THE IMPACT OF FIRE ON HUMMOCK GRASSLAND AND MULGA COMMUNITIES: A LITERATURE SUMMARY

(a) HUMMOCK GRASSLAND

Species which occur in hummock grassland communities need to be well adapted to fire. Indeed Maconochie (1982) stated that:

> "Fire has had a significant influence in the development of the flora and ... perhaps the arid zone vegetation has now become dependent on fire for maintaining its vigour."

Surveys of the hummock grassland flora have indicated that a high proportion of species regenerate after fire by growth from adventitious buds. This feature is observed in a number of families, including Fabaceae, Goodeniaceae, Mimosaceae, Solanaceae, Boraginaceae and Sterculiaceae. A study of central Australian plants revealed that 62 of 426 species of dicotyledons regenerated from adventitious buds and of these 87% occurred in sand-plain or sand-dune communities. Maconochie (1982) concluded:

> "On heavier soils, regeneration from seed appears to be adequate to maintain populations. Here drought is probably a greater environmental influence than fire, which occurs less frequently than in the sandy soil communities where there is a considerable biomass of highly inflammable Triodia and Plectrachne species."

Most species of Triodia and Plectrachne ("spinifex") regenerate after fire from subterranean root stocks. Only very intense fires kill these meristems and it appears that a percentage always survives. All species are predominantly summer-flowering but as in growth, they can also respond opportunistically to favourable moisture conditions at other times of the year. Commonly, Triodia is unable to successfully complete its reproductive cycle. Seed set is infrequent and usually requires a longer period of adequate moisture supply than does inflorescence

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initiation (Jacobs, 1984). Triodia seed is long-lived with some in excess of 15 years old still found to be viable.

Fire helps remove certain germination inhibitors so that germination normally occurs after the next fall of rain. Some 60% of seed remains for later moist periods (Jacobs, 1984).

In the first year or so after fire, there may be a flush of "fireweeds", mostly consisting of annual grasses and herbs, particularly from the families Goodeniaceae, Tiliaceae, Malvaceae and Asteraceae. After several years, spinifex regains dominance and without further fire will form a closed community with 30-40% cover. The time taken to return to original standing biomass varies from 2-3 years in north western Australia (Suijdendorp, 1982) to in excess of 10 years in southern deserts.

The season of burning may have a profound impact on the species composition of regrowth. For instance, Suijdendorp (1980) found that in the Pilbara region, an autumn fire if followed by winter rain led to the establishment of many forbs such as Indigofera spp., Triumfetta spp., Euphorbia spp. and Cassia notabilis. In contrast, summer fires stimulated the growth of perennial grasses palatable to stock, provided summer rains fell.

Some species of spinifex, especially those growing on rocky hillsides, are less able to withstand fire (e.g. Triodia brizoides in the Pilbara; Surrey Jacobs, pers. comm.) and a reduction in their range appears to have occurred.

(b) MULGA

Outside the so-called "Mulga Belt" of south western Australia, mulga also occurs in sandplains or in rocky areas where moisture conditions are suitable. In the Pilbara, it persists in run-on areas along broad valley systems, on elevated outwash plains and on protected southern slopes. Van Leeuwen and Fox (1985) found that A. aneura was more abundant on soils with an acidic reaction trend and sharp community boundaries were observed to correlate with soil boundaries.

Dunlop and Porter (1985) reported that in the south east Pilbara, mulga

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communities often abutt hummock grasslands whilst on slopes spinifex commonly forms the ground stratum, thus subjecting mulga communities to fire risk. They contend that these communities differ from other mulga lands where the sparse grass and forb layer greatly reduces the incidence of fire.

Mulga typically succumbs readily to moderately intense fires, does not resprout, but germination of soil-stored seed may be enhanced. However, seed supply may be depleted by very intense fires or the lack of follow-up rain leading to low recruitment of seedlings. High intensity wildfire, particularly at a frequency that prevents replenishment of mulga seed store in the soil, may cause considerable long-term damage to mulga communities (Griffin and Friedel, 1985).

Interestingly, some leaf/phyllode variants of A. aneura from the south east Pilbara show a limited capacity to regenerate from adventitious buds, a characteristic not reported in other mulga ecosystems (Dunlop and Porter, 1985). Heat transfer into the soil and subsequent death of shallow meristematic tissue appears to limit the survival of shrub species with low to moderate tolerance to fire such as A. aneura, Cassia nemophila and Dodonaea viscosa, since cutting stems off at ground level readily causes resprouting (Hodgkinson and Griffin, 1982).

The typical even-aged structure of mulga communities indicates that during uncommon periods of high rainfall, there is widespread germination and establishment. Amongst some shrub species characteristic of arid eucalypt and mulga woodlands, the coupled events of widespread shrub establishment and episodic burning ensure that shrub dominance was prevented. In some areas, changing fire regimes has led to the massive establishment of shrub species which now constitute a "woody weed" problem (Hodgkinson, 1985).

Fire was identified by Fox (1985) as being the biggest factor creating change in mulga communities. It's effects include the recycling of nutrients from the biomass to the soil, invasion of temporary species, the temporary loss of species, the destruction of parasites and a

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gradual regeneration towards the pre-existing condition. In central Australia, a summer fire was recorded to significantly decrease the grass component of a mulga woodland, whilst increasing the proportion of forbs. Rainfall, season of burning and the reduction of cover appeared to be the most important factors controlling the composition of post-fire herbage. No important effects of fire on soil nutrients was recorded for either a summer or winter fire (Griffin and Friedel, 1984). Some authors believe that in the Pilbara, increased fire frequency has occurred in mulga communities and should this trend continue, hummock grasslands will encroach into areas carrying mulga woodlands (Dunlop and Porter, 1985; Fox, 1985). However, the situation may be different over much of the area, with a decline in fire frequency post-Aboriginal burning, but an increase in both the area burnt by summer wildfires and their intensity. Hot fires running from spinifex into the boundaries of mulga stands tend to kill peripheral mulga trees which may then remove shading effects and allow the invasion of stand margins by spinifex (Start, 1987). Under Aboriginal fire regimes, the boundary between spinifex and mulga stands was undoubtedly dynamic with the mulga expanding out into spinifex areas before being curtailed by fire. The current fire regime of infrequent, intense wildfires may however be leading to the continual contraction of susceptible mulga stands through the attrition of individuals on the margins.

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