

# Invertebrate Studies Performed through Curtin University



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## INTRODUCTION

The scope of this paper is to list invertebrate and other related ecological research that has been performed in the Western Australian Wheatbelt by Curtin University staff and students. We have not included work that has specific relevance to invertebrates in rehabilitated mines (for example, at Eneabba) or areas of primary production (for example, farm paddocks). We have, however, borne in mind any management principles that can be derived from this and other research conducted outside the Wheatbelt region where it has implications for the management of remnant vegetation in south-western Australia.

The major theses and papers resulting from these investigations are listed in the References. In Table 1, these studies are grouped together under broad management topics. For each of these topics, primary research outcomes are briefly summarised, and their management implications and degree of implementation listed.

The major users of our research are considered to be land users, land managers, and those advising these groups.

## RESEARCH TOPICS

Research undertaken on invertebrates in remnants and on other related topics through the School of Environmental Biology at Curtin University has focused on the role of invertebrates in ecosystem function and recovery following disturbance (refer to the research topics listed in Table 1). Some of this work has also emphasised the benefits of habitat diversity to the conservation of invertebrates. The general approach to the work has been at an applied rather than a theoretical level.

## MANAGEMENT IMPLICATIONS

The implications of research outcomes for land managers are listed in Table 1. The implications are often of a general nature and based on the results of several different projects, some of which have been

performed by other research groups.

In some cases, further research is required before our conclusions can be implemented by managers. For example, with respect to our work on corridors, while we have been able to demonstrate that corridors of native vegetation support greater numbers of ant species than do corridors containing large proportions of exotic plant species, we cannot describe the minimum number or cover of native plant species required to ensure that ant communities are maintained. Our findings therefore need to be incorporated with those from other studies before final recommendations may be made.

It is important that the work of conservation managers be guided by well-founded principles that are based on ecological research. These principles should be constantly upgraded in the light of new research findings. For this to happen, it is necessary for liaison to occur between researchers and land managers so that results of research may be disseminated. This process would also enable researchers to hear the needs of land managers and to plan research to fulfil their requirements.

## DISSEMINATION OF FINDINGS

We have adopted a broad approach for the dissemination of research findings. For each research project undertaken, we aim to alert relevant persons and organisations to the thrust of research programs and their results. Up to five different methods may be used. These are shown in Table 1 under the heading "Dissemination of Findings". Details of the dissemination methods are provided in the Note (see page 46).

Cooperating with other research institutions and land management groups that have a role in the conservation of remnants is another important part of the information transfer process. Organisations that have been involved in the research undertaken by Curtin University are shown in Table 1.

## IMPLEMENTATION OF FINDINGS

It is difficult to know exactly whether, and if so how, research findings have been implemented at the management level, because some findings result in a very diffuse set of implications. It is even more difficult

to establish whether research findings have had some bearing on the development of ideas presented in management plans. It is possible that research findings may have had some influence on a plan, even if there is no acknowledgment of the findings in the final product.

In endeavouring to demonstrate management adoption of our invertebrate research, we have identified three levels at which this might occur (Table 1). Firstly, there are instances where research findings are known to have contributed to management actions or the development of resource information for land managers (a "Confirmed Contribution"). In such cases, verbal acknowledgment or referencing of research material has been forthcoming.

Secondly, there are instances where it is suspected that research findings have contributed to the development of a general management ethos, or the adoption of certain management practices, but these suspicions are unconfirmed (an "Unconfirmed Contribution"). This occurs when the relevant literature does not acknowledge work, and personnel with responsibility for the management of the relevant issue may be unaware of the work. Yet, it is virtually inconceivable that management approaches taken are not influenced by the research outcomes, although this influence may be three or more times removed from the researchers and their work.

The third level at which research findings may have relevance to managers are those instances where the manager is simply not aware of the research, or the relationship between the research findings and the land user or manager is less obvious. An example is the importance of unpredictable, infrequent disturbance events, such as one in one hundred year flood or fire events. While these may have an enormous impact on species and communities, they are poorly understood by managers. As a consequence, we have identified groups of people or organisations who could potentially benefit from such information and listed them under the heading "Potential Contribution". Dissemination of information to these groups probably requires direct consultation as a means of ensuring that the management implications of research findings are adequately disseminated.

Despite efforts to ensure that research findings are

appropriately disseminated, we still experience problems in getting our message to users. Reasons for this are thought to include:

- ❖ insufficient time for the preparation of scientific papers and conference presentations;
- ❖ an absence of mechanisms which support the dissemination of research information to target audiences;
- ❖ an absence of mechanisms that provide feedback on the adoption by managers of research findings;
- ❖ inadequate knowledge of relevant research findings among users, including landcare officers, training staff and land managers;
- ❖ an apparent misconception by users that scientific work is undertaken for academic rather than practical reasons.

## CONCLUSION

Research undertaken at Curtin University has relevance to the conservation, management and restoration of remnants in south-western Australia. While there are some instances where research findings are known to have contributed to management programs and recommendations, we believe that much information never reaches target audiences. This occurs despite a substantial effort to inform the community about current research programs and outcomes.

Inadequate communication between researchers and managers is perceived to be a major cause for the poor dissemination of research results. Actions that will help overcome this problem include:

- ❖ databases of researchers, managers and their specific interests and projects, to encourage communication of information and ideas between both groups;
- ❖ developing feedback mechanisms so that the research community may check that research data are reaching relevant land managers, and also so that land managers can suggest suitable topics for future research;

- ❖ setting up a centralised computer system or sorting house for research outcomes that are related to the values and management of remnants for nature conservation, sustainable agriculture, and other uses. This central information base could act as a formal centre for remnant networking. It could be responsible for the development of mechanisms that facilitate the dissemination of information between land managers, researchers and other users. The centre could provide a focus for the development of landscape models integrating nature conservation and agricultural production values;
- ❖ dealing with the perceived misconception that research is undertaken for academic rather than applied reasons;
- ❖ ensuring that research findings are taught to potential land managers (for example, trainee farmers) by circulating information to coordinators of agricultural courses at secondary and tertiary levels.

We have also identified two other factors that require attention if the nature conservation values of remnants are to be maintained. These issues, which are worthy of discussion at this workshop, are:

- ❖ Remnants on private property require protection from ongoing degradation processes. Protection programs must be accompanied by a management program that ensures the ongoing survival of these remnants.
- ❖ The importance of invertebrates and microorganisms in the maintenance of remnant ecosystems must be realised by land managers.

**Table 1: Summary of research undertaken by the authors and their associates in the Western Australian Wheatbelt, including the broad management implications of each topic.**

Research Topic*	Summary of Research Outcomes	Management Implications	Dissemination of Findings					Co-operative Research	
			Scientific Publication	Conference Participation	Popular Articles	Semi-formal Discussions	General Media		
<b>PAST RESEARCH</b>									
A. Seed removal by ants (1,6,10).	Direct seeding operations may be impeded by: <ul style="list-style-type: none"> <li>certain species of ants</li> <li>temporal factors</li> <li>site characteristics.</li> </ul>	Maintain vigilance for problem ant species. Avoid direct seeding at vulnerable times. Treat vulnerable seeds to avoid seed removal.	✓	✓	✓	✓	✓	CSIRO	
B. Herbivory by native caterpillars (11,12,13).	Magnitude of damage by bag shelter moths varies with: <ul style="list-style-type: none"> <li>temporal factors</li> <li>site characteristics.</li> </ul>	Depending on the extent of the outbreak, control of leaf defoliation may be required in: <ul style="list-style-type: none"> <li>outbreak years</li> <li>nutrient enriched areas (e.g. road verges and remnant edges).</li> </ul>	✓					✓	CSIRO CALM
C. Role of termites in nutrient cycling (7).	<i>Drepanotermes tamminensis</i> has a major role in nutrient cycling within certain ecosystems.	Maintenance of remnants should include: <ul style="list-style-type: none"> <li>the retention of dead plant material as habitat for soil fauna and the maintenance of nutrient cycling</li> <li>the protection of termite structures from damage.</li> </ul>	✓	✓					CSIRO
D. Use of ants as bioindicators of environmental health (4,8,9).	Ant community composition is a useful indicator of the degree of: <ul style="list-style-type: none"> <li>habitat degradation</li> <li>habitat restoration</li> <li>habitat similarity.</li> </ul>	Assessment of the ant community can provide a rapid indication of the state of the environment.	✓	✓	✓	✓	✓		CSIRO CALM  Mining Co's
E. Conservation potential of remnants and corridors of native vegetation (1,8,9).	The biotic composition and ecology of remnant habitat is influenced by its: <ul style="list-style-type: none"> <li>physical features</li> <li>management.</li> </ul>	Corridors of native vegetation will have greater conservation potential if they: <ul style="list-style-type: none"> <li>are wide rather than narrow</li> <li>comprise native rather than exotic plant species</li> <li>are adjacent to native habitat.</li> </ul> Edge effect impacts on remnant habitat must consider: <ul style="list-style-type: none"> <li>the ecosystem component for conservation</li> <li>the imposing disturbance regime.</li> </ul> Remnants should be fenced to exclude farm livestock.  Restoration of remnants will require amelioration of: <ul style="list-style-type: none"> <li>altered microhabitats</li> <li>soil physical changes</li> <li>soil nutrient imbalances</li> <li>altered plant and animal composition and dynamics.</li> </ul>	✓	✓		✓	✓		MRD          CSIRO
F. Influence of prescription burning on invertebrates (2,3,5).	Prescribed burning of remnants influences invertebrate: <ul style="list-style-type: none"> <li>abundance and diversity</li> <li>recovery time.</li> </ul>	Findings may have relevance to deciding the timing and periodicity of burning regimes.	✓	✓		✓			CALM
<b>NEW RESEARCH</b>									
G. Abundance of arthropods and birds on trees in paddocks, corridors and native vegetation.	Potential of trees in different spatial arrangements to support invertebrates, avifauna and food web processes.	Trees remaining in corridors and paddocks may form a nucleus for landscape restoration.	✓	✓		✓	✓		UNE MOT
H. Re-establishment of biota and nutrient cycling in revegetated habitats.	Degree to which different revegetation strategies facilitate the re-establishment of nutrient cycling processes. Value of revegetated habitat to the maintenance of regional biodiversity.	Re-establishment of soil and litter biota and nutrient cycling may be influenced by revegetation practices.				✓			CSIRO UWA STSCG

\* Numbers refer to relevant references in list on page 46.

Implementation

Confirmed Contribution	Unconfirmed Contribution	Potential Contribution
<p>Adoption of seed predation control measures (e.g. pelletisation) by revegetation organisations (e.g. MRD, mining companies).</p> <p>Control measures (e.g. shire councils) have not been required to date.</p>	<p>General recognition of the problem in direct seeding operations.</p> <p>Could influence choice of trees for road verge plantings.</p> <p>Maintenance of ecosystem processes by remnant and reserve managers.</p> <p>Protection of termite habitat and structures from destruction.</p>	<ul style="list-style-type: none"> <li>• Conservation organisations</li> <li>• Mining companies</li> <li>• Shire councils</li> <li>• Schools</li> <li>• Revegetation organisations</li>   <li>• MRD</li> <li>• Shire councils</li> <li>• Conservation groups</li>   <li>• Conservation managers</li> <li>• Farmers managing remnants on private property</li> <li>• Revegetation organisations</li> </ul>
<p>Other research and publications involving research on ecosystem status and habitat restoration.</p> <p>Contributed to the justification of widening of road verges (MRD).</p> <p>Strengthened the need to plant or seed native species on road verges (MRD).</p> <p>Literature providing guidance on the management of remnants (Hussey, B.J.M., and Wallace, K.J., 1993. <i>Managing Your Bushland</i>. Department of Conservation and Land Management, Perth).</p>	<p>The incorporation of ants as bioindicators of environmental health in every State and territory of Australia.</p> <p>Supporting the thrust of the Remnant Vegetation Protection Scheme.</p>	<ul style="list-style-type: none"> <li>• Conservation organisations</li> <li>• Mining Companies</li> <li>• Shire councils</li>   <li>• Conservation organisations</li> <li>• Shire Councils</li>   <li>• Technical education of landcare advisers (e.g. LCOs)</li> <li>• Managers of remnants on private property</li> <li>• LCDs and other rural groups</li> </ul>
<p><i>Awaiting results</i></p>	<p>Findings have stimulated further research on the impact of prescribed burning outside the jarrah forest.</p> <p><i>Awaiting results</i></p>	<ul style="list-style-type: none"> <li>• Conservation managers</li> <li>• Managers of remnants on private property</li> <li>• Managers of road verges</li>   <li>• Managers of remnants on private property</li> <li>• Conservation managers</li> </ul>
<p><i>Awaiting results</i></p>	<p><i>Awaiting results</i></p>	<ul style="list-style-type: none"> <li>• Managers of remnants on private property</li> <li>• LCDs</li> <li>• Revegetation organisations</li> <li>• Conservation managers</li> </ul>

## REFERENCES

This reference list covers invertebrate studies undertaken in the Wheatbelt excluding areas of primary production and mined lands. Numbers with each reference relate directly to those used in the Table.

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## NOTE: APPROACHES USED BY CURTIN UNIVERSITY TO DISSEMINATE RESEARCH FINDINGS

The methods used by Curtin University to disseminate its research results, shown in Table 1, are outlined below.

### Scientific Publication

Publication in scientific journals, conference proceedings and books (for example, *Australian Entomological Magazine*, Australian Society for Soil Science and the "Nature Conservation" book series). This is done either during, or within one to three years of completing, a project.

**Conference Participation**

Oral and poster presentations at scientific and management oriented conferences (for example, Australian Entomological Society, Australian Mining Industry Council Environmental Workshops, Enviromine).

**Popular Articles**

Publication of popular articles in magazines such as *Ecos*, *Curtin Gazette* or publications aimed at schoolchildren.

**Semi-formal Discussions**

Semi-formal and informal discussions and presentations to local people and potential end-users during the course of field study programs. Talks and discussions with rural land users (for example, Men of the Trees at Dowerin, opportunistic discussions with local farmers, talks to catchment group Annual General Meetings, Lions Club talks).

**General Media**

Publicity through local and State newspapers (for example, articles in the *Countryman*), radio (for example, *The Science Show*) and television networks.

# 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

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