Impact of Fire on Fauna in Remnant Vegetation–Research Findings and their Implications for Management

Gordon Friend
Wildlife Research Centre, Department of Conservation and Land Management, PO Box 51, Wanneroo, WA, 6065

INTRODUCTION

The following is a summary of the major findings from ongoing projects to research the impacts of experimental fires on small vertebrates and invertebrates inhabiting remnant shrubland and woodland vegetation in the Wheatbelt and South Coast regions of Western Australia. These studies have focused on Tutanning, Durokoppin and East Yorkrakine Nature Reserves in the Wheatbelt over the past seven years (1987–1993), and on the Stirling Range National Park between 1989 and 1992. For further detail on these areas, study design, and results, the reader is referred to Friend *et al.* (1989), Friend (1993), Friend and Williams (1993), Little and Friend (1993), and Strehlow (1993).

In addressing the primary aims put forward for the remnant vegetation workshop at Dryandra from the perspective of a research worker involved in this area, I have adopted a quite specific approach which refers to the first major objective: "To list, based on work in the South West over the last decade, significant research results and their implications for remnant management".

RESEARCH FINDINGS

Ten major research findings and their implications are listed in point form below, followed by their implications for management.

1. *Research finding:* The small vertebrate and invertebrate fauna inhabiting semi-arid woodlands and shrublands in Western Australia appears to be relatively resilient to single fire events of small scale and low to moderate intensity (but see point 7). The impact of repeated fires, however, is unknown.

   Management implications: Single fires may not be a great threat to fauna provided they are infrequent and of small scale relative to remnant size. It is essential that whole reserves are not burnt in one event, especially by a high intensity fire.

2. *Research finding:* Resilience may be greater in the seasonally dry shrublands and woodlands than in the more mesic but less seasonal habitats (for example, South West forests). Adaptations for seasonal aridity may impart considerable resilience to fire. However, despite this, fauna populations may change greatly under a regime of frequent fires. There are fire-sensitive species and habitats within the regions studied (for example, *Phascogale calura*, *Allocasuarina*, mygalomorph spiders) that require special consideration.

   Management implications: Management prescriptions developed for mesic areas (for example, jarrah forest, etc.) do not necessarily apply to semi-arid ecosystems. Some details of life history and habitat preferences are needed for all species, in order to decide appropriate management prescriptions (see also point 5).

3. *Research finding:* Frequency and scale of burns are probably the two most important factors to consider in fire management. There is no evidence from our studies (for example, in Stirling Range National Park, where both spring and autumn experimental burns have been conducted) that season of burn is of major significance, at least to invertebrates.

   Management implications: Burning should not be carried out too often, or on too large a scale (see also points 6 and 10).

4. *Research finding:* Post-fire response patterns of most small vertebrate groups are closely tied to (and may be predicted from) their shelter, food and breeding requirements (life history parameters).

   These patterns are as follows:
   - ❖ mammal responses are reasonably predictable;
   - ❖ reptiles somewhat less;
   - ❖ amphibia show little relationship.

   These patterns are derived from large-scale wildfires throughout temperate Australia. Data from our smaller scale and lower intensity mallee-heath fires, however, have not shown such clear trends for small mammals and reptiles.

   Management implications: A model to predict the broad impact of fire on small vertebrates is thus

possible, and indeed has been developed. A database of species' life history characteristics and probable post-fire response patterns can be linked to such a model. This needs further input of data and needs to be made accessible to managers.

5. *Research finding:* Given the above, fauna can be considered and grouped in terms of life history categories based on shelter and food requirements. Thus we do not have to worry about every species (for example, the 50 plus species in our Wheatbelt studies reduce to 16 life history categories).

   Management implications: The use of life history categories greatly simplifies the amount of information that managers need to consider when developing fire management plans.

6. *Research finding:* Results from space-for-time studies of potentially sensitive species in the Stirling Range National Park (for example, honey possum, *Tarsipes rostratus)* indicate clear trends with post-fire age of vegetation.

   Management implications: These data suggest a minimum time between burns in the Stirling Range National Park of 15–20 years (allowing some leeway). In the lower rainfall areas of the Wheatbelt region, where vegetative growth is slower, the minimum is likely to be 20–25 years.

7. *Research finding:* For invertebrates, the level of taxonomic resolution (that is, orders versus species level identifications) influences the results of studies on fire impact.

   Management implications: One cannot assume that all is well if looking at broad-scale taxonomic groupings, because responses are species-specific. Individual species may be markedly affected by fire (both increases and decreases), but at the order level of identification these trends will tend to cancel out and thus not be apparent.

8. *Research finding:* Particular groups of invertebrates which are long-lived and have special habitat requirements seem especially sensitive to fire. Such "indicator" species or groups (for example, mygalomorph spiders) set the limits for fire regimes.

   Management implications: Invertebrates may prove better indicators of seral status and appropriate fire regimes than higher organisms. Invertebrates should be included in fire ecology studies and, indeed, in biological surveys in general.

9. *Research finding:* Invertebrate abundance and composition do not correlate well with floristics or vegetation structure. Patterns which may exist are at a fine level of resolution.

   Management implications: Categorising and protecting areas on the basis of plant and vertebrate species richness does not necessarily ensure adequate conservation of invertebrates.

10. *Research finding:* With respect to animal abundance and composition, the synergistic effects of season, locality and year-to-year variability in climate, and stochastic events like droughts and locust plagues generally outweigh any changes attributable to fire alone. An excellent example of such synergistic impacts is the post-fire locust plague which eliminated *Allocasuarina* from an area burnt at Tutanning. This may lead to long-term impacts on stand structure and faunal abundance and composition, simply because these two events happened in tandem.

    Management implications: Fire managers need to take account of pre-fire conditions (for example, is drought in force or imminent?) before burning, but many post-fire events and outcomes are beyond the managers' control.

CONCLUSION

Given the importance of season, climate and stochastic events in determining species abundance and distribution patterns, the need for and use of fire as a routine management tool to maintain or increase faunal diversity needs to be carefully evaluated. At this stage in the development of our knowledge base, it is clearly better to err on the side of conservatism in formulating any fire regime for remnant shrubland and woodland habitats. As a general rule, larger scale block burning should not be carried out except in special

circumstances — for example, for specific regeneration purposes, experimental research or where it contributes to a well-considered strategic fire management objective. Protection of areas from large-scale, high-intensity wildfires through a system of internal and external low fuel zones should remain a high priority for managers of remnant vegetation.

REFERENCES

Friend, G.R., 1993. Impact of fire on small vertebrates in mallee woodlands and heathlands of temperate Australia: A review. *Biological Conservation* **65**: 99–114.

Friend, G.R., and Williams, M.R., 1993. Fire and invertebrate conservation in mallee-heath remnants. Final Report, Project P 144, World Wide Fund for Nature Australia.

Friend, G.R., Smith, G.T., Mitchell, D.S., and Dickman, C.R., 1989. Influence of pitfall and drift fence design on capture rates of small vertebrates in semiarid habitats of Western Australia. *Australian Wildlife Research* **16**: 1–10.

Little, S.J., and Friend, G.R., 1993. Structure of invertebrate communities in relation to fire history of kwongan vegetation at Tutanning Nature Reserve. *CALMScience* **1**: 3–18.

Strehlow, K.H., 1993. Impact of fire on spider communities inhabiting semi-arid shrublands in Western Australia's Wheatbelt. BSc Honours thesis, Murdoch University.

REMNANT NATIVE VEGETATION
TEN YEARS ON

A DECADE OF RESEARCH
AND MANAGEMENT

PROCEEDINGS OF THE
DRYANDRA WORKSHOP
SEPTEMBER 1993

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT
1995