



**SUSTAINING THE WESTERN MYALL WOODLANDS:
ECOLOGY AND MANAGEMENT**

by

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ABSTRACT

When this study began, the western myall (*Acacia papyrocarpa* Benth.) was widely perceived to be under threat. There were concerns about the future sustainability of the species. In the Whyalla area in South Australia where the species has been well studied, evidence suggested that the population was aging with recruitment being suppressed, apparently by herbivores. Compared to the pre-settlement era, the western myall woodlands are now subjected to sheep grazing, rabbit infestation and much larger kangaroo populations. The aim of this project was to assess the sustainability of western myall under current land usage across the major part of its range in South Australia and thus provide a basis for land management strategies to ensure its survival.

Key features of the population dynamics of western myall were not known. For example, it was regarded as a long-lived species but its true life span had not been established. Prior to this study, a minimum life span of at least two hundred and fifty years had been inferred from a short (10 year) growth study. Recruitment is infrequent, possible only a few events every century, in keeping with the unpredictable, arid environment in which it grows. A review of the existing knowledge about western myall indicated the following key issues as the most relevant to my broad objective:

- confusion about its geographic range,
- the impact today of the introduction of vertebrate herbivores about a century ago,
- uncertainty about its population dynamics,
- the lifespan of the species, and
- variations in population structure across its range: are the Whyalla populations typical?

I determined the likely limits to the geographic range of western myall in South Australia by a review of the literature and from Herbarium and other records of the South Australian Department of Environment and Natural Resources and then investigated its geographic boundary by field surveys.

I used the knowledge that western myall recruits infrequently, information about the grazing behaviour of sheep, rabbits and kangaroos, and century-old maps of paddock subdivision and

watering point location to investigate the historical impact of the introduction of vertebrate herbivores on the landscape. In the process I developed the new concept of "fossil paddocks" (FP). An FP is an old paddock that has had a new pattern of smaller paddocks and new watering points progressively imposed upon it. Evidence from this study suggests that many cohorts of western myall that emerged this century are essentially missing even in the absence of sheep grazing. The study also indicated that recruitment has occurred in the presence of sheep. There is no evidence that kangaroos suppressed the cohorts however rabbits are certainly implicated; my study shows that recruitment occurred most abundantly in areas where there are no modern rabbit populations, and was almost completely absent where rabbit populations flourish.

The population dynamics of the species were studied to assess the adequacy of seedling recruitment. The focus of that study was on the various factors that eliminate seedlings, because seedling emergence is driven by episodic events and is unlikely to be under the direct influence of pastoral managers. My study revealed that recruitment is much more common across the woodlands as a whole than had previously been assumed from the Whyalla research. Furthermore recruitment was associated with the absence of rabbits, and was apparently independent of the presence or absence of sheep and kangaroos. This is an important finding.

My studies show that rabbits appear to be more of a threat to western myall seedlings than sheep. The seedlings and adult foliage of western myall are palatable to both rabbits and sheep, however sheep show a clear preference for adult foliage over seedlings and reject both (particularly seedlings) if other forage species are available. Rabbits appear not to discriminate between adult foliage and seedlings.

I undertook three studies to gain an understanding of the life span of mature individuals (dendrochronology, mortality from aerial photographs and radiocarbon dating) as a prerequisite to estimating the rate of recruitment needed to maintain the populations and thus allow management strategies to be formulated. Mature and aged western myall trees possess a very striking habit; with age their branches sweep to the ground with the increasing weight of foliage - eventually they becoming procumbent. By repeatedly propping on the ground

and growing upright again (up to six times) the gnarled branches of some of the oldest specimens become polyprocumbent. The dendrochronology study yielded credible age ranges for all but the oldest life stages of western myall. The greatest age I obtained using dendrochronology was 350 years for a middle aged specimen with one event of procumbency. There are trees which are clearly very much more aged than this; unfortunately these generally have rotten heartwood and are thus not good candidates for dendrochronology. However, I speculate that these oldest trees must be at least 500 years and likely very much older.

Results of my mortality study also indicate that the life span of the oldest trees in the populations may be much more than 500 years. Other findings from the mortality study are that rates of mortality vary across the woodlands in South Australia and are higher in the south than in the north. I was able to calculate the numbers of recruits needed at each recruitment event in order to maintain the populations; in the south at least 11 recruits are needed per 100 trees at each event whereas in the north the number required is only six. While these levels of recruitment are observed in some areas of the woodlands, particularly in the north, clearly in many areas the required rate of recruitment is not being sustained.

I examined the population structure of western myall across the woodlands in the study area. My studies show an aging population in the south with a younger, more vigorous, population to the north. Given the fluctuating climate of the late Pleistocene and Holocene Periods the woodlands we see today can only have been in existence for a maximum of 10,000 years, and given that trees are long-lived, I propose that the western myall may still be expanding its range northwards from prehistoric refugia located further south.

In aggregate, the results of these investigations cast doubt on the conventional view that the continued viability of the western myall woodlands is unsustainable in the current pastoral sheep-grazing regime. The occurrence of episodic events obviously plays a major role in recruitment. Rabbits, when present, remain a threat to both seedlings and juveniles; sheep on the other hand, whilst consuming both in small quantities, appear to have less of an impact on seedlings. Furthermore the recruitment patterns vary significantly in different parts of the species' range possibly due to long-term biogeographic trends. Currently in the north

mortality is lower, trees are generally younger and rates of recruitment are higher than in the south.

From my study a picture begins to emerge of a species that is recruiting in the arid zone in spite of pressure from some vertebrate herbivores. This is however an oversimplification. Whilst it is recruiting well in some areas, mortality and life span studies show that in many areas not nearly enough recruits survive at each event in order to maintain the populations. In spite of this, it is apparent that some western myall recruitment can occur under the current sheep stocking rates in the absence of rabbits. Whether rates of recruitment would be higher in the absence of sheep is not known; the precautionary principle should thus prevail and no attempt should be made to raise the current conservative stocking levels.

If the western myall woodlands are to be preserved, the fundamental management aim must be to maintain the populations by enabling the recruitment of enough individuals and by maximising the survival of adults. The removal of pastoralism at its current rates of stocking and the spelling of paddocks after recruitment occurs would not obviously improve the situation for western myall in South Australia. Proposed strategies for the management of the western myall woodlands include the control of rabbits (the recent release of calicivirus into the area coupled with follow-up warren ripping is an obvious strategy) and the protection of juveniles with rabbit-proof tree guards. These measures however, are extremely time consuming and costly.

The real threat to western myall is at the contracting edge of its range (the south) and active management may be needed to ensure the maintenance of populations here. The precise technology to do this is not clear but this thesis provides insights for future research to this end.