

# NATURAL regeneration of riparian vegetation in Western Australia

by Neil Pettit

## Introduction

The purpose of this study was to provide baseline information on the processes involved in the recruitment and regeneration of riparian vegetation. As there is a paucity of basic ecological studies on riparian vegetation in Australia, the project is fairly broad in scope, and aims to provide a general picture of vegetation recruitment and regeneration processes in the riparian zone, as well as providing a starting point for more detailed work. The project also examined the impact of grazing on riparian vegetation.

The study sites for this project are located on two rivers, the Blackwood River in the south-west, and the Ord River in the Kimberley region of north-west Western Australia. The Blackwood River was chosen as being representative of river systems in the south-west of Western Australia while, in contrast, the Ord is a tropical northern Australian river influenced by monsoon rains that result in large seasonal flows. Table 1 provides a snapshot of the two rivers.

## Riparian vegetation

The structure of the vegetation on the Blackwood River consists of an overstorey dominated by *Eucalyptus rudis*, with a shrub understorey at ungrazed sites and annual species dominant in areas grazed by livestock. On the Ord River, there is a much more diverse overstorey and an understorey dominated by perennial grasses. Figure 2 provides information about the number of species and percentage cover of different vegetation types at each of the sites. Figure 3 shows the size class of trees at each site, as well as the difference in distribution as a result of stock access and grazing.

Figure 3 shows the difference in tree size class distribution between grazed and ungrazed sites. Exclosure experiments conducted as part of the project have showed little improvement after three years, with only minor increases in the occurrence and cover of native species. Establishment of these species may be difficult because of the increase in abundance of exotic

Figure 1: Location of the Blackwood and Ord Rivers.

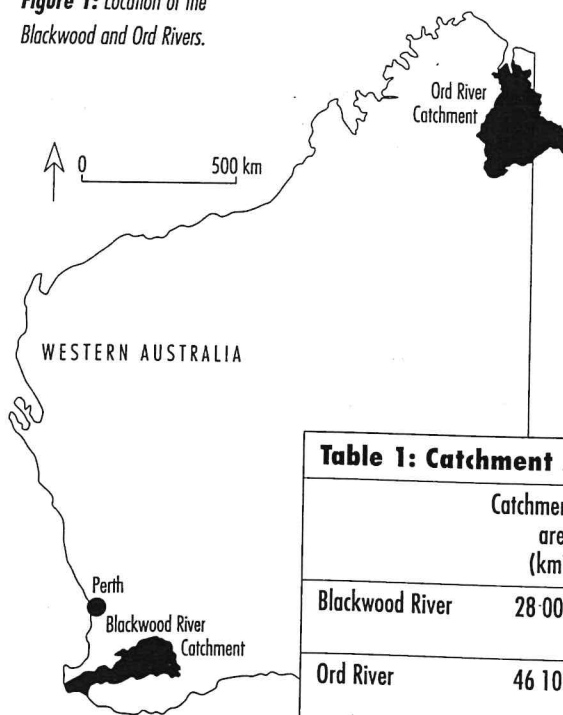
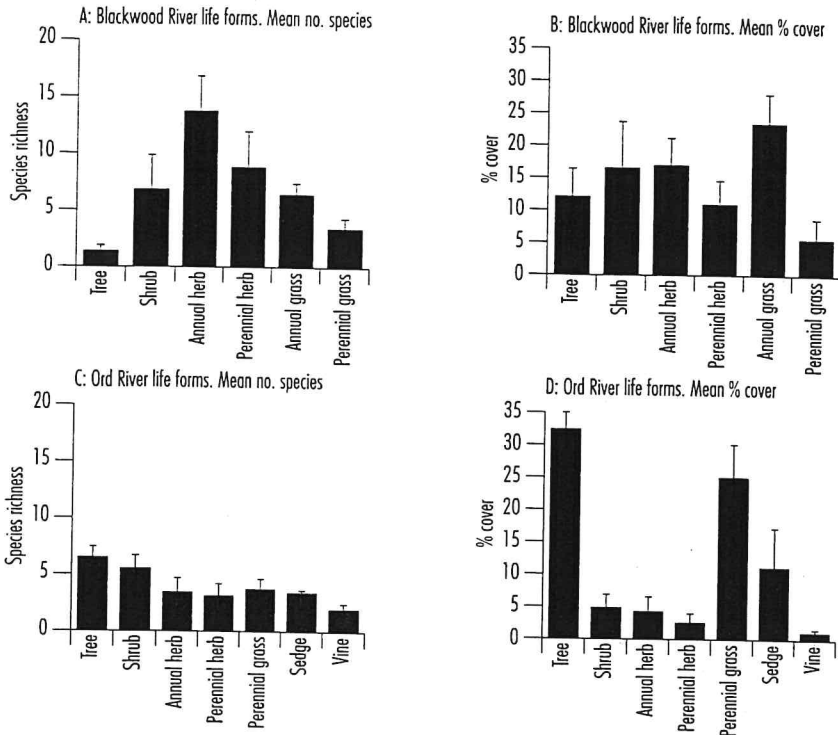


Table 1: Catchment statistics for the two rivers in this study.

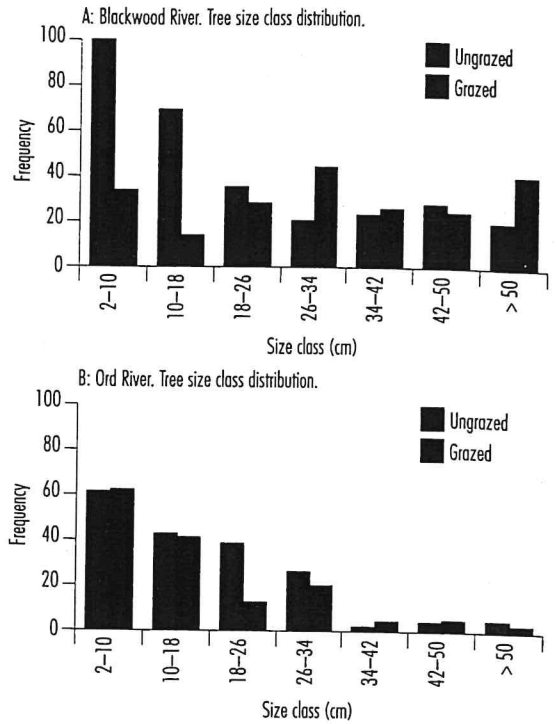
	Catchment area (km <sup>2</sup> )	Rainfall range (mm yr <sup>-1</sup> ) (x 10 <sup>6</sup> m <sup>3</sup> )	Mean annual flow (m <sup>3</sup> sec <sup>-1</sup> )	Maximum recorded discharge	Water quality	Disturbance
Blackwood River	28 000	350–1000	659	1190	Brackish	85% cleared farmland, sheep and cattle grazing
Ord River	46 100	400–700	4320	31 000	Fresh	Cattle grazing, regulated in lower reaches

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**Figure 2:** Number of species and percentage cover of the major life form types on the Blackwood River (A and B) and Ord River (C and D). Values are means ( $\pm$ S.E.) for six sites on the Blackwood River and five sites on the Ord River.

grasses and annual herbs that occurred as a result of the absence of grazing. However, these results are only based on the short-term, and a much longer period of time is required to look at the vegetation dynamics and successional processes of these sites. For example, these sites may need some episodic disturbance such as a flood and/or particular climatic conditions for a successful recruitment event.



**Figure 3:** Comparison of size class distribution of overstorey species at grazed and ungrazed sites on the Blackwood River (A) and Ord River (B) sites.

## Regeneration processes

The project found that the regeneration of vegetation from soil seedbanks is important for annual species of herbs and grasses, but of only minor significance for perennial species. For perennial species, particularly overstorey species, direct seedfall from existing vegetation occurs and enhanced dispersal by floating downstream with flood debris, a consequential recruitment mechanism. This finding shows the important relationship between flow and regeneration. Figure 4 (see page 10) shows this by contrasting the different reproductive *phenology* of four species monitored in the study, each of which appear to be well adapted to the hydrological regimes of the river.

Historical flow records can be used to develop a picture of the natural flow regime for a particular river, and this can be related to patterns of vegetation development such as reproductive phenology, seedling establishment and population structure, as well as plant community patterns in the riparian zone. Variability in natural flow regimes as a disturbance, therefore, can be used in conjunction with other abiotic and biotic factors in developing a model of vegetation dynamics for the riparian zone.



**Photo at left:** Structure of riparian vegetation on the Blackwood River.

**Photo this page:** Structure of riparian vegetation on the upper Ord River.

Photos by Neil Pettit

- Phenology** — study of periodicity phenomena in plants such as timing of flowering in relation to climate
- Allogenic** — processes operating outside the system, for example, physical processes
- Autogenic** — processes operating within the system, for example, successional processes

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In the Ord River, the regime of intermittent high frequency large flood disturbances prevents the establishment of stable states of vegetation and, as a result, the ecosystem is characterised by long periods of transition between short-lived stable states. This finding means that the riparian ecosystem is driven by *allogenic* rather than vegetation *autogenic* processes (Baker & Walford 1995).

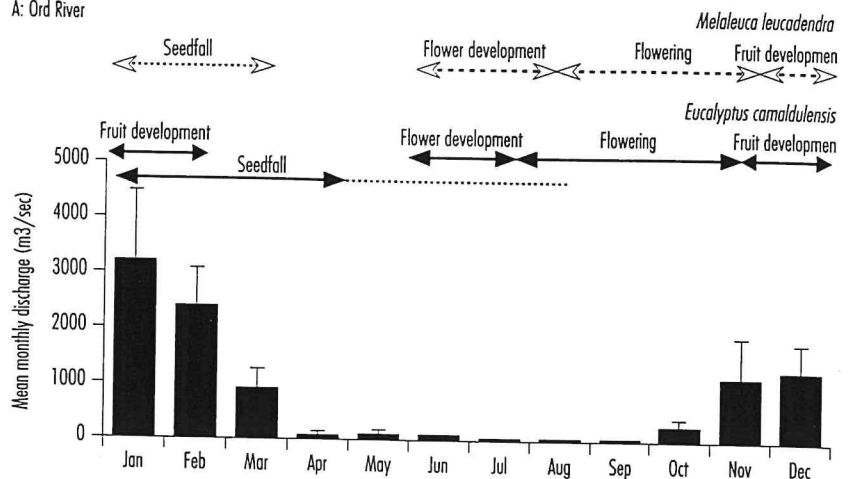
In contrast, lower energy seasonal flooding on the Blackwood River allows mature stands of trees to develop throughout the river profile. Recruitment is continual, although species can also respond to large flood events. This disturbance regime results in long periods of stable states with short periods of transition. Riparian vegetation in this system is subjected to longer periods of *autogenic* processes and, because of lower frequency flooding disturbance, shorter periods of *allogenic* processes.

These results highlight the very different fluvial regimes of the two rivers and their effect on vegetation dynamics. The implications for management of riparian vegetation is that it should take into account the frequency of change in vegetation, as well as recognise that disturbed states, and long periods of transition between states, are part of the natural process. This suggests that altering natural flow regimes, such as that which occurs through river regulation, has significant effects on riparian vegetation dynamics.

## In summary

This work has relevance for the management of riparian zone vegetation. Clearly, for regeneration and recruitment process to operate within the riparian zone, the importance of fluvial processes and the need to understand the natural flow regime of a target river is a critical first step. Where the riparian zone is highly modified, through such things as livestock grazing and/or weed invasion, natural regeneration of the riparian vegetation may be a long term process. If intervention such as replanting is appropriate, care should be taken that species selected are adapted to particular site conditions such as, flooding regime, landscape position and river geomorphology.

A: Ord River



B: Blackwood River

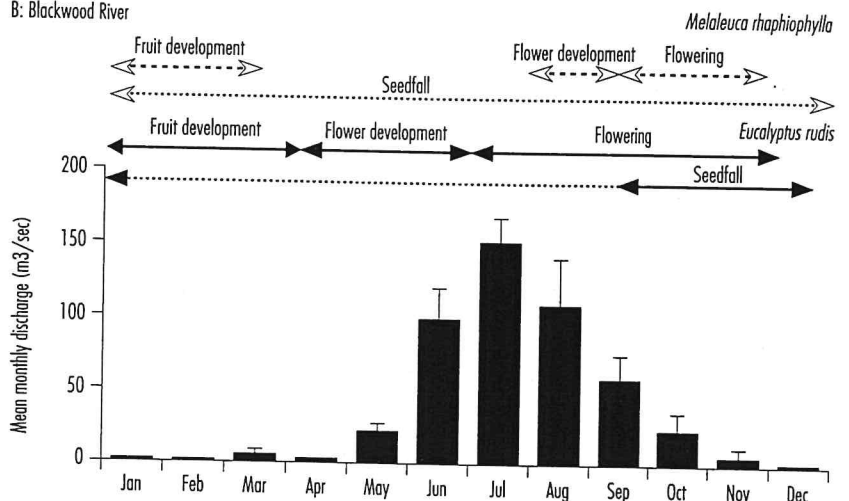


Figure 4: Relationship between phenology of selected riparian species with monthly river flow levels for the Ord River (A) and the Blackwood River (B).

## References

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Aerial view of riparian vegetation on the lower Ord River.