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Eucalypt Woodlands
A Guide to Management

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Cover photo:
Salmon Gum Woodland
Photo: Liz Brown WWF

Useful References

Save the Bush Toolkit. (nd) Charles Sturt University and Orange Agricultural College, The University of Sydney.

Managing Your Bushland. (1993) Hussey, B.M.J. and Wallace, K.J. Department of Conservation and Land Management publication.

Managing Wheatbelt Woodlands Information Kit. (2000). Holt, C. and Brown, E. Agriculture Western Australia Publication.

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This Guide

This guide was mainly developed using information gathered from studies in Salmon gum *(E. salmonophloia)* woodlands. However, the principles in this guide can be broadly applied as it considers the general ecological processes that occur within most woodlands.

If your goal is to restore a woodland to a healthy, functioning unit with a range of original species, this guide provides a way of diagnosing the health of individual woodlands and some of the causes of poor health. It also suggests some relevant management actions.

There is a huge array of different types of Euclaypt Woodlands in the Western Australian Wheatbelt, many of which are complex natural communities that have not been comprehensively studied. For this reason, management specifications for each type of woodland are not possible. This document can only serve as a guide and expert advice should be sought whenever possible.

Each woodland will be different, as will the goals and requirements of each land manager. Therefore guidelines and information sources like these are useful to a certain point, after which, the land manager must determine the specific actions and methods. There are a number of other information sources that can help in making these decisions (see references on opposite page)

This guide only looks at actions to take within an individual remnant and therefore should be integrated with landscape-scale planning (farm and catchment plans) to link in with proposed corridors and revegetation for conservation, agricultural and hydrological purposes. Action plans for individual woodlands designed in isolation will not ensure the long-term survival of the woodland.

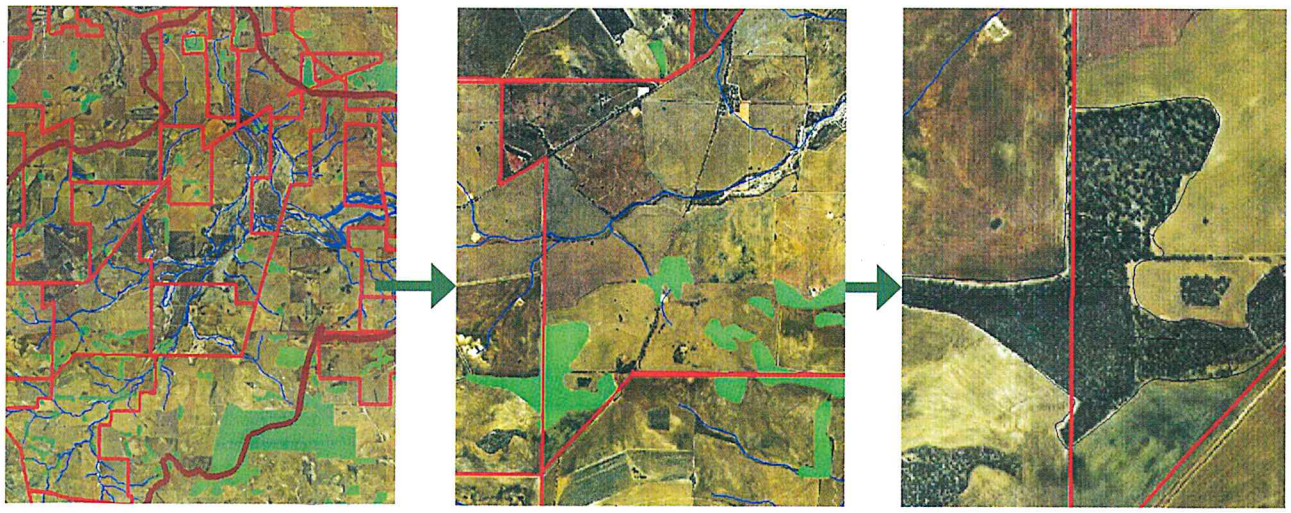
An example of where this guide fits with other local and regional plans is given below:

Introduction

Good quality eucalypt woodlands are under threat or have been affected by external factors such as rising watertables, weed invasion, grazing, feral animals and geographic isolation. Healthy woodland is not only important for conserving native plants and animals, but it is also an important resource for maintaining and increasing farm productivity and can be integrated with the agricultural systems on the farm.

The benefits of healthy bush to the farmer include: (Source: **Save the Bush Toolkit.** (nd) Charles Sturt University and Orange Agricultural College, The University of Sydney).

- Helping to prevent recharge and so contributing to the control of the watertable
- Contributing to a healthy catchment
- Providing habitat for wildlife such as native wasps, birds, lizards and echidnas which help control agricultural pests
- Stabilising land that cannot be used directly for agriculture



Catchment plans hydrology, amount, design and connectivity of revegetation, and remnant vegetation → **Farm plans** agricultural production, connectivity of remnant vegetation and revegetation → **Individual woodland** adaptive management (THIS GUIDE)

- Providing shade and shelter for adjoining agricultural production areas
- Enhancing the living environment for farm families
- Stabilising stream banks and filtering water
- Improving market value and saleability of rural properties

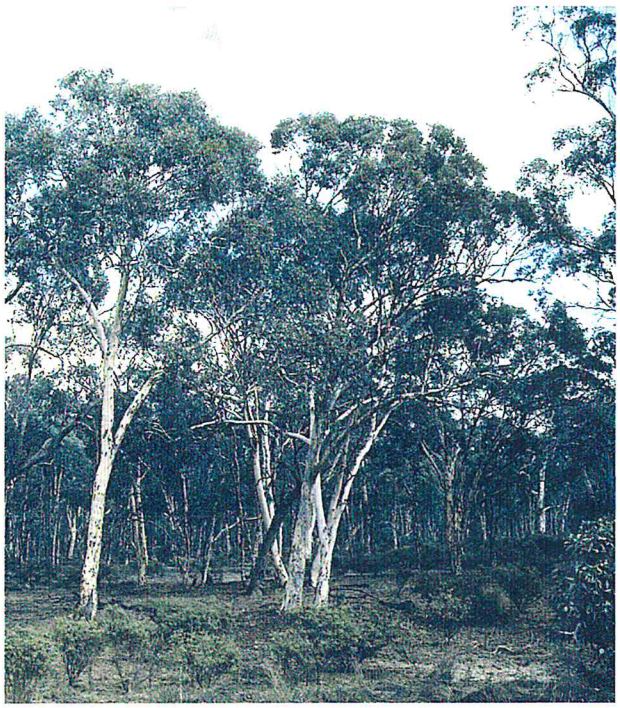
Where should I concentrate my efforts?

Some bush areas are more valuable than others, and some priorities need to be set to gain maximum benefits from management actions. In assigning priorities the following points should be considered:

- Maintaining woodland that is in good condition and relatively weed free is much more cost effective than rehabilitating degraded bush.
- Larger patches are easier to manage than smaller linear patches and are less subject to edge effects and weed invasion. However, even small areas can be important.
- Areas within the woodland that are free of weeds or other disturbances should be considered first.
- Even moderately degraded woodland is a valuable asset in highly degraded landscapes. Trying to re-establish native plant communities from scratch can be expensive, complex and difficult to achieve.
- The presence of rare, threatened or significant flora or fauna species or woodland communities, for example salmon gum woodland, is considered a priority for conservation in the Wheatbelt.
- Woodland remnants that can be easily connected to nature reserves or other large areas of bush may be of greater value than isolated remnants.
- Woodlands on tops of hills or on breakaways or ridges can be very important for salinity control.
- Some woodlands may be under threat from external influences, like salinity, and rehabilitation may be difficult to achieve.

What do you need to manage your woodland?

- A vision of a healthy woodland
- Some goals and objectives to work towards
- An indication of how healthy your bush is to start with
- An idea of what needs doing



Wandoo woodland (E. wandoo).
Photo: D Bicknell

- An action or implementation plan
- A toolkit of management options
- A way to record changes, successes and setbacks
- The ability to modify your action plan depending on what is happening in your woodland
- Knowledge or access to knowledge on woodland ecology

Our complex and diverse eucalypt woodlands

There is incredible diversity amongst eucalypt woodlands in the wheatbelt. While this diversity means that there are many spectacular woodlands to experience throughout the wheatbelt, it also means that there is no such thing as a "typical" woodland. This makes it difficult to prescribe management actions that will be relevant to all woodlands. The key is to understand what type of woodland you are dealing with, and what its natural and healthy structure and composition is.

Woodlands are generally described as ecosystems that contain widely spaced trees. Eucalypt woodlands comprise at least one, and often a couple of dominant eucalypt species, and several different types of understorey. There are many different species of dominant trees and considerable variation in the associated vegetation. Some woodland communities can contain a huge diversity of plant species, others may have only a few species.

E. salicola woodland near Dundas Lake.
Photo: N McQuoid

The complexity and diversity of different woodlands can be illustrated with the following examples:

1. Woodland type

- Tall woodlands (canopy cover 10-30%, trees over 30m)
- Woodlands (canopy cover 10-30%, medium trees 10-30m)
- Open woodland (canopy cover less than 10%, medium trees 10-30m)
- Low woodland (canopy cover 10-30%, trees less than 10m)
- Thickly wooded succulent steppe

2. Geographic

- Widespread, common and generally fairly uniform eg *E. salmonophloia, E. loxophleba* and *E. platypus*
- Widespread, scattered and uncommon eg *E. clivicola* in the Borden to Ravensthorpe region, *E ornata* from the Kondinin area
- Geographically restricted but locally common eg *E.ornata, E. gardneri subsp ravensthorpensis*
- Geographically restricted and uncommon eg *E melanophitra* - a mallet that is found on 3 breakaways near Corackerup, *E. newbeyi* on the Pallinup Estuary

Salmon gum (E. salmonophloia) woodland at Gnowangerup. Salmon gums are typically a tree form.
Photo: N McQuoid

The mallets E. decens, E. argyphia and E. gardneri east of Pingrup.
Photo: N McQuoid

3. Growth form

- Tree (potentially very large single stem plant, usually reproduces from seeds, and only sometimes from root stocks) eg *E. wandoo, E. capillosa, E. salmonophloia, E. longicornis*
- Mallet (single stem trees, usually not that big, only grow from seed, mostly smooth bark) eg *E. astringens, E. gardneri, E. platypus*
- Mallee (multi-stemmed plant that usually regenerates from root stock, although sometimes from seed)eg *E. loxophleba ssp loxophleba, E. oleosa*
- Hybrids eg, *E. loxophleba* (mallee/tree) x *E. spathulata (mallet)*

The uncommon E. hebetifolia at Kojonup. This shows the typical mallee form with multiple stems arising from an underground lignotuber. Photo: N McQuoid

4. Different life-forms within a species

One particular species may have a variety of life-forms across its range eg *E. sargentii* is usually a tree, but is sometimes found as a mallee, *E. loxophleba* often looks like a tree but is actually a mallee species.

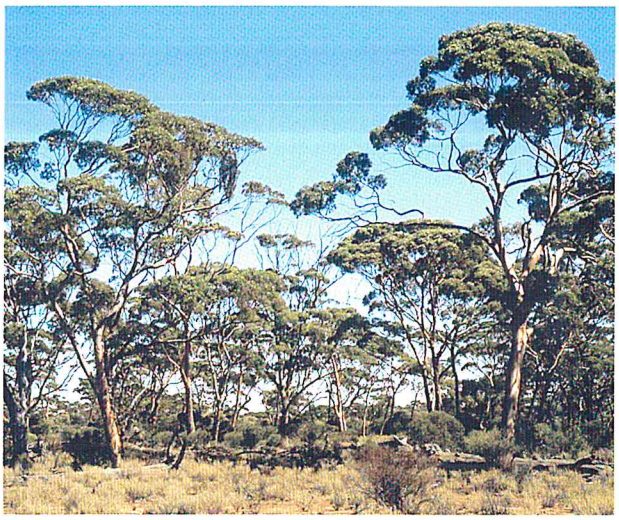
5. Associated vegetation

Eucalypt woodlands often have a well developed shrub understorey, although in some woodlands this becomes replaced by grass-like herbs, rushes, sedges and some true grasses. Woodlands on alkaline soils in lower rainfall areas may have semi-succulent chenopods dominant in the understorey. The associated vegetation may change across the geographic range of a woodland eg *E. salmonophloia* woodlands can have grassy, chenopod or shrubby understories. The understorey may also change with time eg as *E. astringens* woodlands mature, their understories virtually disappear.

The hybrid form of Swamp Yate (E. occidentalis) and Moort (E. platypus platypus) at the Ongerup golf course. Photo: N McQuoid

6. Soil conditions and management implications

The soil type not only makes a difference to what understorey is associated with a particular woodland, but also as to how easily the site can be disturbed. For example, woodlands on sandy soils are not very robust and are more likely to become weedy even without any perceived disturbance (eg *E. loxophleba*), whereas woodlands on heavier soils tend to be more robust and less prone to disturbance (eg *E. salmonophloia* and *E. astringens/E. salubris* woodlands on breakaway gravels).



Salmon gum woodland. Note the different understorey to the salmon gum woodland shown on page 5. Photo: C Yates

7. Regenerative / reproductive biology

Different woodlands have varying abilities to reproduce. For example,

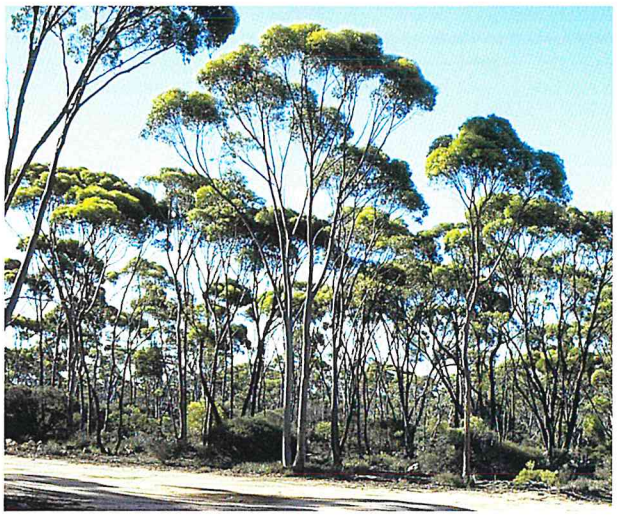
- *E. loxophleba* self-sow readily under simple conditions (moisture available, sheep removed) and therefore lend themselves to revegetation because of their reproductive biology.
- Mallets (eg *E. salubris*) need cataclysmic disturbance such as burning.
- *E. salmonophloia* need a significant amount of disturbance and favourable seasonal conditions to regenerate.

Regeneration in the Fitgerald River National Park.
Shows E. praetermissa and E. platypus with Gastrolobium reticulum.
Photo: N McQuoid

8. Management planning

The following questions should be considered before developing the management requirements of your woodland, as they will influence your activities.

- What sort of woodland is it? For instance, are the trees reseeders or resprouters, is it a young woodland?
- What soil is it on? For instance, is the soil sandy and susceptible to weed establishment?
- Where is it and what are the climatic/rainfall conditions? For instance, the recruitment and seedling establishment time becomes shorter the further east that you go.
- Is there understorey? Should there be understorey? (woodlands do not have to have a shrubby understorey, and in fact often don't have one for most of their "mature" life).



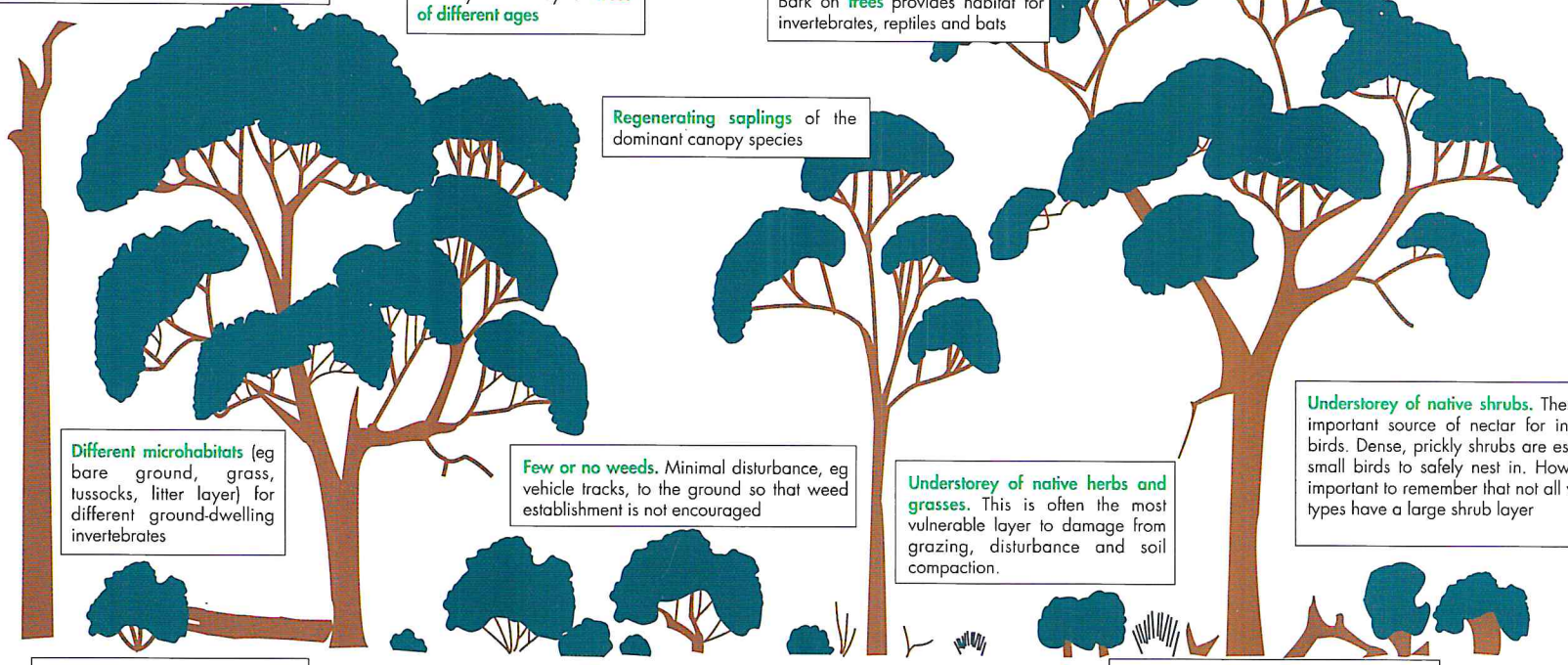
Salmon Gum woodland at the Salmon Gums townsite.
This shows a shrubby understorey and is different to the salmon gums woodland shown on the cover and the one on page 5.
Photo: N McQuoid

Regeneration post fire in a gimlet (E. salubris) woodland. Photo: N McQuoid

where

Features of a healthy woodland

'Based on a drawing by Mike Bamford and reproduced from "Exploring Wheatbelt Woodlands", Department of Conservation and Land management, by permission of the publisher.'



No rabbits and feral predators (cats and foxes.) These predators can cause local extinctions of woodland fauna

No fertiliser drift or run-off from neighbouring paddocks. The increased nutrient levels encourage weeds, and can kill some native plants.

Infrequent fires. Too-frequent fires destroy habitats, allows weed invasion and reduces the seed bank.

Links to other remnants via corridors (as designed in a regional or catchment plan)

Tree hollows and standing dead trees are important nesting and roosting sites for many birds and mammals

Healthy overstorey of **trees of different ages**

Bark on **trees** provides habitat for invertebrates, reptiles and bats

Regenerating saplings of the dominant canopy species

Different microhabitats (eg bare ground, grass, tussocks, litter layer) for different ground-dwelling invertebrates

Few or no weeds. Minimal disturbance, eg vehicle tracks, to the ground so that weed establishment is not encouraged

Understorey of native herbs and grasses. This is often the most vulnerable layer to damage from grazing, disturbance and soil compaction.

Understorey of native shrubs. These are an important source of nectar for insects and birds. Dense, prickly shrubs are essential for small birds to safely nest in. However, it is important to remember that not all woodland types have a large shrub layer

Fallen logs are important habitat for invertebrates, reptiles, amphibians and small mammals

Soil crusts (cryptograms) of lichens, mosses and algae hold the upper layer of soil together, preventing erosion and preventing weed establishment.

Soil structure should be friable and not compacted through stock grazing. Compacted soil makes it difficult for seedlings to establish and also decreases water infiltration.

Litter layer of fallen leaves and twigs, and decaying vegetation. Letter provides habitat for many invertebrates, reptiles and amphibians. The breakdown of litter by bacteria and fungi form an important part of the nutrient cycles of a woodland.

Healthy Woodland checklist

(Developed for a 'mature' tree woodland)

Healthy woodlands provide vital habitats for native plants and animals by having healthy ecological processes occurring within them. This checklist will help identify them in your woodland.

This checklist can be completed as an informal monitoring sheet at the same time every year. Comparison from year to year will give an indication of how the woodland is changing.

Main eucalypt species present: _____

Features of good woodland health	Write: None Few Some or Many	Features damaging to woodland health	Write: None Few Some or Many
Woodland contains mature trees that are producing seed		Perennial and annual weeds present	
Old trees with hollows		Ground flora predominantly weeds (>20% cover)	
Saplings less than 4m tall present		Widespread dieback in trees	
Native shrub understorey present		Evidence of rabbits	
Native grasses and herbs present		Evidence of feral cats/foxes	
Evidence of plants regenerating		Soil surface eroded	
Litter cover, leaves, bark or twigs present on ground		Soil compacted	
Fallen timber, logs left on the ground		Feral bees present (these may compete with native bees and honeyeaters for nectar)	
Lichen and moss crusts on ground		Herbicide damage to plants	
Spring annuals present - eg lilies, daisies, orchids		Signs of human impact - litter, tracks etc	
Birds present (other than those commonly seen in paddocks)			
Evidence of native mammals (eg diggings)			
Evidence of native reptiles			
Range of invertebrates present (insects, spider etc.)			
Impact of edge effects on woodland			
Woodland connected to other remnants			

Guide to the assessment of remnant woodland condition and appropriate management actions

This guide was mainly developed using information from studies in Salmon gum *(E. salmonophloia)* woodlands.

Use this guide by working through each dot point of Step 1 (pages 10 and 11). Go to Steps 2 and 3 (pages 12 and 13) when indicated but return to Step 1 each time to complete the dot point list.

As you work through Step 1, write down the list of actions that you need to take. These will form the basis of your action plan.

Blue Text indicates additional information can be found in the Managing Wheatbelt Woodlands Information Kit (see references).

Green Text indicates a move to steps 2 or 3 of this guide.

Once you have reached the end of Step 1, go to Step 4 (page 13).

Step 1. What condition is the woodland in?

Symptom of poor health	Known causes of poor health	Management actions (see enclosed sections for detail)	Why action is important for good woodland health
◆ No old trees with hollows	timber harvesting	stop harvesting of timber ***add artificial tree hollows***	Tree hollows provide shelter and nesting sites for woodland fauna
◆ No young trees or other plants	livestock grazing regeneration system may not be functioning no natural *pollinators*	exclude livestock by ***fencing*** **go to step 2**	Younger trees are needed to replace older trees when they die
◆ Widespread ***dieback*** in trees	secondary salinity rootzone waterlogging nutrient enrichment Insect attack ***Phytopthora***	take actions to lower water table through landscape scale plans (catchment or regional) remove livestock, reduce fertiliser input (establish ***buffers,*** avoid spray drift)	Trees provide shelter and resources for woodland fauna and prevent land degradation
◆ Loss of native shrub understorey diversity (dependent on woodland type) remove livestock	livestock and rabbit grazing no recruitment	remove livestock ***eradicate rabbits*** re-establish understorey **(go to step 2)**	Understorey species provide resources for woodland fauna, protect soil from erosion and contribute to and trap organic litter in the ecosystem
◆ Loss of native ground flora diversity (native grasses and herbs) (dependent on woodland type)	livestock and rabbit grazing – no regeneration no recruitment	remove livestock, ***eradicate rabbits*** re-establish understorey **(go to step 2)**	Ground flora species provide resources for woodland fauna, protect soil from erosion and contribute to and trap organic litter in the ecosystem

Symptom of poor health	Known causes of poor health	Management actions (see enclosed sections for detail)	Why action is important for good woodland health
◆ Ground flora predominantly weeds (>20% cover)	livestock and rabbit grazing, soil disturbance and nutrient enrichment windblown soil and seed from farmland	remove livestock and rabbits, reduce inputs of fertiliser, reduce soil disturbance, undertake ***weed control*** program, establish ***buffer***	Weeds contribute to the loss of native plant species diversity
◆ No fallen timber, logs left on the ground	firewood harvesting fire	leave fallen timber on ground implement fire control measures	Fallen timber, logs provide habitat for fauna and trap organic litter in the ecosystem
◆ Reduced litter cover of leaves, bark or twigs	livestock grazing, loss of understorey to trap litter fire	remove livestock and re-establish understorey implement fire control measures **(go to step 2)**	Organic litter layer protects soil from erosion, provides habitat for fauna, maintains soil structure and contributes nutrients to the soil for plant growth
◆ Loss of ***soil cryptogam cover***	livestock grazing, loss of understorey vehicular traffic	remove livestock, allow natural regeneration limit traffic	Cryptogams protect soil from erosion and fix nitrogen into the ecosystem
◆ Loss of soil surface micro-topography (roughness)	livestock grazing, loss of understorey vehicular traffic	remove livestock and re-establish understorey limit traffic **(go to step 2)**	Soil surface micro-topography provides safe sites for germination of seeds and increases soil water infiltration
◆ Soil surface eroded	livestock grazing, loss of understorey vehicular traffic	remove livestock and re-establish understorey limit traffic **(go to step 2)**	Erosion reduces the ability of the soil to provide habitat for plant growth
◆ Soil compacted	livestock grazing, loss of understorey vehicular traffic	remove livestock and re-establish understorey limit traffic **(go to step 2)**	Soil compaction reduces soil water infiltration and increases erosion
◆ Woodland contains few reproductively mature trees		enlarge remnant by ***replanting around edges*** with canopy and understorey species	Woodlands with few trees may have reduced levels of seed fitness and lower viability
◆ Woodland has high edge to area ratio		reduce edge to area ratio by ***replanting around edges*** with canopy and understorey species	Woodlands with high edge to area ratios are more susceptible to weed invasion
◆ Woodland not connected to other remnants		create ***habitat corridor*** to nearest remnant	Connectivity of remnants increases their viability for many species

Step 2. Will plant species re-introductions be necessary?

Use this step to determine whether there is a source of seeds for natural regeneration to occur.

Use the following table for each species in the woodland community

a. Are there seed producing adults present in the remnant, and is the seed viable?	yes	Check step 3
	no	**Go to b**
b. Are seeds of the plant species likely to be present in the ***soil seed bank?*** (for most species soil seed stores persist for less than 3 years except for fire ephemerals and legumes)	yes	Check step 3
	no	**Go to c**
c. Can seed of the species disperse onto the site (few native perennials are good dispersers)	yes	Check step 3
	no	It will be necessary to reintroduce species to the site by ***direct seeding*** or planting seedlings (if possible use ***local provenance species***) **go to step 3** before undertaking planting program

Step 3. Will site amelioration be necessary for species to re-establish?

Use this step to determine whether the conditions in the remnant will allow seed germination and seedling establishment and if any site works will be necessary

a. Does the species require some form of disturbance to break ***seed dormancy?*** Many legumes and fire ephemerals only germinate following heat shock or exposure to smoke.	**yes**	Use small scale fires or ***smoke treatments*** to break dormancy go to b
	no	go to b
b. Does the species require some form of ***disturbance*** for seedlings to establish? For example salmon gum, gimlet and wandoo are most likely to establish seedlings in the gaps created by the death of adult trees following disturbances such as fire.	**yes**	Use fire at a scale which does not endanger the whole remnant or alternatively mimic ***disturbance*** by cultivation or planting in open spaces go to c
	no	go to c
c. Are there weeds present on the site? Competition from weeds for limited soil water can reduce the probability of native species' seedlings surviving.	**yes**	Undertake ***weed control*** program go to d
	no	go to d
d. Is the soil in the remnant compacted? Soil compaction reduces soil water infiltration and the probability of native species' seedlings surviving.	**yes**	Increase ***soil water infiltration*** (deep ripping, brushing). **go through step 2 for other species**
	no	**go through step 2 for other species**

Step 4. Monitor regeneration

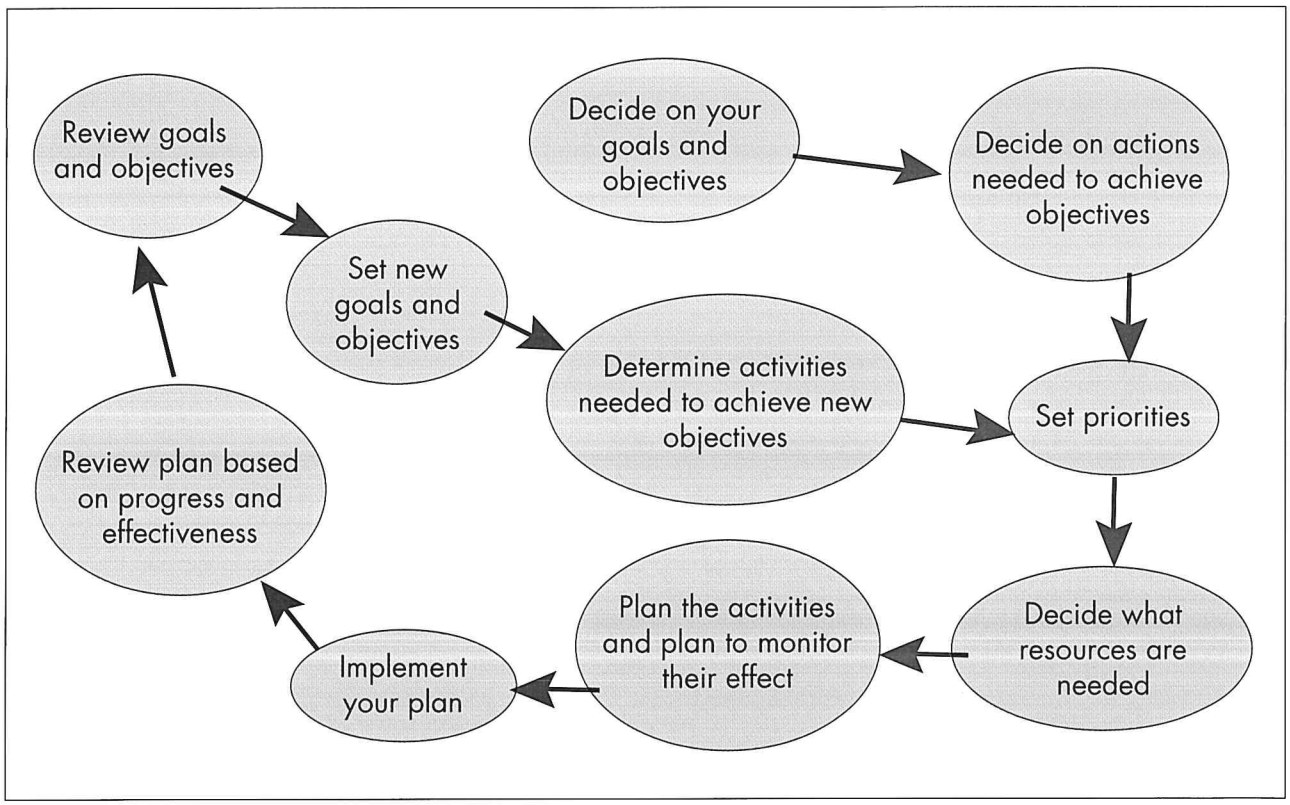
Monitoring need not be difficult. It is essential, however, to know whether you are reaching your goal, and if you need to change your management in response to changes in the woodland. Some simple ***monitoring techniques*** are described in the Managing Wheatbelt Woodlands Information kit.

Adaptive management

Adaptive management is having the ability to modify your action plan depending on what is happening in your woodland. An adaptive management plan requires:

- setting goals/objectives,
- implementing some actions,
- monitoring your progress and
- periodically reviewing the plan based on the progress.

Adaptive management can be thought of as a continual loop, as in the following diagram:



Given below is an example of a management plan with an overall goal, and some of the objectives and actions needed to achieve this goal. Some objectives will be quite general, while others will be very specific.

Goal: to restore a woodland remnant to a healthy, functioning unit with as close as possible range of original species, and a variety of wildlife habitats

Objective	Priority	Action	Resources needed	Schedule
Eradicate rabbits	High	1 Lay 1080 one shot oats	1080 from local Agwest Officer, hire baitlayer	Feb 2001
		2 Rip warrens	Tractor, deep ripper	June 2001
Control weeds spring	High	1 Record presence and density of weeds. Prioritise control	Copy of Western Weeds Allocate time	Summer - 00/01
		2 Plant buffer of local shrub species around woodland	Seeds, tubestock, tree planter	Winter 2001
		3 Undertake spot weed control and have native plants ready for weed free areas	Tubestock, herbicides	Depends on weed ecology
Restore original plant species	High	1 Compile animal and plant species list	Survey woodland - with help from Bushcare	Spring 2001
		2 Visit reference site/local regional herbarium for original species composition	Visit site with Bushcare Support Officer/ contact local herbarium	Spring 2001
		3 Order trees for planting and seed for direct seeding	Species list, money!	2001 ready to plant in 2002
Introduce tree hollows	Medium	1 Build 5 different nest boxes (see Western Wildlife article)	From article	Autumn 2002
Monitoring	High	Take photos, do checklist		Winter 2000 and ongoing

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