The Use of Fire in the Management of Nature Reserves in Western Australia.

Summary of a talk given to the Western Chapter, Australian Systematic Botany Society at the Western Australian Herbarium December 6, 1977.

Introduction

Not necessarily my intention to provide the answers at to-days seminar - but rather to promote discussion.

System of Nature Reserves throughout the State presently
977 Reserves totalling 8.4 m hecatres.
These are reserves set aside for the Conservation of Flora or Flora and Fauna, some of which are vested in the Western Australian Wildlife Authority (serviced by the Department of Fisheries and Wildlife).
Also a system of National Parks, reserves set aside for Recreation and Conservation and vested in the National Parks Authority.
48 National Parks totalling 3.9 m hectares.
There are numerous other small reserves throughout the State vested in other organizations for purposes including conservation. However, I want to confine my comments to Nature Reserves.

Objectives in the Use of Fire

a) to reduce the fire hazard and the risk of unplanned fire, with its associated potential for causing damage
b) as a tool to aid in the conservation of the biota.

The W.A. Wildlife Authority recognizes the need to burn in reserves for these purposes and has prepared general guidelines for prescribed burning.

However I believe it is important to recognize that the two objectives should be met with two different types of fires:
a) Fires for hazard reduction
b) Biologically desirable fires (define later).

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Hazard Reduction Burning

Most will be familiar with the HRB which takes place in areas such as State Forest at present - a generally well known and accepted practice involving use of easy to control, low intensity fires to reduce the accumulation of litter and slash. Fires tend to be spring-time of predictable weather patterns and greatest care of fire control.

Within Nature Reserves we are presently concentrating mainly on Strategic Fuel Reduction Burns.

3 examples:

Tutanning Nature Reserve - abt. 2 000 ha in Central Wheatbelt divided into blocks. Burning blocks can produce a mosaic of fire ages throughout the reserve.
Here we wish to isolate sections of the reserve from each other to ensure that the whole reserve cannot be burnt out by a single wildfire. Burning has been more regular in the central constriction of the reserve.

Boyagin Nature Reserve - totals abt. 5 000 ha just to the west of Tutanning N.R. Slide only shows one portion of the reserve. Again, to ensure that the whole reserve is not reduced to a uniform state by a single fire we wish to provide fuel reduced buffer areas for fire control. The areas between the system of parallel firebreaks (about 100 m apart) are burnt more frequently than the larger blocks of the reserve.

Two Peoples Bay Nature Reserve - ca. 4 000 ha. East of Albany on the South Coast, contains the only known populations of the Noisy Scrub Bird. The bird is a ground dwelling species, and its diet consists predominantly of litter invertebrates. It is speculated that the reason for its survival in the areas of this reserve is that the Mt Gardner area is fairly well isolated from fires. Widespread fires elsewhere throughout the bird's range over the last 150 years have killed birds and reduced the food resource.

The bird is fire sensitive. On the reserve can recognize a number of areas of potential fire hazard - Farms to the West, Picnic Area and Tourist areas. Necessary to isolate these areas from the Noisy Scrub Bird Areas.

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Again use bufferstrip. Large strip 200 ha through the narrow portion of the reserve. A thinner buffer strip between the picnic areas and the N.S.B. areas.

However, to me the most interesting aspect of the use of fire in the management of Nature Reserves relates to Biologically Desirable Burning mentioned earlier.

define: Ideally, the preservation of the biota will be accompanied by the maintenance of natural processes of the environment in which the organisms evolved (and will continue to evolve). Thus, e.g. if fire was one of these processes, then management of the reserves will involve a simulation of the natural (i.e. pre-European) fire regime. Fires which are lit to deliberately simulate this regime and thus have a biological function are those I term B.D. Fires.

The Natural Fire Regime

What is this and how does one set about finding out about it? Historical records are poor, so information must be gleaned from diverse sources including biological ones.

Questions to be asked include:

a) Is fire necessary for the conservation of any species of plant or animal?
b) If no, How do species persist in the absence of fire?
c) If yes, What is the time scale of the dependance (i.e. how long does it take for a particular species of plant to regenerate after a fire to provide habitat and/or food resource for a particular species of animal, and after what period of time does the regenerated vegetation become unusable?)
d) Under what circumstances would fires have occurred in nature (i.e. time of year etc.).

Looking at the need for fire for conservation of plants.

Most experiments on regeneration show a high species richness soon after a fire, richness diminishes as succession proceeds. The implication is that there is a loss of species with time.

Most of these experiments are relatively short term < 30 years

The loss of species with time reflects a diminishing population density of that species rather than its total loss i.e. often sample areas are too small to determine this. In conjunction with A.S.Weston and M.E.Trudgen, I have been carrying out experiments on Middle Island (Recherche Archipelago). By virtue of some of the collections which have been made on the island since the visit by Robert Brown in 1802/03, we are able to speculate that, until recently, the island had remained largely unburnt since ca. 1800. In the summer of 1972/73 a severe wildfire burnt half the island. Studies have been made on the regeneration of the vegetation following this fire and on the unburnt vegetation. The results to date show:

Only 4 of the ca. 240 vascular plants recorded for the island were not present in the unburnt section of the island i.e. were only collected in the burnt section - after the fire.

Scaevola aemula R.Br.
Alyogyne hakeaefolia (Giord). Alef.
Hibiscus huegelii Endl.
Villarsia parnassifolia (Labil.) R.Br.

All the remaining species will exist in the absence of fire of major disturbance for > 180 yrs.

These four species will persist as viable seeds in the soil for at least this period of time.

Certain structural features which one is able to recognise in present day vegetation may be fire dependant, esp. dense even aged stands of trees and shrubs.

Some of these structural features may be important for the conservation of species of animals.
- e.g. the Woylie (*Bettongia penicillata*) utilizes dense thickets of *Gastrolobium* and *Oxylobium* shrubs for cover.

It must be stressed that populations of all of these species of so-called fireweeds (species which germinate prolifically after fire) are maintained in the absence of fire (at lower densities):

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e.g. Acacia pulchella some regenerate after 13 years.
seed scarification with time and by effect of ant burial.
similar results for Oxylobrum parviflorum at Tutanning N. Reserve.

Karri (Eucalyptus diversicolor) is a tree species which regenerate to form even aged stands after hot wildfire (similar to E. regnans).

Results of sampling at Walpole National Park show recruitment of juveniles to fill a gap in the canopy created by the death of an adult. No fires in this area for > 30 years.

Other mechanisms whereby species may persist in the absence of fire include:

a) layering/development of adventurous roots from branches (Melaleuca lanceolata on Bald Island.
b) development of new stems from a lignotuber as old stems die to give a mallee-like habit (e.g. Eucalyptus angulosa on Middle Island).

Lastly I want to say that some of these structural features in the vegetation which we see now may be post european artifacts.
Adjacent areas, same vegetation (species composition) on the Lake King - Salmon Gums Road near Esperance. Unburnt area Eucalyptus open woodland (to 8 m) with tall Melaleuca ununata shrubs to 3.5 m and a healthy low shrub storey.
Burnt area Mallee heath same Eucalyptus species, single stem killed by fire and developed Mallee habit around this dead stem. Mallees to 2.5 m low shrubs < 1.5 m tall.

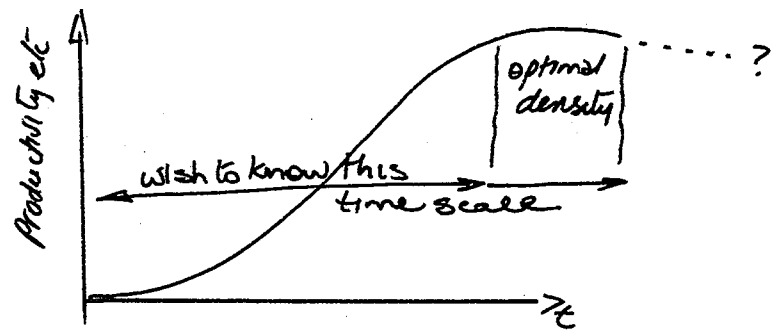
I may have appeared preoccupied for most of this talk with the fire - vegetation dependance relationship. This is because the traditional argument used to support the widespread burning in areas of natural vegetation has been that the vegetation is dependant on fire.

I believe there is no evidence to support this argument. All species of plants which I have studied to date are able to persist in the absence of fire for a considerable period of time.

Some species of animals appear dependant on structural features in the vegetation which are more common after fire.

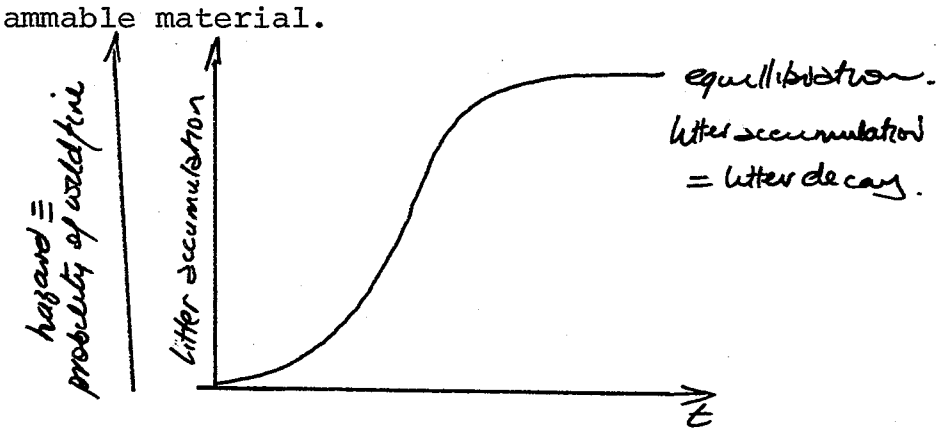
I don't dispute the fact that fires did occur in the past in most of our ecosystems and that fire may have been a significant ecological factor in the evolutionary environment. But fire should be seen in its proper perspective.

I have looked at the first two of the questions posed above. The next question relating to developing an understanding of a natural fire regime relates to time scales of fire dependance.



Supposing we can find that a species of animal utilizes a species of plant during the period when it provides canopy cover > 70%. If we can study field populations of the plant species we can discover how long it takes for those conditions to be produced after a fire and for how long the conditions persist. This time factor will provide a clue to the optimum fire regimes, especially the between fire interval, for this combination of species.

It may be possible to model probabilities of fire occurrence in a similar way based on a knowledge of time scales of accumulation of flammable material.



Look at probability of fire occurrence at a certain time of year.
Most likely to occur at time of greatest fire hazard.
(differs from time of most hazard reduction burning).

In Summary

Have attempted to make a distinction between:
Fuel reduction Burning
Biologically desirable burning on Nature Reserves.
Biologically desirable burning involves a simulation of the Natural fire regime.
There is little data on such a regime, but likely to involve:
1. producing a mosaic of areas with different fire histories
2. the interval between fires will be variable
3. Season of burning will vary, but most fires will be at the time of greatest hazard.

My research is primarily directed towards determining a natural fire regime for each of the reserves, using evidence gleaned from:

1. time scales of biological processes especially regeneration of vegetation and use by animals, accumulation of flammable materials.

2. looking at probabilities of fires occurring over time and throughout the year.

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