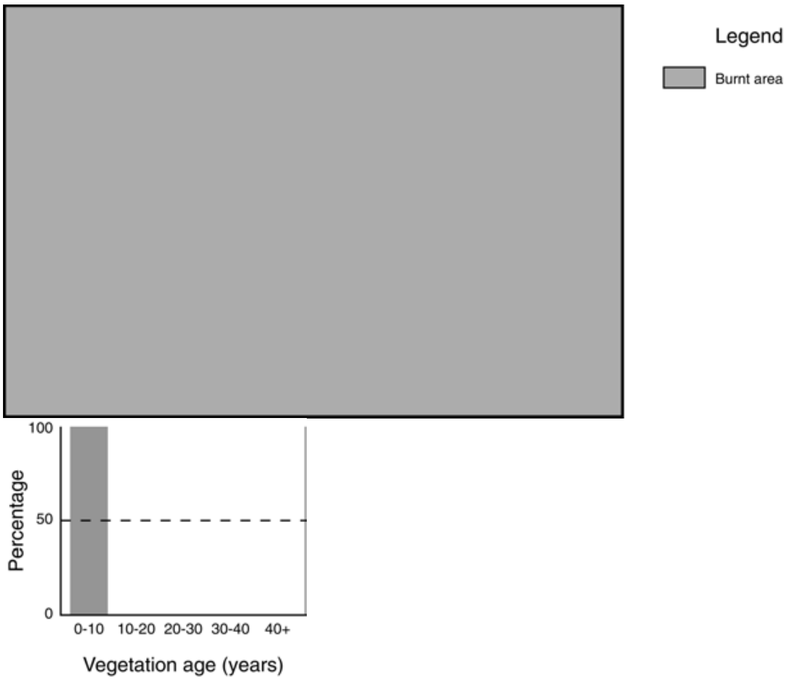

Figure 1b: Fire spreads unchecked and burns entire remnant. All vegetation now 0 years old (as shown in adjacent vegetation age class graph). No suitable malleefowl habitat remains. Malleefowl may become locally extinct.

Scenario 2: Habitat remnant with multiple vegetation age classes

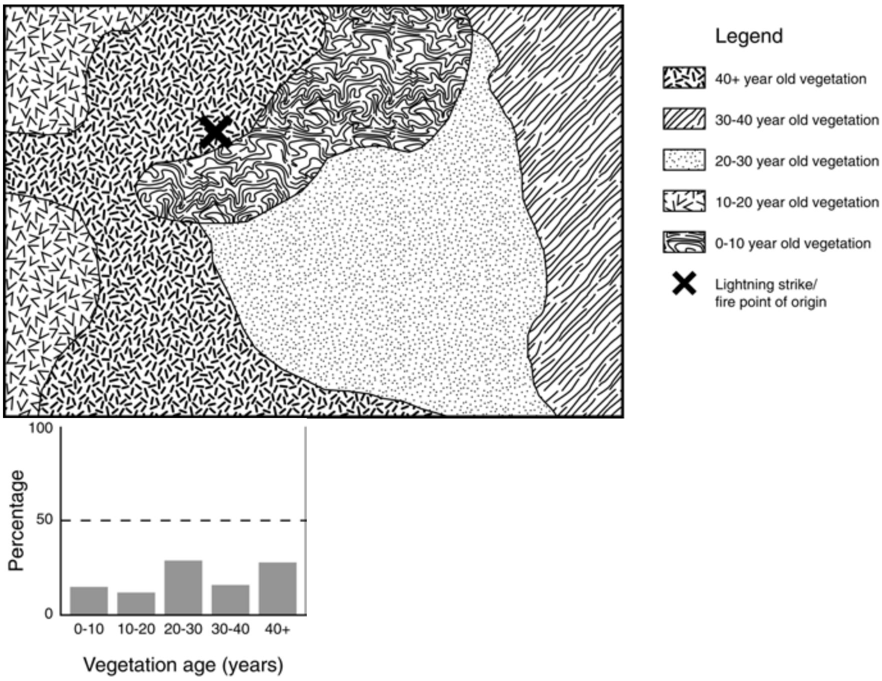

Figure 2a: Same hypothetical habitat remnant. Single vegetation type (mallee-spinifex). Five different age classes (as shown in adjacent vegetation age class graph). X shows a lightning strike and subsequent fire ignition.

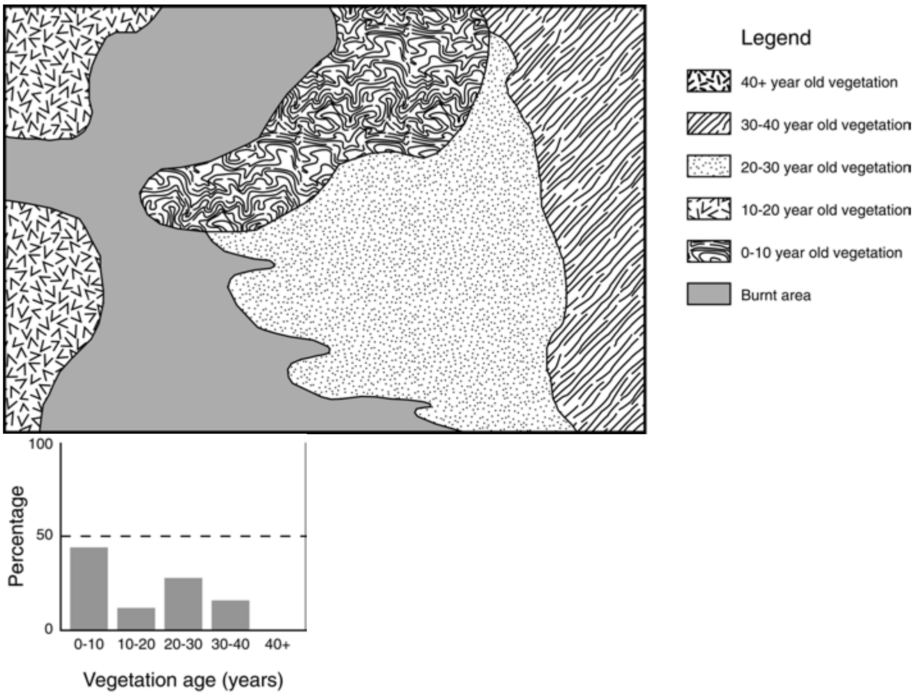

Figure 2b: Spread of fire is largely constrained by younger vegetation age classes with discontinuous fuels (a small amount of the 20-30 year old vegetation is burnt). All 40+ year old vegetation has been burnt (as shown in adjacent vegetation age class graph). Large areas of <40 year old vegetation remain. Malleefowl may persist.

Scenario 3: Habitat remnant with multiple vegetation age classes with pro-active fire management program

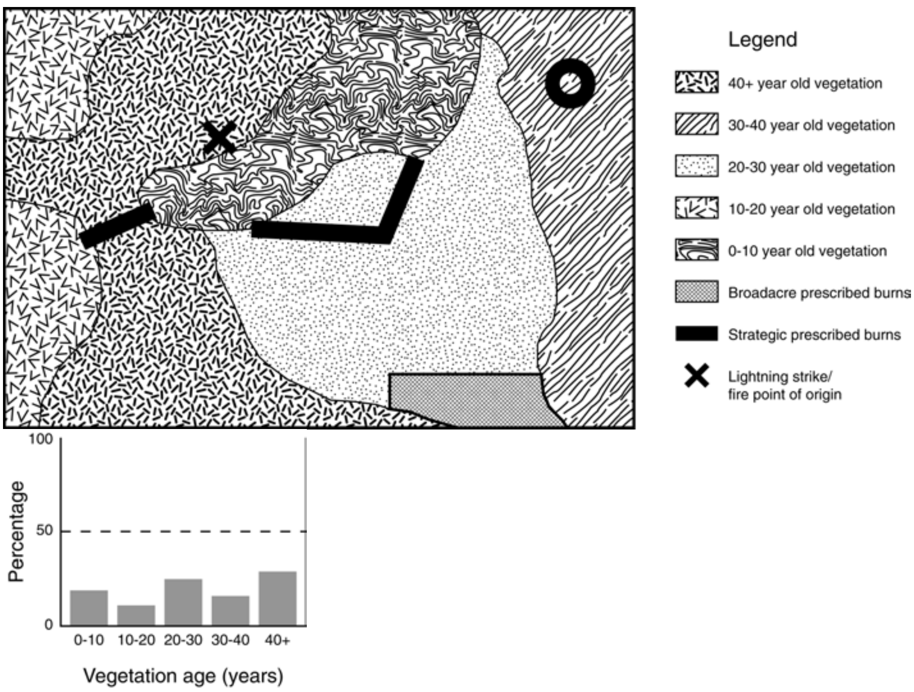

Figure 3a: Same hypothetical habitat remnant. Single vegetation type (mallee-spinifex). Five different age classes (as shown in adjacent vegetation age class graph). Pro-active fire management strategies include strategic prescribed burning (both linear fuel-reduced zones

and for specific protection of a localised biodiversity asset) and selective broadacre prescribed burning. X shows a lightning strike and subsequent fire ignition.

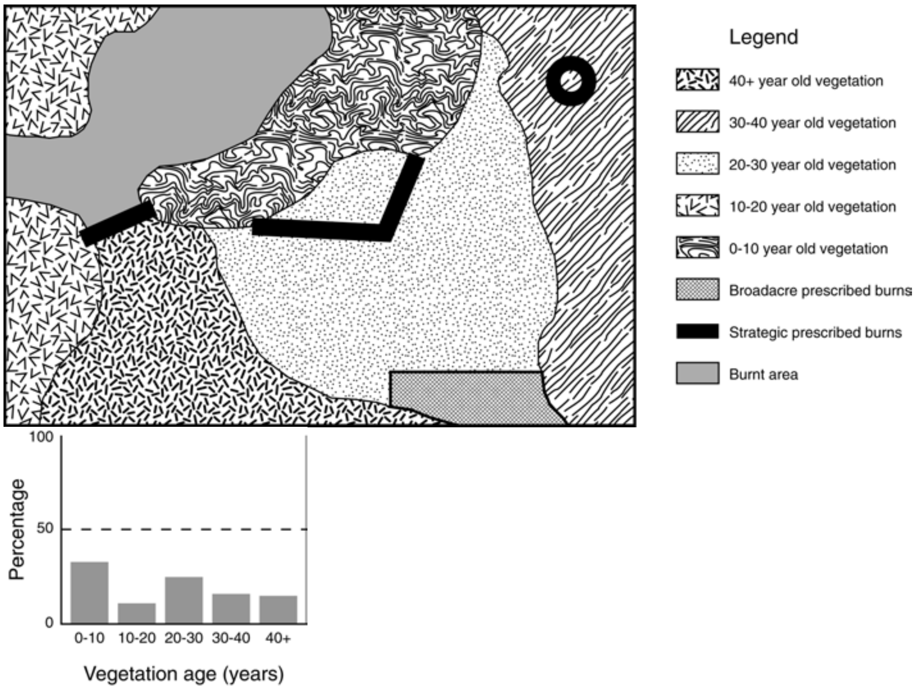

Figure 3b: Spread of fire is constrained active fire management strategies and by younger vegetation age classes with discontinuous fuels. Approximately half of the 40+ year old vegetation is retained (as shown in adjacent vegetation age class graph). Malleefowl likely to persist.

Conclusion

Fire can have both negative and positive effects on malleefowl conservation. Fire can render habitat unsuitable for malleefowl for many years. Inappropriate fire regimes can cause local extinction of malleefowl, particularly in small and/or isolated remnant habitat areas. However fire can also provide greater food resources and, as discussed in this paper, provide a mechanism for successful malleefowl conservation.

A pro-active fire management program should define an acceptable range of fire regimes, based on an understanding of flora and fauna responses to fire and fire frequency thresholds. A range of vegetation age classes should be promoted, providing opportunities for species with different habitat requirements. Fire management actions should be tailored to maintain this age class variability. An adaptive management process should be used, to assess the effectiveness of the fire management program, to redefine goals and objectives, and to guide future management actions.

The pro-active fire management program described in this paper will not maximise the abundance of malleefowl at any one point in time. However, it will help to ensure that malleefowl (and other mallee species with similar habitat requirements) are conserved within a management area at all points in time, thereby avoiding local extinction.

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