

Look after your natural assets

3RD EDITION



**Landcare for the bush block
and small farms in the
Upper Murrumbidgee Catchment**

Look after your natural assets

3RD EDITION 2010

Landcare for the bush block and small farms in the Upper Murrumbidgee Catchment

Landcare

Landcare is a unique Australian response to land and water degradation. Networks of local landowners are the backbone of Landcare. Landcare groups plan, implement and monitor on-ground works. They also raise awareness and share resources and knowledge.

There are more than 1,977 (NSW Landcare 2009) Landcare groups in New South Wales and the Australian Capital Territory working on a wide range of degradation problems. Landcare groups rank weed control, revegetation, remnant vegetation loss/decline, soil erosion by water and river corridor degradation as their top five issues.

How to find your local Landcare group

Phone numbers for voluntary Landcare organisations are subject to change; contact www.landcare.nsw.gov.au for details of a Landcare group near you.

Look After Your Natural Assets was originally produced by members of the Gearys Gap Wamboin Landcare Group with assistance from the Natural Heritage Trust, edited by Maria Taylor and designed by Sue Van Homrigh.

The 3rd Edition was revised by Jo Perkins, Peter Duffy, Steve Welch, Lynton Bond, Ron Chesham, Tanya Noakes, Roger Good, Maria Taylor, Chris Fowler, Douglas Kerruish and Pauline Carder.

Original illustrations for all editions: Ric Bevis and Rainer Rehwinkel.

Thanks to all those who supplied information, suggestions and comments.

Look After Your Natural Assets 3rd edition was produced with the assistance of funds made available by an ACT Government Environment Grant, Cooma-Monaro Shire Council, Upper Murrumbidgee Landcare Committee, Molonglo Catchment Group, ACT Waterwatch, Gearys Gap Wamboin Landcare Group and ActewAGL.

This is a living document which will be updated regularly at www.umccc.org.au

This book provides the basics on a wide range of topics. The final chapter provides contact details for a range of government and non government agencies, who can help with further information.

Good information is always good currency. Since the first edition of this document, the amount and quality of resources available on websites has increased. We have included links to follow up for many of the topics.

The Upper Murrumbidgee Catchment Coordinating Committee (UMCCC)

The UMCCC is made up of rural land managers, local governments, conservation groups, utility corporations, community Landcare groups and representatives of both NSW and ACT government agencies, with responsibilities for natural resource management in the Murrumbidgee Catchment above Burrinjuck Dam.



© Upper Murrumbidgee Catchment Coordinating Committee and the Gearys Gap Wamboin Landcare Group, 2003

© Upper Murrumbidgee Catchment Coordinating Committee 2010

CONTENTS

THE UPPER MURRUMBIDGEE CATCHMENT (UMC)

The Upper Murrumbidgee Catchment.....	2
Upper Murrumbidgee Catchment facts.....	4

THE RESOURCE BASE

Soils	5
What's the nature of our soils?.....	5
Erosion	5
Soil acidity	6
Dryland salinity	7
Salinity in the Yass River Subcatchment (case study)	8
Sodicity.....	8

Water	9
Development depends on surface water.....	9
Water quality.....	9
Groundwater.....	9
Water law.....	9

Native Vegetation	10
Cherish your native grasses and pastures – or they will disappear.....	10
Can you tell the difference between Serrated Tussock, Poa Tussock and Red-Anthered Wallaby Grass?	10

MANAGING YOUR PROPERTY

Animals – Stock and Wildlife	12
Stocking rates.....	12
Know your land classes.....	13
Grazing management	13
Natural Sequence Farming (case study)	14
Prograze®	14
A Horse or Two (case study).....	15
Livestock Health and Pest Authority.....	16
Wildlife	16
A sugar glider in every tree? (case study).....	17
Is your firewood someone's home? (case study)	18
Parrots in the pink (case study)	18
Some threatened fauna	19
Wildlife friendly fences	19
Pest animals	19

Domestic Issues and Responsibilities	21
Why everyone's septic system matters.....	21
Fire management	23

Vegetation	24
Native Vegetation Conservation Act.....	24
Some threatened understorey plants in the Upper Murrumbidgee Catchment.....	25
How good is that patch of bush?	26
Who cares about understorey?.....	26
Strategies for bringing back native vegetation.....	27
What happens with Eucalypt dieback?.....	27
Tree Preservation Orders.....	28
The pros and cons of pine.....	28
Mistletoe – friend or foe?	28
Roadside vegetation management.....	28
The right tree in the right place (case study).....	29
Diversity = Stability (case study)	30
So you want to plant trees on your block?	30
How about an acacia woodlot?	32
Bigger than a woodlot: farm forestry with natives..	32
Getting on top of phalaris (case study).....	33

Weeds	35
Weeds.....	35
Weed control methods.....	36

Water	38
Managing riparian zones	38
Livestock control near creeks, streams and rivers (case study)	38
Aquatic plants and animals.....	39
Restoring or developing wetlands and dams for clean water.....	39
Rules for new dams.....	39
Livestock control near creeks (case study).....	38
Turning a dam into a wildlife sanctuary (case study)	40
Track erosion (case study).....	41

APPENDICES

Appendix A: Plant species	42
Appendix B: Understorey species.....	45
Appendix C: Listed threatened species.....	45

USEFUL CONTACTS

Contacts	48
Government Contacts in the Upper Murrumbidgee Catchment.....	48
Some non government organisations	inside back

THE UPPER MURRUMBIDGEE CATCHMENT

THE UPPER MURRUMBIDGEE CATCHMENT

The Upper Murrumbidgee Catchment (UMC) has experienced rapid changes in land use as larger properties are subdivided into smaller units — hobby farms, lifestyle/bush blocks and rural residential subdivisions. Land use now varies widely, as do the expectations and skills of new rural residents. These changes bring new challenges for soils, water, vegetation and animals. This book provides landholders with some tools and contacts for positive land management. You'll also find the personal experiences of small acreage landholders who share what they have learned about practical land care.

Everybody living out of town wants to see the country stay alive and healthy. Keeping it that way is a big job, particularly as a lot of country changes from broadacre farming to smaller rural residential blocks. Lots of organisations help: Landcare and other voluntary social groups, local councils, State and Commonwealth departments.

But in the end it comes down to what each and every one of us does and doesn't do. Being out of town brings responsibilities as well as the joys of space, quiet, animals, big gardens and trees.

People with a history of farming generally know about this stuff and know how to work with their neighbours on common problems. People who are new to the bush often need a hand to work out some of the ins and outs of being part of a rural or semi-rural community.

That's what this booklet is about: some hard information, some hints, some ideas, some questions for you. We hope it helps you make the most of your block and work in harmony with your natural and social environments.

— Peter Duffy, Upper Murrumbidgee Catchment Coordinating Committee (UMCCC) Chair

“There is a growing number of small lifestyle or ‘hobby farms’, especially in the upper catchment near the ACT and around larger rural centres such as Wagga Wagga. A wide range of community interests and organisations contribute to natural resource management, including industry groups, corporations, Landcare networks and groups, non-government organizations (such as Greening Australia), government agencies, local government and numerous other community groups.

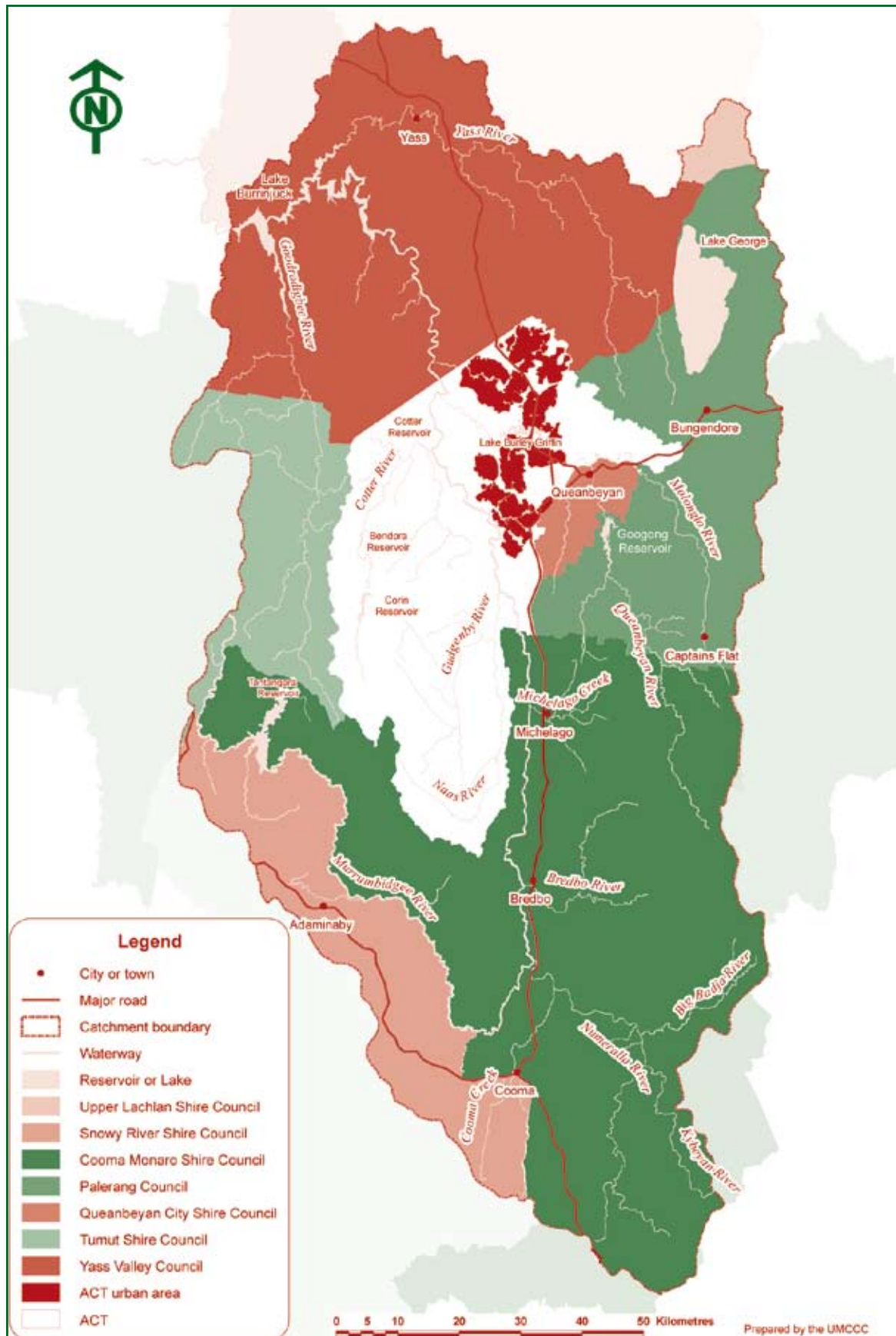
The Murrumbidgee CMA's operational area is determined by the NSW Government and includes most but not all of the natural drainage basin for the Murrumbidgee River. The Australian Capital Territory (ACT) lies entirely within the natural drainage basin of the Murrumbidgee River, but it is a separate jurisdiction. Although the ACT is excluded from the Murrumbidgee Catchment Action Plan, both the NSW and the ACT Governments agree that the Murrumbidgee catchment must be managed across jurisdictional boundaries. To meet this commitment, the ACT helped prepare the Murrumbidgee Catchment Blueprint and both organisations are actively pursuing opportunities for collaboration.”
(Murrumbidgee Catchment Action Plan)

Murrumbidgee Catchment Management Authority, Catchment Action Plan www.murrumbidgee.cma.nsw.gov.au

The ACT Natural Resource Management Plan can be found at www.actnrmcouncil.org.au or phone 13 22 81



The Upper Murrumbidgee Catchment



Upper Murrumbidgee Catchment (UMC) facts

The Upper Murrumbidgee Catchment extends from the headwaters of the Murrumbidgee River, above Tantangara Dam in Kosciuszko National Park, to Burrinjuck Dam — a total of 14,060 km². For catchment management purposes, the Lake George internal drainage basin (970 km²) is included.

The UMC is bounded to the south and east by the Great Dividing Range, and as such it forms part of the south-eastern edge of the Murray–Darling Basin. The Mudoonen and Fiery Ranges respectively form most of the northern and western boundaries. The Australian Capital Territory (2,400 km²) is located wholly within the UMC.

The UMC is the source of water for communities living in the Cooma, Queanbeyan, Canberra and Yass regions, as well as major downstream communities. There are more than 380,000 people in the Canberra – Queanbeyan area alone.

The Murrumbidgee River initially flows in a south-easterly direction, before turning to the north near Cooma and flowing through the ACT. There are 13 major sub catchments, including Lake George. The main tributaries include the Numeralla, Bredbo, Queanbeyan, Cotter, Molonglo, Yass and Goodradigbee Rivers. Significant sections of these rivers, and the Murrumbidgee itself, are deeply incised, while there are other areas with narrow and relatively flat floodplains.

Changes brought by European settlement have altered native vegetation communities through clearing, grazing, pasture improvement, urbanisation, fire management and radiata pine plantations. Weeds and feral animals have also caused considerable impact on native ecosystems. While their effects have been significant, large areas remain relatively unaltered and in some areas there is also evidence of increased tree cover since settlement.

Land use

Wool and beef production are the major rural land uses in the UMC. Other forms of agriculture are limited by soils, climate and topography, but include the grazing of deer as well as dryland cropping and production of irrigated vegetables, stone and berry fruit and olives and wine grapes — the latter two have expanded greatly in recent years.

Other significant land uses in both NSW and the ACT are hardwood and plantation softwood forestry, and conservation reserves including national parks and nature reserves.

Traditional agricultural establishments are now declining with the continuing urban development in Canberra and Queanbeyan and subdivision of rural land for rural residential developments.

Population

The population of the UMC is approximately 400,000. Over 80% are urban residents of Canberra alone. There is continuing demand for rural residential living reflected in developments near Yass, Murrumbateman, Sutton, Gundaroo, Bungendore and Michelago. Residential developments such as in the Molonglo Valley, Googong and Tralee are all recognition of the growing population.

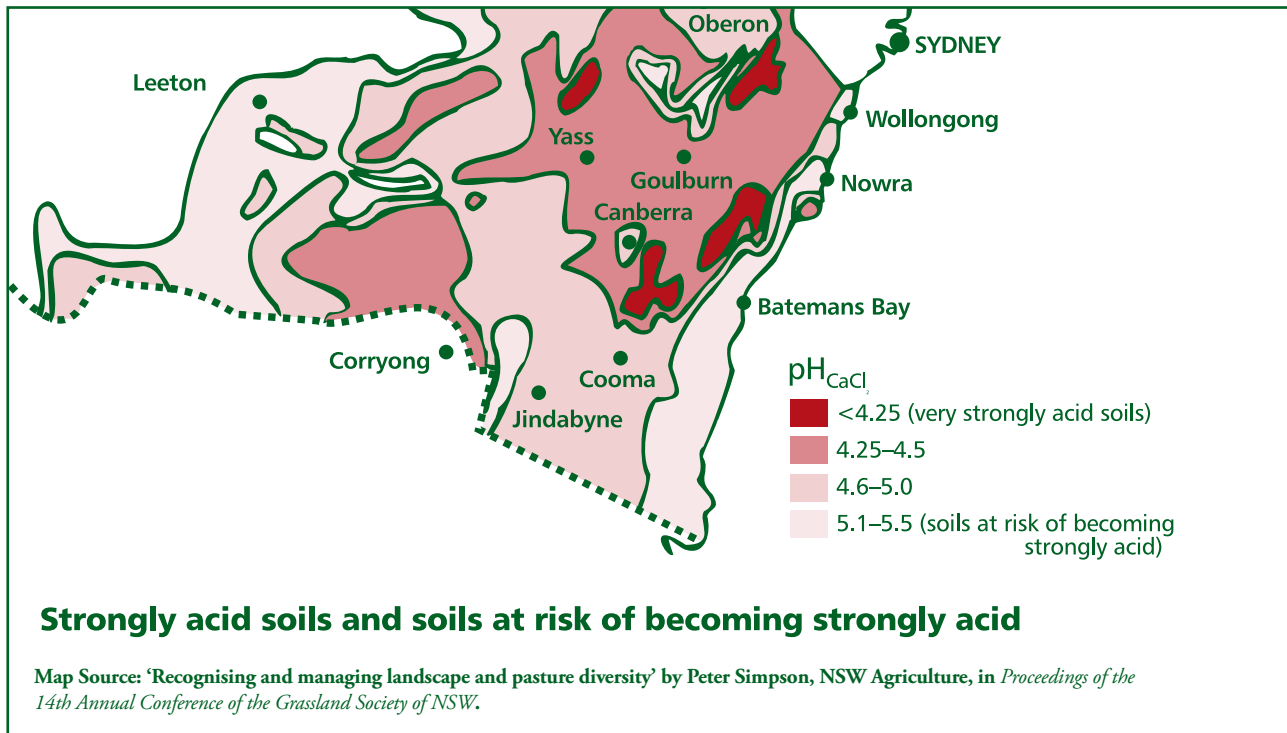
Upper Murrumbidgee Catchment facts

- The UMC is the water catchment of the Murrumbidgee River above the Burrinjuck Dam wall.
- The UMC is an important part of the of the Murray–Darling Basin.
- The UMC includes over 14,000 km² of land.
- Important rivers include the Murrumbidgee, Numeralla, Bredbo, Queanbeyan, Cotter, Molonglo and Yass Rivers – these rivers are our drinking water.
- Important habitats in the UMC include areas of upland grasslands, riverine gorges, open woodlands and chain-of-ponds wetlands.
- About 16% of the UMC is in the ACT, the rest is in NSW.
- A significant proportion of people live in the cities of Canberra and Queanbeyan. Other towns include Cooma, Yass, Bungendore, Adaminaby, Gundaroo, Murrumbateman, Bredbo, Nimmitabel and Captains Flat.

NOTES:

THE RESOURCE BASE

SOILS



What's the nature of our soils?

Soil types vary considerably on the Southern Tablelands of New South Wales.

soil acidity is a major feature of soils in the Upper Murrumbidgee Catchment

Basalt derived soils

Less than 5% are fertile basalt soils. Where rainfall is above 500 mm, these soils are suited to high-input pasture systems based on introduced species. Acidity problems are low to minimal, and these soils have high rainfall infiltration rates.

Granite derived soils

About 30% of the Upper Murrumbidgee Catchment has granite soils with substantially lower natural fertility than basalt soils but they can sustain introduced pasture species. However, introduced pastures have been increasing the level of acidity over time. Some of these soils are also highly erodible. Dryland salinity is occurring on some of the lower slopes and in discharge areas.

Sedimentary duplex soils

More than 50% of the total area is covered by sedimentary duplex soils. These are by far the most challenging to manage. Many are naturally acid (pH 4.5 or below in CaCl₂

measurement), and are located in semi-arable to non-arable environments. Frequently these soils have acidity extending to a depth of 1 m or more.

Soil tests are recommended

The use of soil tests on your property is strongly recommended to correctly diagnose acid soil and saline soil problems.

Erosion

The various forms of erosion, including sheet, rill, gully and wind erosion, are problems in different parts of the catchment. **The main protection against erosion is adequate vegetation cover.**

Soil erosion results in loss of valuable land, through the removal of soil, nutrients and organic matter, and can cause sedimentation, turbidity, declining productivity and dust storms.

Sheet, rill and gully erosion results from water flowing across the land surface. They occur in all land areas where there is insufficient ground cover to provide protection for the soil.

There is evidence that major soil erosion problems occurred in the UMC during the 1800s as a result of land management practices (particularly the introduction of sheep, cattle, horses and rabbits) and flood events.

most soils in the UMC have moderate to high erosion hazard

Causes of soil erosion

- Excessive runoff related to ground cover loss and soil compaction
- Land management activities including overstocking, poor pest animal control, excessive or inappropriate clearing, urban development
- Drought conditions
- Naturally unstable soils
- Intense rainfall events

Effects of soil erosion

- Loss of topsoil, nutrients and organic matter
- Increased turbidity in streams and storage dams
- Sedimentation of storage dams
- Sedimentation and flooding of infrastructure, i.e. roads, bridges
- Destruction of aquatic habitat
- Increased mobility of nutrients and pollutants in waterways

The highest levels of gully erosion are east of the Murrumbidgee River between Cooma and Michelago, and between the northern ACT border and Burrinjuck Dam. Current erosion mapping shows that many gullies are active, but many have been stabilising over the last 50 years, either naturally or as a result of management activities.

Sheet and rill erosion is comparatively minor and localised in extent. For example, the Bredbo area has suffered extensive sheet erosion on moderate slopes and cleared areas. Sheet erosion is considered severe where there is 20–30% bare ground and obvious disturbance to the soil surface.

Tips for preventing erosion on an established block

- Farm tracks should be well sited, constructed and maintained — utilise higher country or ridges and avoid creeks and wet areas.
- Site tracks in sunny aspects where possible, to dry the track surface.
- Consider rotational grazing and do not overstock or overgraze.
- Dams are not necessarily an answer to stopping erosion.
- Locate stockyards on high ground.
- Do not use bare earth firebreaks.
- Maintain, enhance or revegetate with appropriate native vegetation along flow lines.
- Do not remove natural vegetation on highly erodible country and revegetate marginal land with native species.
- Restrict stock access to marshy land or flow lines.
- Keep vegetation above 70% coverage.

Soil acidity

Many of our soils are naturally acid, but common management practices, particularly the use of annual legume-based pastures, encourage even greater soil acidity. This is because of the inefficient use of nitrogen, leading to an accumulation of nitrate in the soil. When there is a mismatch between rainfall and plant demand for nitrogen, nitrogen is leached from under pastures or crops, which lowers the soil pH. The result: many plant species will not grow as acidity increases.

soil acidity is a long-term soil degradation issue that has links to both soil erosion, through reduced ground cover, and dryland salinity, through reduced water use by annual crops and pastures

Naturally occurring acid soils

These areas can be identified easily by the native timber and pasture species present. Peppermint (*Eucalyptus dives* and *E. radiata*), Scribbly Gum (*E. rossii*), She-oak (*Casuarina* spp.) and Sifton Bush (*Cassinia* spp.) nearly always indicate strongly acid soils.

Wiregrass (*Aristida ramosa*), Weeping Grass (*Microlaena stipoides*) and some Wallaby Grasses (*Danthonia* spp.) are also highly acid-tolerant and, where they dominate, the likelihood is that soils will be acid.

Kangaroo Grass (*Themeda triandra*) and Redgrass (*Bothriochloa macra*) tend not to grow in strongly acid soils and are usually associated with Yellow Box (*E. melliodora*) or Apple Box (*E. bridgesiana*) trees.

Causes of soil acidity

- Natural pH decline through leaching
- Past and present land use
- Build-up of soil organic matter
- Removal of alkaline plant and animal produce and waste products
- Nutrient uptake by plants
- Use of shallow-rooted legumes for pasture and hay production
- Continued application of ammonium fertilisers

Effects of soil acidity

- Reduced agricultural viability and production rates
- Increased production costs, i.e. addition of lime
- Ground cover decline, increasing likelihood of soil erosion and water quality decline
- Reduced water use by vegetation contributing to salinity
- Development of subsoil acidity
- Soil structural decline
- Loss of native vegetation species and weed invasion

Soil acidity in the Upper Murrumbidgee Catchment

Almost all soils in the UMC are classified as strongly acid (pH 4.25–5.0) and there are some areas of very strongly acid soils (pH less than 4.25). Subsoil acidity is known to occur in some areas, although it is difficult to detect.

There are three basic strategies for managing acid soils:

- use perennial native pastures to reduce nitrate leaching and slow the rates of acidification
- use lime to raise soil pH
- use plants that are tolerant of acid soil conditions.

In practice a combination of all three strategies may be used on any property.

An 'Acid Soil Action' manual is available at www.lwa.gov.au

What is soil pH?

The pH of the soil is a measure of its relative acidity or alkalinity. The pH scale is divided into 14 points, each of which is 10 times more or less than its neighbours. A pH of 7.0 is considered neutral, above 7.0 is alkaline and below 7.0 is acidic. (There are two scales, water and CaCl_2 , which give slightly different numbers.)

Your soil pH, nutrients and worms

Soil pH controls the availability of plant nutrients. It can also help or hinder the activity of earthworms. Earthworms prefer to live in a neutral environment, where the soil pH is near 7.

What is the best pH for agricultural plants?

A soil pH (CaCl_2 — measured as calcium chloride) between 5.0 and 8.0 provides the best conditions for most agricultural plants. If the pH drops below 5.0, it has a negative effect on plants (such as Lucerne) that are sensitive to acidity.

Plants that are more tolerant of acidity, such as subterranean clover, continue to grow normally until the pH falls below 4.5. Below pH 4.2 all plants, except the very highly acid-tolerant, show a significant reduction in production. Very few plants survive below pH 3.8.

The material above is excerpted from: CSIRO, *Soil pH Test Kit leaflet*. Fenton, G. et al. (1996) *AgFact AC.19 Soil Acidity and Liming*. NSW Agriculture.

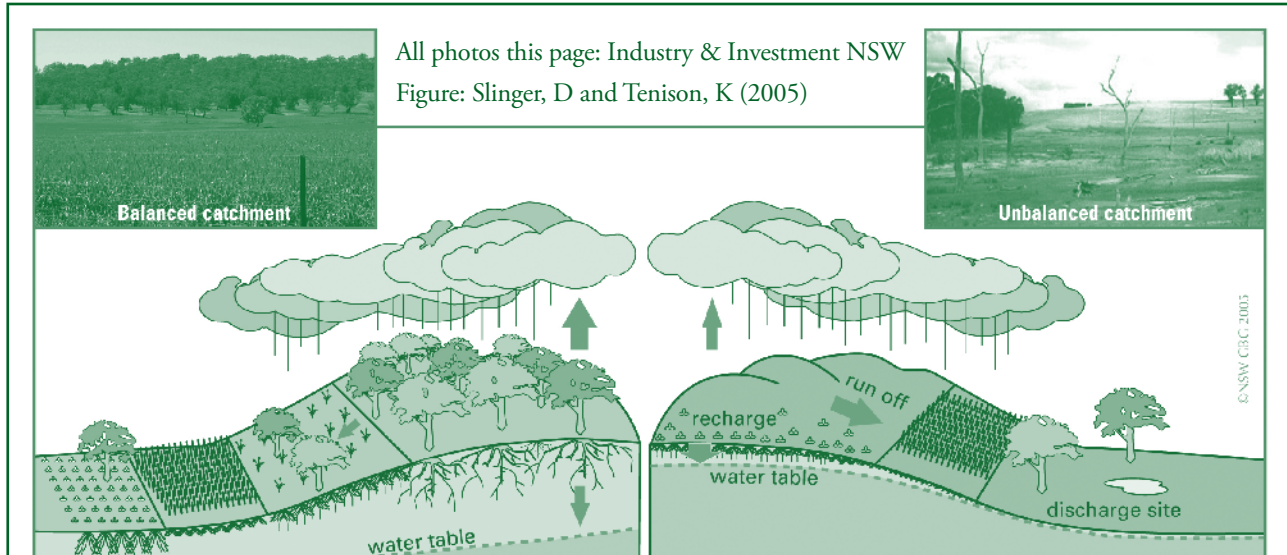
Dryland salinity

Dryland salinity occurs naturally or if catchment hydrology is changed, when groundwater discharges or seeps to the surface bringing soil salts with it. When the catchment water balance is disturbed, i.e. when deep-rooted perennial vegetation is removed, dryland salinisation is accelerated. Dryland salinity can cause vegetation loss and stream salinisation and can act as a precursor to soil erosion. Urban areas and infrastructure are also affected by dryland salinity.

In the last 40 years the area in the Southern Tablelands affected by dryland salinity has increased rapidly. Saline scalds have been developing in the Yass River subcatchment for more than 30 years. Anecdotal reports suggest that salinity outbreaks were observed near the upper Murrumbateman Creek following the 1902 drought. Aerial photos of the Yass River subcatchment indicate increasing extent and severity of salinity between 1941 and 1973, with particularly severe problems evident in the early 1960s.

In other subcatchments of the UMC, there is a lack of information on existing and potential dryland salinity problems, largely due to lack of groundwater monitoring. Minor salinity outbreaks have been observed in the Molonglo and Queanbeyan River subcatchments and the Lake George Basin, indicating there could be other problem areas and that there is a risk of more widespread problems if further action is not taken.

Minor areas of **urban salinity** have been identified in Canberra and Queanbeyan with the Gungahlin area of Canberra affected by emerging salinity. Yass township is also considered susceptible to urban salinity.



Causes of dryland salinity

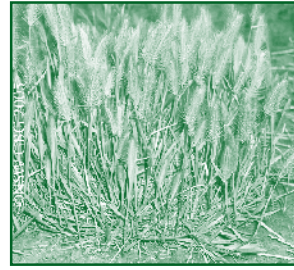
- Replacement of deep-rooted perennial vegetation with shallow-rooted pastures and crops that use less water resulting in an elevation of the watertable — bringing salt to the surface
- Over-irrigation of crops, lawns and recreation areas with similar effect to the above
- Rock/sediments containing high levels of salt
- Salt in rainfall; rainfall amount and distribution
- Landform and hydrogeology characteristics

Effects of dryland salinity

- Loss of desirable vegetation
- Growth of salt-tolerant species
- Reduced crop and pasture production and decreased enterprise flexibility
- Waterlogged soil
- Soil erosion on bare areas
- Increased salt loads in waterways
- Reduced surface and groundwater quality
- Declining soil structure
- Damage to buildings, roads, septic systems and pipes

How can you tell if you have saline soils?

Dryland salinity can be detected visually by changes in pasture composition as well as scalding of the ground surface. Cocksfoot and white and subterranean clover thin out and disappear as salinity levels increase, and are progressively replaced by more salt-tolerant species including Paspalum, Yorkshire Fog, Couch and Sea Barley Grass.



SEA BARLEY GRASS

Photo: Industry & Investment NSW

CASE STUDY



SALINITY IN THE YASS RIVER SUBCATCHMENT

In 1993, dryland salinity was estimated to affect 1–5% of the Yass Valley (total area 159,000 ha) with the potential to degrade up to 20% of some areas. Saline land is indicated by scalds and the dominance of salt-tolerant grasses that are often unpalatable to stock. Shallow groundwater in the saline areas is generally brackish.

The estimated economic cost of dryland salinity in the Yass River Valley for 1991 included \$400,000 per year to local and state governments and between \$200,000 and \$500,000 per year for landholders.

The Murrumbateman Landcare Group has produced self-directed tour notes for the Yass Valley salinity demonstration sites to promote awareness of the problem and its management.

Photo: Murrumbidgee CMA

Sodicity

Soil sodicity is a cousin of soil salinity. The two are often confused, probably because both involve sodium. Compared to salinity, sodicity is actually a more widespread form of land degradation. It affects nearly a third of all soils in Australia causing poor water infiltration, surface crusting, erosion and waterlogging.

Runoff from sodic soils carries clay particles into waterways causing water turbidity or cloudiness. Turbidity causes environmental problems in rivers and wetlands. Runoff from sodic soils carries high levels of nitrogen and phosphate into waterways, contributing to algal blooms.

The difference between saline and sodic soils

In **saline soils**, sodium has a partner in crime, chlorine, with which it forms a salt NaCl. The presence of salt in the soils reduces the availability of water to plants and, at high enough concentrations, can kill them.

In **sodic soils**, much of the chlorine has been washed away, leaving behind the sodium ions attached to clay particles in the soil. Soils are considered sodic when their exchangeable sodium percentage (ESP) is more than 6%. When wet, the clays in sodic soils lose their ability to stick together, leading to unstable soils which readily erode and become impermeable to both water and plant roots. They often have a severe surface crust. Soils can be saline and sodic at the same time. The inherent sodicity problem will usually be masked by the obvious visual salinity symptoms.

Treating sodicity

Identification and management of these areas is important. Sodicity can be treated by applying gypsum to the affected soil. However, large quantities of gypsum may be needed to have anything more than a short-term effect.

NOTES:

THE RESOURCE BASE

WATER

Development depends on surface water

there is continuing pressure on surface water from rural residential development

Limited groundwater availability has meant a heavy reliance on surface water in the catchment, with increasing demand from all sectors.

Groundwater resources have not always been well assessed — and in areas where groundwater is available, this usually leads to groundwater use without consideration being given to local or regional impacts. Further rural residential growth ensures there will be continued demand on groundwater.

Water quality

Surface water quality in the UMC has been generally good but in recent times has experienced a sharp decline, partly as a result of the 2003 bushfires. Vegetation loss can have a serious impact on water quality with bushfires being a major risk to water supply catchments. The 2003 fires denuded much of the landscape of trees, which hold fragile soils in place, slowing the flow of water across the landscape during rain events. Both of these functions significantly reduce erosion and limit turbidity (suspended solids) in waterways. With the regrowth and planting of trees in our region, water quality is slowly improving.

Water quality issues in our region are also the result of drought and outdated land management techniques. Good pasture management means good water quality.

Stocking rates on dry soils must be flexible with the goal of a minimum above 70% or greater soil coverage. In good years, this means more animals, in poor years, less. Allowing less than 70% pasture coverage significantly raises the chance of large scale soil loss when rains do come. Soil and nutrient loss is terrible for the soil, the farmer, and the river where it all ends up.

Local water quality concerns can often be ameliorated by increasing riparian vegetation and removing direct access to the waterway by stock. These two actions are effective in promoting and sustaining good water quality. By fencing out riparian areas, and planting deep rooted trees, salinity is reduced, nutrient run-off from fertilisers and stock is controlled, and stream bank stability is maintained.

Waterwatch, a community water quality monitoring program in the region offers free training, equipment and facilitation of water quality monitoring and improvement on both small and large scale projects.

Groundwater

In the UMC most of the usable **groundwater** occurs in fractured rock.

Towns and villages such as Murrumbateman, Sutton and Bungendore rely largely on limited groundwater. Adaminaby, Cooma, Bredbo, Captains Flat and Yass all draw water from local rivers. The Googong, Bendora, Cotter and Corin Dams supply Queanbeyan and Canberra.

For more Groundwater information see “Topic 3 - Factsheet for Rural Landholders, Groundwater in the Upper Murrumbidgee Catchment – understanding your bore.”

Water law

— in the Australian Capital Territory

The use of water in the ACT is regulated under the *Water Resources Act 2007* (ACT).

Surface water, including water from a dam, to be used for commercial purposes must be licensed.

All groundwater use must be licensed. A permit is required before a bore is constructed or altered. Only drillers licensed in the ACT may construct, modify or seal off a bore located within the ACT. It is an offence to waste bore water or to place any matter including water in a bore without approval.

A permit is required to construct or alter a dam or other water control structure if it will be on a waterway of larger than 2 megalitres capacity. The construction of a dam may also require a development approval.

dam construction requires development consent in all local government areas — contact your local council

— in New South Wales

The NSW Office of Water within the Department of Environment Climate Change and Water administers the management of surface and groundwater. The office reports to the Minister for Water for water policy and the administration of key water legislation including the *Water Management Act 2000*, and the *Water Act 1912*.

In NSW there are three basic rights to access water available to rural landholders.

- 1. Domestic and stock water** – Landholders over an aquifer or with river or lake frontage can access water for domestic (household) purposes or to water stock.
- 2. Native Water Title** – Anyone who owns native title with respect to water, as determined under the *Commonwealth Native Title Act 1993*, can take water for a range of personal, domestic and non-commercial purposes.
- 3. Harvesting runoff** – Harvestable right water is generally intended for essential stock and household use but can be used for any purpose. Harvestable right water allows for landholders in most rural areas to collect a proportion of the runoff on their property and store it in one or more farm dams up to a certain size. Any amount of water over the harvestable right is subject to licensing. This will be established with the NSW Office of Water.

Entitlements and water trading

Irrigation and other commercial access to surface water above a property's harvestable right are constrained by an embargo on the issuing of new water entitlements.

That means new water licences or licences for additional water (apart from exempt purposes) can be obtained only by buying the required water entitlement from someone else — 'water trading'. There are guidelines established for 'water trading' within catchments in NSW and you should contact your nearest NSW Office of Water within the Department of Environment Climate Change and Water.

Groundwater

All groundwater bores in NSW require licensing before drilling. Licences will specify how much water can be pumped and for what purposes this water can be used.

There are fees and charges for irrigation bores, which vary depending on usage.

NOTES:

THE RESOURCE BASE

NATIVE VEGETATION

Cherish your native grasses and pastures — or they'll disappear

Native pastures are valuable natural capital resources which many people use for grazing.

How native pasture works for you:

- prevents erosion and provides soil stability
- offers low-cost landscaping and a habitat for native flora and fauna
- used sensitively, can provide grazing for your animals
- can increase rainfall infiltration into the soil up to fourfold
- helps ensure a clean catchment for water, provides understorey for woodland, and combats salinity.

What have you got?

Local native pastures are dominated by Kangaroo Grass (*Themeda australis*), Spear Grass (*Austrostipa* spp.), Wallaby Grass (*Austrodanthonia* spp.) and Snow Grass (*Poa* spp.). If revegetating, try to select and/or maintain the species that match your soil and environment.

What's it look like?

To identify your grasses, the following are good resources: NSW DPI, CSIRO, libraries or specialised places such as the Botanic Gardens. Take a specimen, either fresh or preserved. Try to take in plants with flowers, fruits or seedheads, or draw flowers or seeds. Species are easier to identify when they are flowering or seeding.

Using native pastures for grazing

Many of us live on steep middle to upper slopes with low-fertility, acid, shallow soils susceptible to erosion. Such land is only suitable for permanent pasture based on native grasses or to be left undisturbed.

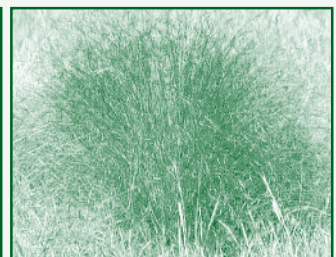
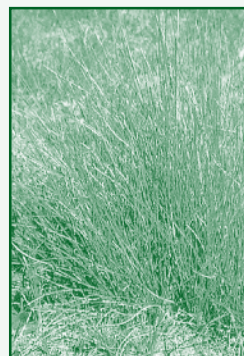
Until recently native grasses were thought to have little value for grazing or conservation, and were replaced with

'improved' pastures. Their excellent resistance to drought and low temperatures went largely unacknowledged as was the fact that they are generally better suited to acid soils.

Natives like Wallaby Grass, Weeping Grass and Snow Grass respond to grazing, are green year-long and have moderate to high forage value.

Unfortunately, commercialisation of our native grasses has been difficult and some may not be available in quantity at economic prices and/or are difficult to establish. So look after what you've got!

Can you tell the difference between Serrated Tussock, Poa Tussock and Red-Anthered Wallaby Grass?



Hint: only one is a noxious weed and some people pull out the lot.

SEEK ADVICE.

CONTACTS



ACT – Department of Territory and Municipal Services (TAMS)

GPO Box 158, CANBERRA CITY, ACT 2601
Macarthur House, 12 Wattle St, LYNEHAM ACT 2602
Phone Canberra Connect 13 22 81
www.tams.act.gov.au



Or:

ACT – Department of the Environment, Climate Change, Energy and Water – for water licensing matters

GPO Box 158, CANBERRA CITY, ACT 2601 Macarthur House, 12 Wattle St, LYNEHAM ACT 2602
Phone Canberra Connect 13 22 81
www.environment.act.gov.au

ActewAGL (for matters relating to water supply in the ACT and Queanbeyan region)

GPO Box 366 CANBERRA CITY ACT 2601
Phone 13 14 93

Department of Primary Industries - part of Industry and Investment NSW

Queanbeyan 28 Morisset St Queanbeyan
Phone 02 6298 0888
Cooma 39 Bombala St Cooma Phone 02 6452 3411
Yass 25 Waroo Rd Yass Phone 02 6226 2199
www.dpi.nsw.gov.au

There are downloadable fact sheets on all water related topics

NSW Office of Water Department of Environment, Climate Change and Water

Queanbeyan 11 Farrer Place Queanbeyan
Phone 02 6229 7000
Sydney Head Office Phone 02 8281 777
information@environment.nsw.gov.au
www.environment.nsw.gov.au

REFERENCES



Eddy, D., Mallinson, D., Rehwinkel, R. and Sharp, S. (1998) *Grassland Flora: A Field Guide for the Southern Tablelands (NSW & ACT)*. Available through the Botanic Gardens bookshop.

Eddy, D. (2002) *Managing Native Grassland: A Guide to Management for Conservation, Production and Landscape Protection*. World Wide Fund for Nature.

Simpson, P. and Langford, C. (1996) *Managing High Rainfall Pastures on a Whole Farm Basis*. NSW Agriculture.

NSW Agriculture (1990) *Agfact (P2.5.32) Grasses — Native and Naturalised: Recognition, Value, Distribution*. NSW Agriculture/DLWC Prograze® publications.

Grassland Society of NSW (1999) *Proceedings of the 14th Annual Conference of the Grassland Society of NSW*. Available from Grassland Society of NSW, c/- South Orange Post Office, Forest Road, Orange NSW 2800.

Hird, C. (1991) *Soil Landscapes of the Goulburn 1:250,000 Sheet*, Soil Conservation Service of NSW, Sydney.

Simpson, P.C. (1994) 'Perennial grasses — acid soil tolerance' in C.H. Bastick et al. (eds) *Landcare in the Balance: Proceedings of the 1994 Australian Landcare Conference*, Hobart.

Department of Conservation and Land Management (Salt Action) *Detecting Dryland Salinity on the Southern Tablelands of New South Wales* — pamphlet with photos of indicator plants, symptomatic landscape features.

Department of Conservation and Land Management (Salt Action and the National Soil Conservation Program) (1994) *Dryland Salinity 8: Options for Control*.

NSW Agriculture (1996) *AgFact AC.19 Soil Acidity and Liming*.

NSW Agriculture (1996) *Agfact AC.10, 2nd edition, Improving Soil Structure with Gypsum and Lime*.

Slinger, D and Tenison, K (2005). *Salinity Glove Box Guide*, NSW Department of Primary Industries.

NOTES:

MANAGING YOUR PROPERTY

ANIMALS – STOCK AND WILDLIFE

Stocking rates

Overstocking can be a quick route to destroying pastures and bushland. When starting out, seek advice from the NSW Department of Primary Industries (NSW DPI) and/or your local council and consider the whole environment on your block.

Rule of thumb: Keep at least 70% vegetation cover at all times. If feed is scarce, fence your paddock trees so stock can not ringbark them.

Stocking rates below are recommended by NSW DPI as a rough guide. *These figures assume no supplementary feeding and are clearly subject to the quality/productivity of the pasture.*

	<i>Introduced pasture</i>	<i>Native pasture</i>
Sheep	8 per ha	3 per ha
Cattle	1 per 2 ha	1 per 6 ha
Horses	1 per 2 ha	1 per 6 ha
Alpacas	5 per ha	—
Llamas	5 per ha	—
Goats	8 per ha	3 per ha

<i>Stocking rate too high</i>	<i>Stocking rate too low</i>
Increase in bare ground	Increase in less palatable pasture species
Stock losing condition	Old plant growth (litter) smothering new plants
Erosion occurring	
Increase in weeds	

Knowing the capacity of your block and the grazing requirements of your stock is essential. In fact the stocking rate and type of stock may be the most important management decision you make. It can be difficult to determine the appropriate stocking rate for your property. Using a combination of the following guides is a good place to start.

Good ground cover and stocking rates will be reflected in the health and quality of your stock.



0 Very poor

- Very sunken rump
- Deep cavity under tail
- Skin tight under bones
- Very prominent backbone and pelvis
- Marked ewe neck



1 Poor

- Sunken rump
- Cavity under tail
- Ribs easily visible
- Prominent backbone and croup
- Ewe neck, narrow and slack



2 Moderate





- Flat rump either side of backbone
- Ribs just visible
- Narrow but firm neck
- Backbone well covered



3 Good

- Rounded rump
- Ribs just covered but easily felt
- No crest, firm neck

Know your land class on a scale of 1-8

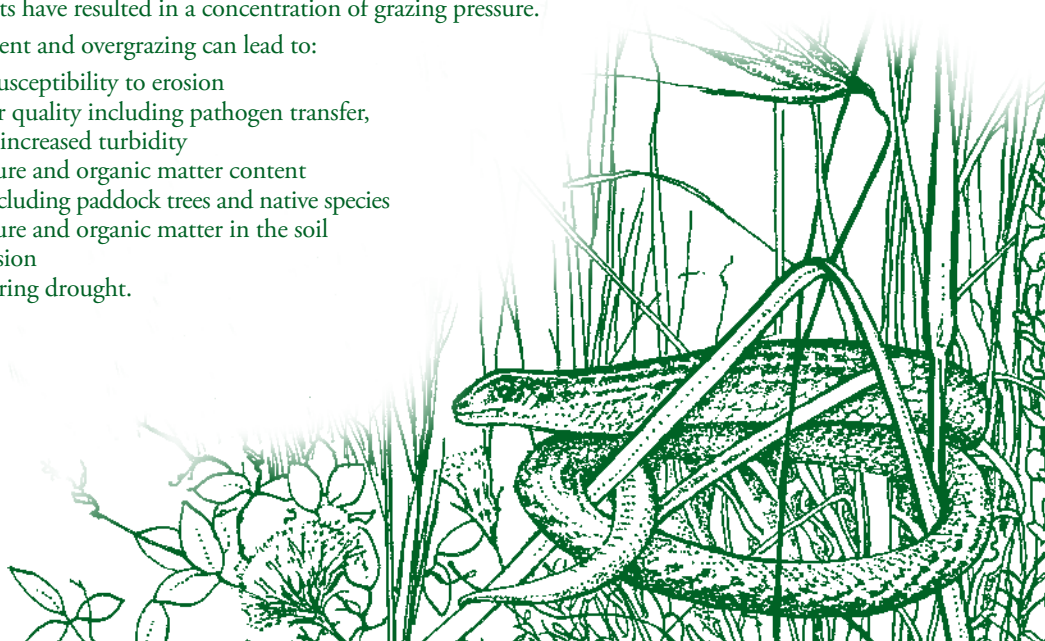
Land class ranges	Land use options and suggested soil conservation practices
1-2 (0-3 degree slope) 	Arable land suitable for regular cultivation crops, and/or high input introduced pastures. No special soil conservation works or practices necessary.
3-4 (3-6 degree slope) 	Grazing land well suited to introduced pastures. It may be cultivated or cropped in a rotation with pasture. Structural soil conservation works such as diversion banks, graded banks and waterways. Soil conservation practices such as pasture improvement, stock control, application of fertiliser and minimal cultivation for the establishment or re-establishment of permanent pasture.
5-6 (6-18 degree slope) 	Land suitable for grazing but not for cultivation. Structural soil conservation works such as absorption banks, diversion banks and contour ripping. Soil conservation practices including limitation of stock, broadcasting of seed and fertiliser, prevention of fire and destruction of vermin. This class may require some structural works.
7-8 (18 + degree slope) 	Land not suitable for agriculture or at best suited to light grazing. Best protected by green timber, incapable of sustaining agriculture. Best suited for conservation.

Grazing management

There is a link between grazing management and the capacity of land to produce quality pastures and fodder. Careful grazing strategies can even increase the diversity of some native remnant grasslands. However, in some cases rural residential developments have resulted in a concentration of grazing pressure.

Poor grazing management and overgrazing can lead to:

- bare patches and a susceptibility to erosion
- a reduction in water quality including pathogen transfer, nutrient runoff and increased turbidity
- declining soil structure and organic matter content
- loss of vegetation, including paddock trees and native species
- declining soil structure and organic matter in the soil
- increased weed invasion
- greater problems during drought.



NATURAL SEQUENCE FARMING

Natural Sequence Farming (NSF) follows principles outlined by Mr Peter Andrews. NSF is a system of farming based on holistic observations and interactions within the natural landscape. Under NSF, Mr Andrews suggests a sustainable farm landscape may form where:

- Stream water is carried on the highest formed land on a flood plain, which includes not only the stream channel and wetlands but also water meadows fed by subsurface flow and braided channels
- Erosion is balanced by sedimentation
- Polluted stream water is filtered as it moves through the chain of ponds, its wetlands, lush floodplain meadows, sandy groundwater intake beds and reed beds along the length of the stream valley floor
- Whole-of-farm ground cover is at a high ratio, with season specific perennial and annual plants maintained in a balance of natural sequences in turn confining weeds to a small percentage of the plant community
- Biodiversity is maintained at a high level with the diversity of habitats created by the natural vegetation and aquatic sequences. (From Paul Newell and Garry Reynolds www.naturalsequencefarming.com)

The Natural Sequence Association was founded early 2007. There is an Upper Murrumbidgee association that can be contacted on **02 6251 5425, 31 Mirning Cres. Aranda ACT 2614**

Prograze®

How to manage pastures to last

Prograze®, a registered PROfarm course run by NSW DPI, is a series of workshops that assist producers and landholders to manage their grazing productively without degrading their pastures or soils.

The workshops are held on-farm and include: recognising the plant species present and how to assess their nutritional value to stock; identifying the quality and quantity of pasture available for stock; manipulating grazing management to control undesirable species and weeds; and developing fodder budgets so that both the animal and pasture needs are met.

CONTACTS



NSW Department of Primary Industries

www.dpi.nsw.gov.au

Yass Phone 02 6226 2199

Queanbeyan Phone 02 6298 0888

Cooma Phone 02 6452 3411



Murrumbidgee Catchment Management Authority

www.murrumbidgee.cma.nsw.gov.au

Phone 02 6229 7700

murrumbidgee@cma.nsw.gov.au

Natural Sequence Farming

www.naturalsequenceassociation.org.au

UM Chapter NSA_UMC@yahoo.com.au

Phone 02 6251 5425 or

c/- 31 Mirning Cres. Aranda ACT 2614



NOTES:

A HORSE OR TWO

What are the benefits of native pasture and how do you keep it healthy?

by *Cornelia Bachor*

Many of us move to a hobby farm (5–40 acres or about 2–15 hectares) in order to keep a horse or two. We may have had an image of horses grazing on lush, beautiful pasture. However, the reality in our area is often quite different: the selection of the block can be far from ideal from a horse's point of view. So we need a workable compromise.

it takes (at least) 3–5 hectares of unimproved native pasture to feed one horse for most of the year, without extensive supplementary feeding

Most soils in the region are shallow, shaly, often (very) acidic, deficient in some elements (nitrogen, phosphorus, molybdenum, potassium, boron, calcium).

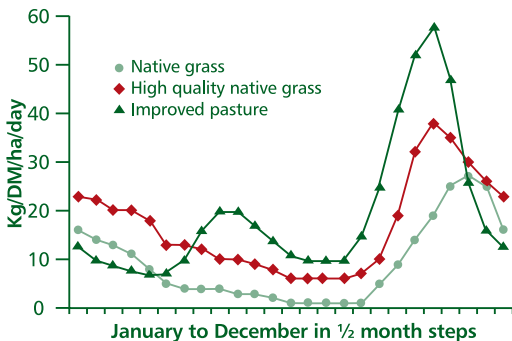
Pastures come in various guises: poor native (Wire Grass, Spear Grass); good native (Wallaby Grass, Kangaroo Grass, mixtures); native plus subclover, and fertilised; or improved pasture (sown perennial grass, clover).

The carrying capacity of these pastures ranges from 1 DSE/ha (DSE = dry sheep equivalent, an animal of approximately 40 kg weight per hectare) for poor native pasture to 7.5–10 DSE/ha for improved perennial pasture. Under this calculation, 1 hectare of improved pasture could support a 400 kg horse for most of the year without additional feeding.

But this has to be taken in its seasonal context. The improved pasture has a very high growth rate from September to November. Well-managed and fertilised* native grasses have a smaller growth rate, but for a longer period — between October and March.

*Blood and Bone and Dynamic Lifter are suited to fertilise native pasture.

Estimated growth rate Southern Tablelands



In good to average years, the improved pasture would yield about 7 t/ha of feed per year, with the native pasture providing about 6 t/ha. So the improved pasture is only a little better overall.

However, in below-average rainfall years, it's likely there will not be enough growth to satisfy the horse's appetite,

regardless of pasture. Theoretically, it takes 3–5 hectares of the unimproved native pasture to feed one horse for most of the year, without extensive supplementary feeding.

That will work to a degree in spring/early summer, but barely in winter. Lack of spring/summer/autumn rainfall often results in reduced pasture growth, and don't forget the grazing competition from kangaroos.

One solution to the feed shortage of native grasses in winter is to undersow subterranean clover. But be careful. If you use a lot of superphosphate and keep stocking rates high, you are in danger of losing the native pasture altogether, leaving you with subclover that does not grow in summer/autumn.

Caution: *There are other reasons to be careful with superphosphate — like nutrients flowing into dams around you or contributing to dieback of nearby native trees. Clover pastures can also contribute to soil acidification.*

If you're thinking about resowing your paddocks to improved pasture, consider that it's expensive and risky: erosion, lack of rain, weed infestation, strike-rate problems happen all too easily; grazing is very restricted in the first year.

Therefore it is far better to maintain and nurture native pasture — the objective is to maintain carrying capacity rather than to increase it.

Increase the time your horses can utilise pasture. It is a good idea to subdivide a bigger paddock into several smaller ones, to give sections time to recuperate while you spell them.

Aim for 70–80% grass cover at all times to avoid erosion, weed infestation...

Consider the siting of gates and fence lines. Gates are best sited away from corners, and avoiding particularly boggy/wet areas.

Plant shelter-belts around your paddocks/property and keep/plant shelter/shade trees within the paddocks.

Your management regime may have to change. Consider yarding or stabling horse/s at night and/or for part of the day especially in winter when we are often faced with wet conditions. Horses can destroy the soil very quickly — depending on area and number of horses, it may be best to keep them off the paddocks.

I decided to sacrifice the vegetation of one area which stays dry during those periods so that the rest of the property will remain sound. We have a shelter and yard for each horse at night throughout the year and all day on very wet days. The wet-weather paddock is used whenever areas are very wet or boggy, and during periods of drought to minimise trampling damage.

The grass paddocks are used during daytime while it is dry and there is sufficient growth. In the depth of winter when there is no feed in the paddocks, the horses are agisted to allow our paddocks two to three months to recuperate.

Manure management: One of the worst chores for any horse owner is cleaning up the paddocks so they don't become 'horse sick'. Pick up manure and compost it for later spreading, or harrow the pasture to spread out the manure.

But please make sure your stockpile does not leach into any waterways that may contaminate your own or your neighbour's dams, creeks or groundwater!

If these management strategies sound like a lot of work — it is definitely worth it, as it allows you to use your paddocks for years to come.

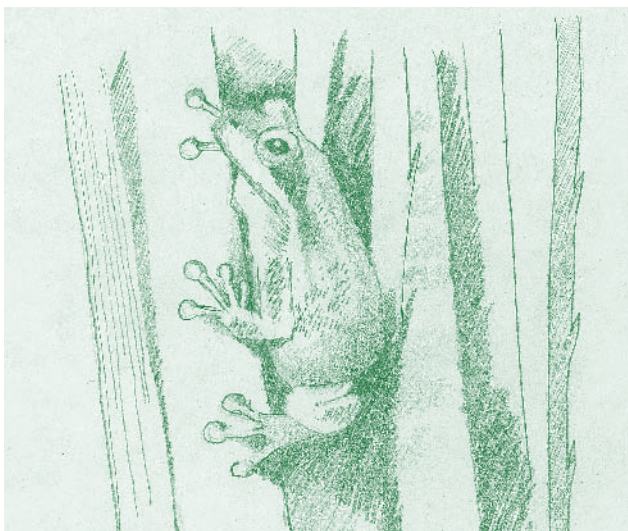
LHPA Livestock Health and Pest Authority (NSW)

The LHPA replaces the Rural Land Protection Board system in NSW. Working with landholders the LHPA's work to ensure the protection of property and livestock from biosecurity risks posed by disease and pests, assist to control pest animals and insects, manage travelling stock reserves, assist with drought relief and employ district vets and rangers. The LHPA assist both large and small landholders and their website provides detailed information and advice.

www.lhpa.org.au



SUPERB PARROT – MARJORIE CROSBIE-FAIRALL © WILDLIFE RESEARCH AND MONITORING, ENVIRONMENT ACT



Wildlife

Living with Wildlife

With thanks to Wildcare Queanbeyan Inc.

Many rural residential areas are blessed with an abundance of wildlife, surrounded by large areas where wildlife has suffered culling and habitat loss for farming and development. More and more people now want to support our wildlife and encourage it back into areas where it once belonged. At the block level, there is a need to create wildlife-friendly properties by:

- controlling domestic animals
- removing or minimising the impact of barbed wire and mesh fencing and netting
- minimising the use of pesticides
- becoming involved with protecting all wildlife in your area
- retaining native vegetation as habitat

Whether it is a kangaroo, echidna, possum, wombat, parrot, galah, bat, lizard, turtle, venomous snake, spider, moth or other native animals, there is much we can do to enjoy their presence, live alongside them and help them when needed.

The Law

Law protects all wildlife and if an injured or orphaned animal is picked up it must be handed into a licensed wildlife group or a National Parks and Wildlife ranger. It is illegal to keep wildlife unless you are licensed. Native animals need the right food and housing. Carers need the skills to 'train' animals to be ready for eventual release back into the wild. Baby animals can grow quite large and they eventually become unmanageable – raised in the wrong way, there will be little chance in rehabilitating animals back into the wild.

Knowing something about 'dangerous' wildlife

Some wildlife can inflict painful and/or toxic bites, so be vigilant and aware of what is around. It is best to keep the immediate area around the house and yard neat and tidy, so you can see what is around.

While tiger and brown snakes are some of the most venomous snakes in the world, they only bite to protect themselves from attack or to disable their prey. Humans are generally too big to be considered as food for snakes but if cornered or otherwise threatened they may retaliate in defence. There is no need to be alarmed if a snake unexpectedly appears: left alone it will just move on. Remove rubbish and woodpiles away from the house to avoid being surprised. Some snakes are attracted to frogs, so expect them by a water feature and in the feed or chook sheds chasing mice. Snakes hibernate in stone walls and woodpiles (as do lizards) and will seek out warm spots in summer – so be aware and take care when working in the garden.

If you use netting around plants, trees and shrubs keep it off the ground so that snakes don't get caught up and give you a surprise.

Never tackle a snake yourself – stand back, watch it, be patient and call in a wildlife group such as Wildcare, the Native Animal Rescue Group or WIRES who have people that are trained to remove them.

Snakes are protected animals and it is illegal to kill them. If you are bitten, be calm, apply a pressure bandage up and back along the length of a limb, immobilise the casualty and call 000. With correct and immediate first aid there will be plenty of time to treat the effects of a bite.

Give all large wild animals, including adult kangaroos and wombats a respectful distance and do not let your dog chase them. It can happen that a dog or human is bitten or kicked, if the animal is defending. Dogs have been drowned in dams by kangaroos, although more kangaroos drown trying to escape dogs!

Driving around

Most drivers don't hit wildlife because they are vigilant and drive slowly in wildlife-rich areas. If you want the best chance to avoid an expensive bump, then reduce speed to allow time to react, avoid 'tunnel vision' and look around much more. Know where wildlife crossing points are and take extra care at dawn and dusk and through the night, as that is when animals are moving around. Locals get to know where kangaroos are likely to be and where they cross the road, but that is of no use if a motorist is simply going too fast to stop.

Wombats 'freeze' on the road

On hearing an oncoming vehicle, the first instinct of a wombat is to stop and crouch. It will not move away until it understands what the noise is. If you have avoided a wombat on the road, stop, go back and chase the animal off the road - but do it safely.

Whether a wombat or kangaroo, please check dead and injured animals on the roadway to see if there is a Joey onboard or loitering nearby. Call your local wildlife group for advice and help.

Habitat — what lives in your vegetation?

Native fauna need areas for feeding, roosting, migration, nesting and rearing of young.

Habitat includes:

- hollows in trees (including dead trees)
- fallen logs
- leaf litter
- understorey shrubs
- native grasses, rushes and sedges
- wet or damp areas
- watercourses
- flowering trees and shrubs
- rocks and boulders
- caves and overhangs
- seasonal cracks in the soil.

Hollows are used by birds, bats and arboreal (tree-dwelling) mammals for roosting and nesting. Native grasses, rushes and sedges are important shelter and feeding areas for small ground-dwelling reptiles and mammals.

Understorey shrubs are important feeding areas for some birds and mammals.

'tidying up' a bush block often removes wildlife habitat

A SUGAR GLIDER IN EVERY TREE?

A good example of a healthy ecosystem at work in the rural environment is the story of the Sugar Glider and wattles.

You may never have seen a Sugar Glider — the smallest of our local possums and gliders — because of its nocturnal habit and secretive ways.

But across south-eastern Australia, these little bug eaters have had a solid impact on keeping down populations of tree-stripping scarab beetles.

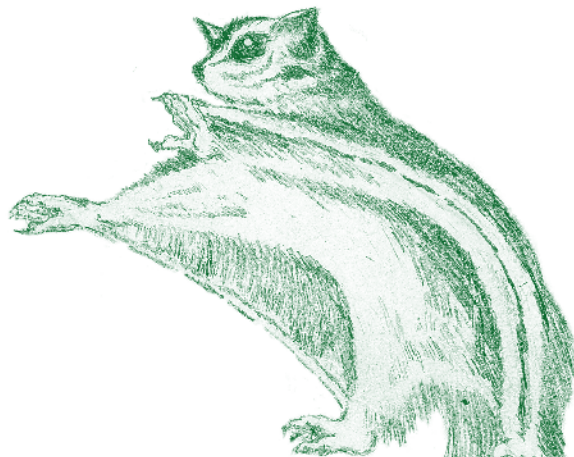
Research in remnant forest has shown that the number of Sugar Gliders is determined by the amount of nectar and sap available in winter. Important species for glider nutrition are certain wattles, particularly Black Wattle (*Acacia mearnsii*) and the sap of the Apple Box (*Eucalyptus bridgesiana*). Not all acacias are suitable as nutrient trees. For example, Blackwood (*Acacia melanoxylon*) is not a gum-producing wattle.

Densities of Sugar Gliders range from as few as one animal per hectare where wattles are absent to as many as 12 per hectare where wattles are abundant.

If you think this is trivial, consider that scientists have estimated 10 Sugar Gliders per hectare could devour as many as 18,000 large scarab beetles during scarab season.

You can improve the habitat for gliders by leaving tree hollows, ground cover, flowering trees and shrubs and wildlife corridors. Here's a good example of the value of linking remnant vegetation and preserving native vegetation on road verges, crown roads and stock routes.

Source: Greening Australia



What's in it for you?

Conserving habitat rewards you with natural pest control. One Straw-Necked Ibis eats about 200 grams of insects every day. The Sugar Glider will eat 25 scarab beetles a day, and 40–60% of the diet of crows and ravens is insects.

Small insect-eating bats eat up to half their own body weight each night. Small native birds (such as robins, fantails, weebills, pardalotes, honeyeaters, butcherbirds and others) found in healthy habitat will control aphids, thrips, scale, lerps, flies and locusts.

IS YOUR FIREWOOD SOMEONE'S HOME?

by Maria Taylor

Whether it's from your block or a wood merchant, the removal of old standing dead and downed trees for firewood, or just to clean up the block, takes away habitat for nesting birds, and other wildlife such as, on the ground, echidnas (which may keep your ant populations in check).

And when you buy firewood commercially, you get into an area that is 'mining' a lot of diminishing habitat out west. The preference for aged box hardwood continues, despite the alternatives in a region with many pine plantations.

Many people who burn firewood (in the ACT and environs) are still convinced that they have to burn Australian hardwoods. Many slow-combustion stove retailers still set the standard at box and ironbark species.

Wood merchants have been importing 35,000–40,000 tonnes of firewood annually from the box and ironbark woodlands of central-western NSW around Forbes, Parkes and Condobolin, 500 km from Canberra — much of it the habitat of the vulnerable Superb Parrot.

Some firewood retailers also sell seasoned pine. The trick to burning pine, and hardwood too, is to make sure it's properly seasoned and burn it with sufficient air. Green wood, regardless of species, and closing down your fire too quickly are the main causes of deposits in chimneys and air pollution. You do have to keep pine under cover or it will lose its 'seasoning', i.e. soak up water again.

Weight for weight, pine provides as much heat as eucalypt, it dries faster and is easier to handle.

Some of us in the rural residential zone have experimented with burning both pine and hardwoods that grow locally. Acacia wood burns well and is great for kindling and fire starters. Why not consider a little firewood plantation on your rural block?

Through personal experience over 10 years we have found Red Stringybark, Scribbly Gum and Brittle Gum (Red Spotted Gum) relatively quick to cure, easy to split and terrific to burn. Seasoned pine is easiest of all to split, great for getting fires up and running and you can always mix pine and hardwood for a longer-lasting fire.

The ACT Government Firewood Industry Code of Practice

Merchants who sign up to the code agree to apply some of the following guidelines.

- Source their wood from cutters and landowners who can show they have collected the wood legally
- Give preference to firewood that has been collected through ecologically sustainable practices
- Provide customers with information about species and source of the firewood they buy
- To reduce smoke, educate consumers about correct firewood storage and burning practices
- To reduce smoke, discourage burning of unseasoned wood
- Preferably sell wood by weight
- Encourage greater demand for plantation and sustainably-managed native forest and waste wood

CONTACTS

Phone Canberra Connect 13 22 81

PARROTS IN THE PINK

(but small birds still struggling)

Ron Hartwig of Trungley Hall in southern NSW is doing his bit to reverse the trend of habitat loss and encourage native parrots to breed on his farm by providing nesting boxes. The reason, Mr Hartwig says, is the low numbers of old trees with hollows left in the area.

His nesting boxes are simply a section of hollow limb from trees that have blown down on the farm, wired up to a fence strainer post. Modifications include an observation hatch to determine if it is occupied, with a similar hatch at the bottom of the hollow to remove debris following the nesting season, or to remove unwanted visitors such as sparrows or starlings.

The entrance hole is designed to be big enough for the parrots to enter, but too small for a goanna or crow to get in. Other additions are a perch at the entrance to assist take-off and shrubs planted near the nesting box as protection from hawks and falcons.

The dozens of boxes Mr Hartwig has produced are occupied by Red-Rumped Parrots and Eastern Rosellas.

Nesting situation worse for smaller birds

Often an even bigger problem than parrot nest sites is the lack of understorey providing harbours and food sources for smaller birds and bats, according to the Department of Land and Water Conservation's Chris Slinger of Wagga Wagga.

"These smaller species, such as bats, wrens, pardalotes, warblers, flycatchers and robins, are insectivorous and provide an essential cleaning service, effectively 'vacuuming' insects off the surface of trees and shrubs, particularly eucalypts.

"Where there is a lack of suitable understorey, it would be worth thinking about planting these species and/or providing nesting boxes for these smaller but important species."

Source: *VegNotes* — NSW Department of Land and Water Conservation Rural Production and Native Vegetation Conservation, Notes for Landholders.

you may not see it, but development has an incremental impact on wildlife



Some threatened fauna

Many of the threatened species (this includes endangered and vulnerable species) found in the Upper Murrumbidgee Catchment are small and hard-to-see ground-dwellers or birds and bats associated with grasslands or grassy woodlands. These plant communities have been the most altered or eradicated by grazing and development.

Threats to fauna include loss of habitat, predation by feral animals, loss or disturbance of nesting sites, illegal trapping and accidental poisoning.

See appendices for a detailed list

Wildlife-friendly fences

With fences being encouraged for stock control and to protect vegetation and sensitive areas, what can the landholder do to make fences more wildlife-friendly?

Here are some rules of thumb that benefit wildlife and stock.

- If possible, use (white) horse-sighter wire on the top strand and white caps on steel posts, or treated pine posts.
- Leave 30 cm between the top wire and the next one down. This is important to avoid kangaroos catching and trapping their legs between the two top wires.
- Don't use barbed wire. If existing fences have barbed wire, consider taking that wire out, particularly on the top strand.
- Keep fences at a moderate height — 4 ft (1.2 m).
- Keep the bottom wire at least 6 inches (15 cm) off the ground — that allows passage for wombats, echidnas and the determined roo.
- Moderate-height ringlock may be OK if kept at least 15–20 cm off the ground. Better are six-wire fence or horse-sighter wire fence design.
- Permanent electric fencing can form a significant barrier to wildlife movement. Echidnas can be electrocuted against low-level live wires.

Wetlands or dams fenced too close to the water can prevent some species of bird from landing and taking off.

If in doubt, discuss wildlife concerns with a fencing contractor or manufacturer and wildlife specialists such as the NSW National Parks and Wildlife Service. The Murray Catchment Management Authority has an excellent brochure on this subject. It can be found at:

http://www.murray.cma.nsw.gov.au/includes/documents/pdf/Wildlife_friendly_fencing.pdf

See also www.wildlifefriendlyfencing.com



WILDLIFE FRIENDLY FENCING

How you can help

Landholders and other community members can assist in the recovery of threatened species in a number of ways, including:

- reporting sightings — including historical observations
- assisting in survey work or regeneration works, and
- widening community awareness.

Pest animals

Pest animals and insects can cause major financial losses on a small block or property. They can also introduce disease and threaten native plant and animal species.

It is the responsibility of the landowner to manage and if necessary eradicate pest animal species such as wild dogs, rabbits, feral pigs, feral cats, foxes.

Domestic cats and dogs can also play a significant role in threatening native plant and animal species and their habitats as well attacking livestock and being a noise nuisance for neighbours in the case of dogs. Keeping your pets under control and within your property boundaries is essential as well as the law.

Taking care of our wildlife includes having domestic pets under control and not allowing cats and dogs to roam on their own. Cats can kill off a huge amount of wildlife and do most of their damage at night, so owners need to keep them inside overnight. Uncontrolled dogs can chase animals causing immense stress, injury and death to wildlife and also to stock animals. If you like living harmoniously 'in the bush' take charge of your pets.

The Molonglo Catchment Group have a Pest Animal pack available at www.molonglocatchment.com.au



CONTACTS



Livestock Health and Pest Authorities (LHPA)

Head Office 161 Kite St Orange NSW 2800
Phone 02 6391 3242



Braidwood Court House Building 170 Wallace St
Braidwood Phone 02 4842 2536



Yass 13 Mitchell St Yass Phone 02 6226 1155
Cooma 5 Dawson St Cooma Phone 02 6452 1122
www.lhpa.org.au

Territory and Municipal Services

For information about fish, plants and animals in the ACT, contact Canberra Connect 13 22 81
www.act.gov.au

National Parks and Wildlife Service

For information about native threatened or protected species in your area, habitat, remnant vegetation, and to enquire about licences to take or kill native species, contact the NSW National Parks and Wildlife Service office closest to you.

Queanbeyan Phone 02 6229 7000

www.environment.nsw.gov.au

WILDCARE Queanbeyan Inc.

NSW animals only (sick or injured, orphaned or urgent, 24 hrs) Phone 02 6299 1966
PO Box 1404 Queanbeyan NSW 2620
communications@wildcare.com.au

RSPCA ACT

ACT animals only Phone 1300 477 722

Wildlife Phone 0413 495 031
12 Kirkpatrick St Weston
PO Box 3082 Weston Creek ACT 2611

ACT Snakes and Kangaroos and Domestic Animal Services

Phone Canberra Connect 13 22 81

REFERENCES



NSW National Parks and Wildlife Service (1999) *Threatened Species of SE NSW: Riverina Highlands*. National Parks and Wildlife Service Species Recovery Plans.

Eddy, D., Mallinson, D., Rehwinkel, R. and Sharp, S. (1998) *Grassland Flora: A Field Guide for the Southern Tablelands (NSW & ACT)*.

Harris, Greg (1990) *Water Supply and Farm Dam Construction* (3rd edition), Soil Conservation Service of NSW.

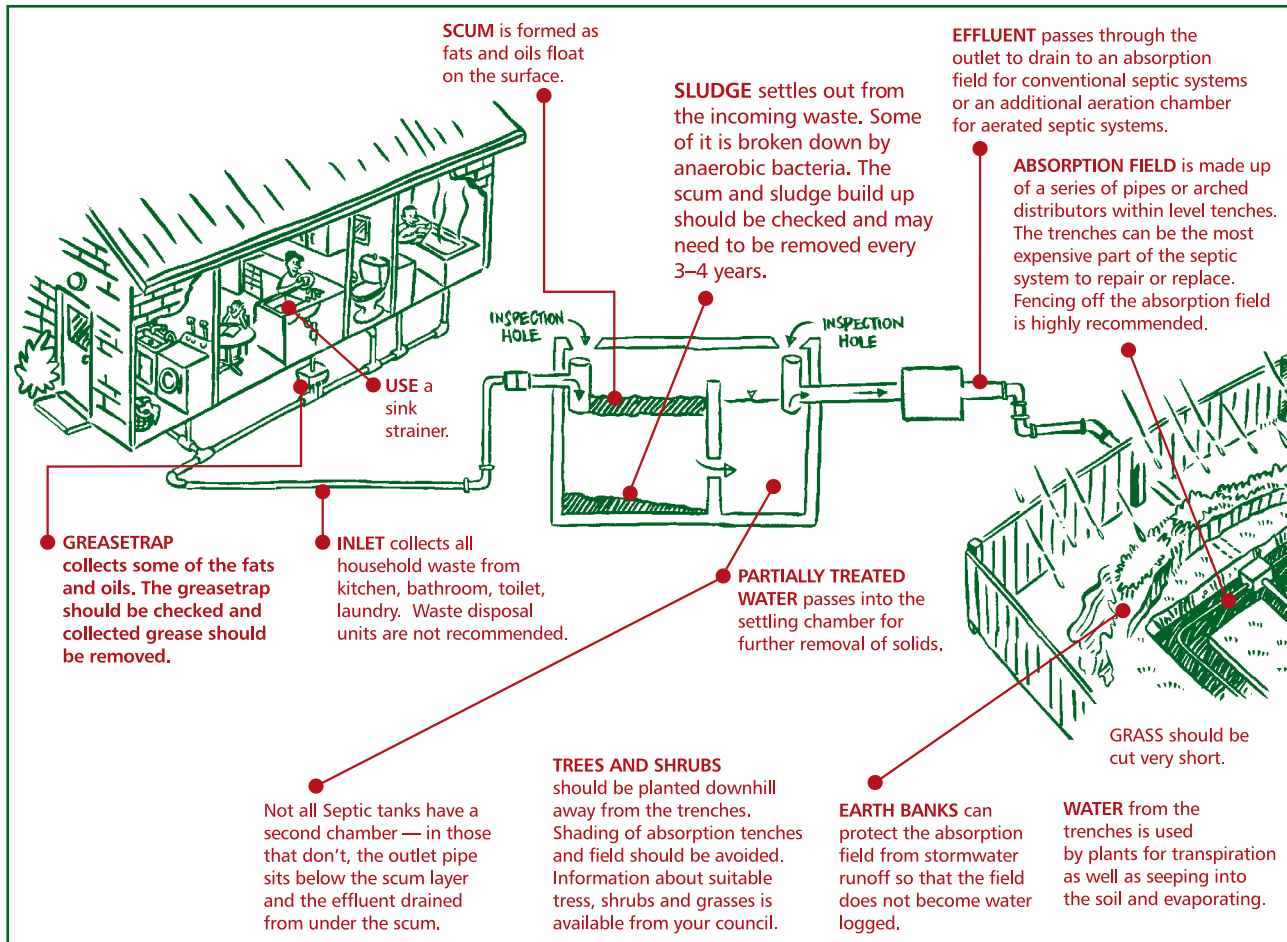
Lindenmayer, David. 2003, *Wildlife on farms: how to conserve native animals / David Lindenmayer ... [et al.]* CSIRO Publishing, Collingwood, Vic.

NOTES:

MANAGING YOUR PROPERTY

DOMESTIC ISSUES AND RESPONSIBILITIES

This chapter outlines some of the issues you may face as a rural landowner and where to seek advice.



Why everyone's septic system matters

Contaminated water is a major concern. Waterways in the UMC feed into rivers such as the Yass, Queanbeyan, Numeralla, Cotter, Gudgenby, Naas, Goodradigbee and Molonglo which ultimately are the main sources of drinking water for our communities. All these rivers eventually run into the Murrumbidgee River which is part of the wider Murray Darling Basin.

Concerns across NSW that many septic systems do not meet environmental and public health requirements have led to State legislation requiring that all 'sewerage management systems' be registered with and approved by local councils. This is known as the 'septic-safe' legislation.

Inadequately treated waste can reach both ground and surface waters if a septic system fails, or is improperly maintained. Disease caused by water borne bacteria and viruses from human waste include dysentery and hepatitis.

Too many nutrients entering dams, creeks and rivers may also lead to algal blooms. Blue green algae (cyanobacteria) can

become a serious health hazard to humans, livestock and other animals. Some toxins released by blue-green algae may cause skin, eye and respiratory irritation and others can be more serious, causing liver and nerve damage and potentially death.

Pathogens (for example Giardia and Cryptosporidium) pose the greatest potential risk to human health from contaminated drinking water.

Rules for septic systems

- All septic tank systems (including standard septic systems, aerated systems and composting toilets) must be registered with local councils.
- Councils are prepared to advise and work with owners to solve problems.
- Remedies might include reducing water demand, diverting stormwater around septic absorption fields and minor filling works to cover ponding. Residents should be aware

that absorption trenches last 5–10 years, depending on maintenance and level of use. Wetland plant species can help filter and absorb runoff.

- Owners may be encouraged to seek longer-term solutions. Councils acknowledge that there are costs involved with upgrading septic systems. The New South Wales Government says it is up to local councils to strive for a balance between costs and health and environmental protection.
- New systems require approval to ensure they are adequate and sited properly. They must be accompanied by a site assessment and soil report. Councils can recommend consultants to do these reports.

For further information and pamphlets about different septic systems, contact your local council.

Absorption trenches last 5–10 years

Better septic performance

- Maintain your system
- Keep stock and machinery off the absorption trench; mow regularly — this increases the water uptake by the grass
- Reduce your water usage
- Use phosphorus-free detergents
- Divert storm water and seepage from disposal areas
- Find out how much sodium salt is in your washing detergent, and switch to a lower-sodium-salt brand

The sodium factor

Sodium can be a major factor in the failure of septic systems because sodium salts reduce the infiltration capacity of soils. Fillers used in most laundry powders can be a major contributor.

Since sodium salts are not affected by septic tank or municipal waste treatment systems, large amounts of salts are going into our rivers and streams.

Rule of thumb: Powders contain a lot more sodium than liquid detergents.

Some water usage facts

- The average family living on tank water uses about 150 litres of water per person per day
- Showers use 10–30 litres per minute — 200 litres in 10 minutes
- Baths use an average of 120 litres
- Toilets can use up to 11 litres per flush — modern dual-flush cisterns use a 3/6 flush (3 litres for half flush, 6 litres for full flush)
- Washing machines use around 100 litres per load
- Dripping taps can use 5 litres per hour
- Dishwashers use up to 50 litres per cycle

Always choose appliances with AAA water ratings.

Plantings for permanently boggy soil e.g. near septic absorption trenches

Some larger, hardy native species for the Southern Tablelands are useful in taking up water from waterlogged soil surrounding septic tanks. They should not be planted right alongside the absorption trench, but can be used anywhere within 20 m distance up to within 3 m of the trench.

Landowners can create a very attractive feature which will provide a harbour for wildlife, turning a potential environmental problem (runoff) into an environmental asset.

Here's another reason to steer clear of detergents containing phosphates (besides too many nutrients in local waterways): they can make establishment of some species more difficult.



For a list of plants suitable for planting in wet areas see Appendices

A mountain of waste

Recycle at home? – “Reduce, reuse and recycle”

Solid waste management constitutes a major challenge for every local jurisdiction including issues about landfill, rural rubbish dumps and chemicals — which are causing serious problems in the Upper Murrumbidgee Catchment. Of particular concern is groundwater contamination and other potential long-term impacts.

While commercial packaging hasn't abated at all, recycling is often at the mercy of market forces. For example, because of market conditions, some local governments no longer recycle paper or cardboard. Glass and plastic bottles are generally accepted. Check recycling opportunities with your local council.

Plastic bags (first remove checkout slips/paper and other foreign material) can be recycled at local supermarkets.

The best advice is to recycle as much as you can on your own property, e.g. compost kitchen waste and lawn clippings; mulch garden/tree clippings; consider paper and cardboard 'bricks' for the fire.

Gully or land filling

Filling is a historic means of disposing of rubbish and restoring erosion gullies. However, some people have used toxic and other inappropriate materials to fill gullies, causing pollution. Poorly stabilised fill material has also been washed out of gullies, causing considerable water turbidity and downstream sedimentation. For this reason, *gully filling is usually subject to a council development application*. As a rule gullies should be filled only with clean excavated natural materials (soil and rock). This is regarded as inert waste. Inert waste does not however mean concrete, bricks or timber. NEVER use any form of used chemical container.

Disposing of chemicals

The correct disposal and storage of chemicals predominantly for pest and weed control are of major concern with increased use of chemicals throughout the UMC.

NSW landholders can undertake courses in the appropriate use, disposal and storage of chemicals. These may be organised by Landcare groups and local councils — check in your area.

ACT No Waste and NSW local councils facilitate the 'Drum Muster' program for the disposal of agricultural chemicals.

Improper use or disposal of chemicals can cause contamination of land and water, risks to animal and human health, and threats to biodiversity.

Fire management

Protection of life and property is the overriding priority in fire management, particularly as urban areas expand and rural residential developments bring more people into fire-prone areas. Some developments that take advantage of the scenic values of steep wooded land are in high-risk areas. See www.rfs.nsw.gov.au and www.esa.act.gov.au for advice. The Department of Primary Industries also has detailed information on bush fire preparedness at www.dpi.nsw.gov.au

So how do you manage your block in both an environmentally friendly and bushfire-safe fashion? Keeping property safe from fires is, however, the responsibility of every landholder. Seriously consider joining the local bushfire brigade. Obtain a Bushfire Survival Plan from the NSW Rural Fire Service or the ACT Emergency Authority.

Here are some pointers:

- All new subdivisions in NSW require a Fire Management Plan.
- Talk to the Rural Fire Service (through your local bushfire brigade) *before* you build a house.
- Create a fuel-free zone around any buildings — this doesn't require ripping down trees in a half-kilometre radius; contact your local bushfire brigade for advice.

The ESA, RFS and DPI website provides much information for undertaking fire protection measures around you home and property.

Absentee landlords

Many rural properties do not have permanent residents. These properties can be left vacant for much of the year and raise potential management problems including:

- Weeds and pest animal control
- Erosion control
- Boundary fence maintenance
- Failure of effluent systems
- Bushfire fuel build up
- Straying stock or stock in poor health.

These problems can affect neighbouring properties as well as causing environmental damage. Council may also enter these properties and place notices or fines.

If you plan to be an absentee landlord consider some of the following options:

- Visit your property on a regular time frame
- Employ farm contractors or employ a farm manager
- Talk to your neighbours regularly.

(from the *Rural Living Handbook 2007–2009 – a guide of rural residential landholders*. Goulburn Mulwaree Council Dec 2006)



CONTACTS



NSW — Phone your local council



ACT — Phone Canberra Connect 13 22 81

**IN EVENT OF FIRE OR
EMERGENCY RING 000
(24 HOURS)**

NSW Rural Fire Service

www.rfs.nsw.gov.au
Phone 1800NSWRFS 1800679737

Yass Southern Tablelands Zone

14/10 Laidlaw St Yass Phone 02 6226 3100

Queanbeyan Lake George Zone & Head Office

10 Ellerton Drive Queanbeyan
Phone 02 6297 1840

Cooma Monaro Team

11 Geebung St Cooma Phone 02 6455 0455

ACT Emergency Services Authority

www.esa.act.gov.au
123-125 Carruthers St Curtin ACT 2605
Phone 02 6207 8444

ACT Fire Brigade 02 6207 8363

ACT Rural Fire Service 02 6207 8609

REFERENCES



Available from Shire Councils:

Managing Waste Water in Your Backyard
Your Aerated Waste Water Treatment System
Your Waterless Composting Toilet
Your Septic System (contains excellent hints on how to keep your system working better)
Your Land Application Area
You can also consult *The Environment and Health Protection Guidelines: On-site sewage management for single households* at the local government website (www.dlg.nsw.gov.au).

VEGETATION

Native Vegetation Conservation Act

Anyone proposing to clear land must consider the *Native Vegetation Conservation Act* (NSW) as well as any local Tree Preservation Orders.

The *Native Vegetation Conservation Act* was developed, among other reasons, to slow and reverse the unsustainable level of native vegetation clearance still going on in New South Wales in the early 1990s.

The Act provides a framework for government and community to work together to achieve sustainable native vegetation management through:

- regional vegetation management plans (RVMPs) developed by community-based regional vegetation committees
- property agreements with individuals and groups of landholders.

Clearing native vegetation

In areas without a regional vegetation management plan (RVMP), those who seek to remove more than a few trees for a house site or other council-approved development should consult the NSW Department Environment Climate Change and Water for clearing restrictions, exemptions and development consent.

Compliance

The NSW Department Environment Climate Change and Water can impose stop-work notices to halt clearing, or remedial notices directing that restoration work be carried out. Offences under the Act, including unauthorised clearing and failing to comply with a notice, are pursued in the Land and Environment Court.

Threatened Species Conservation Act

Under the Threatened Species Conservation Act (NSW), landholders considering any clearing (or other actions that require local council approval, such as subdivisions) must also consider whether this may affect animal threatened species. See appendix for a list of threatened species in the UMC.

Incentives

A number of incentives are available to help landholders maintain native bush. These programs include funding for:

- fencing
- site preparation
- site management, including weed and feral animal control
- tree and understorey planting and regeneration.

The incentive schemes are many and varied and, because the specifics of the schemes change regularly.

See Useful Contacts for details.

Some threatened plants

Historically, habitat clearance, intensive grazing and modified pastures have resulted in the decline of many plant species that are now listed as threatened. A sample list of some threatened plants in the Upper Murrumbidgee Catchment can be found in the appendices.

Several plant communities are listed as endangered ecological communities under various Commonwealth, State or Territory Acts. These include:

- **natural temperate grasslands** of the Southern Tablelands of NSW and the ACT (Commonwealth and ACT legislation) — a diverse vegetation community where native grasses dominate, which contains a diversity of other non-grass species (forbs or wildflowers including native peas, orchids, lilies, daisies and many others) and, sometimes, scattered trees or shrubs
- **box/gum woodlands** (White Box, Yellow Box, Blakely's Red Gum Woodland — NSW legislation; Yellow Box / Red Gum Grassy Woodland — ACT legislation) — a vegetation community found in low-lying situations or slopes, characterised by particular tree species and often with a grassy ground layer, that, like native grasslands, also have a diversity of forbs.

Remnant native vegetation

Remnant vegetation is the remaining indigenous vegetation, including forests, woodlands and native grasslands, in an otherwise cleared landscape. The value of remnants is increasingly recognised, and many landholders are protecting and linking them so they become self-sufficient.

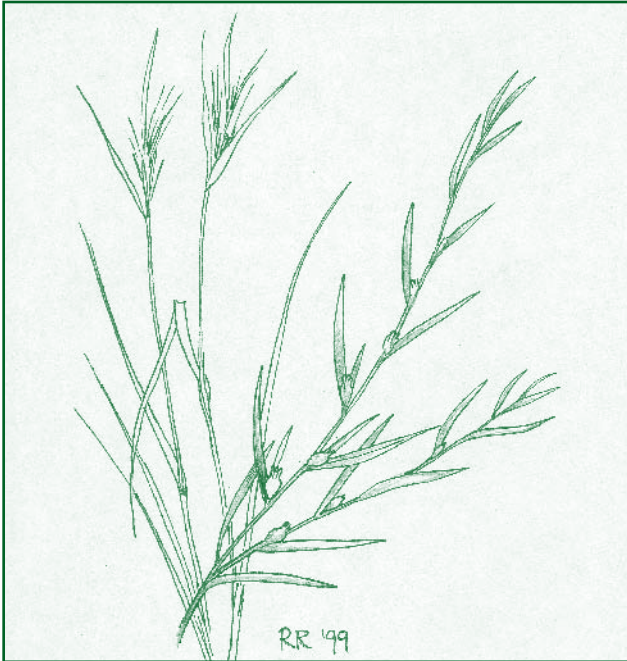
Why keep and maintain native bush?

If you are lucky enough to have native trees and understorey on your rural residential block, you have a number of advantages: shade and shelter for stock, soil stability, windbreaks, homes for native wildlife. Native trees, shrubs and grasses are deep-rooted perennials that keep saline groundwater well below the surface, provide a source of seed for revegetation projects and offer a landscape that is pleasing to many people.

From a community perspective, there are other considerations for conserving what we have. Many blocks are on former sheep pastures where the native woody vegetation was removed. Small remnant forest or woodlands, isolated paddock trees and native grasslands are often retained in these landscapes. There might be nearby bush remnants on public land like the road verges and public-access greenways.

Urban expansion in the Canberra/Queanbeyan area is resulting in a localised loss of native vegetation. Firewood collection in the region further reduces habitat for birds and ground species. Grazing animals can degrade native grasslands and bushland. All this means that anything that helps restore and link remnant patches of native vegetation on private and public lands enhances their value as wildlife corridors and as biological reservoirs. That means preserving the understorey too.

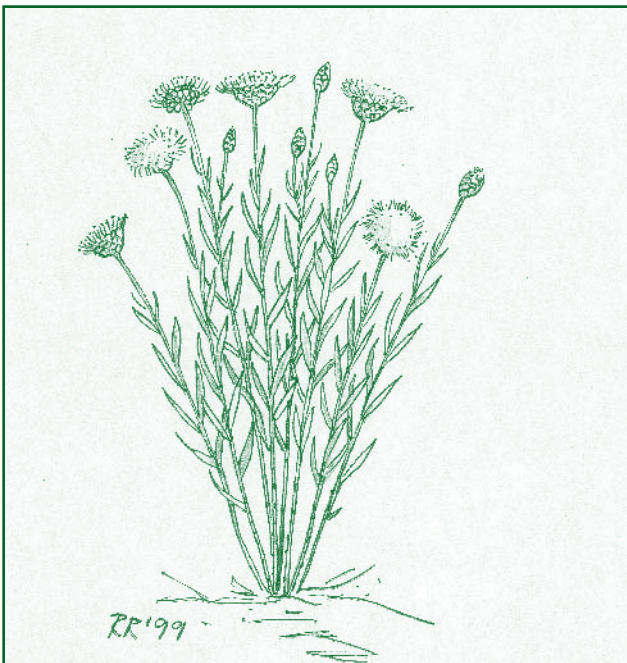
*Some threatened understorey plants
in the Upper Murrumbidgee Catchment*



Austral Toad-flax (*Thesium australe*) Biennial forb to 30 cm long. **(Vulnerable)** Found in grassland or grassy woodland, grows among tussocks often in damp sites, flowers from November to January. Parasitic on Kangaroo Grass.



Tarengo Leek Orchid (*Prasophyllum petilum*) Orchid with fragrant pinkish-mauve to greenish flowers to 30 cm tall. **(Endangered)** Woodland or grassland in fertile soil.



Button Wrinklewort (*Rutidosis leptorhynchoides*) Perennial herb with yellow button-like head 8–15 mm wide. **(Endangered)** Found in grassland or open grassy woodlands.



Small Purple Pea (*Swainsona recta*) Perennial herb 30 cm high, purple pea-like flowers. **(Endangered)** Found in grassy understorey of woodlands and open forests. One of the largest known populations is in Yarrawlumla Shire.

Pale Pomaderris (*Pomaderris pallida*) Compact rounded shrub 1–1.5 m high, pale green-white leaves covered in soft star-shaped hairs; small pale-yellow flowers. **(Vulnerable)**

How good is that patch of bush?

Rule of thumb: Larger patches of vegetation are more viable — 5 hectare minimum is a useful yardstick for a block. Avoid fragmenting existing areas of native vegetation, including remnant grasslands. If new fence lines, access tracks or services are being constructed, consider placing them around an area of native vegetation, not through it.

How healthy is your native vegetation?

Signs of degraded native vegetation:

- eucalypts of young age class with no shrub understorey
- mainly grassy understorey with perennial spring/summer growing native grasses replaced by annual grasses such as barley grass; weeds
- less than a dozen species of native plants
- less than a dozen bird species, usually dominated by large aggressive species such as Noisy Miner, Crimson Rosella, Mudlark and Cockatoos
- about five species of mammals (kangaroos, Brushtail and Ringtail Possums and bats)
- one or two reptile species, such as Brown Snake, and
- abundant insects (few species).

Degraded vegetation will degrade even further, ultimately dying.

It is easier and cheaper to look after these areas now than repair land degradation problems and plant trees later on.

Signs of healthy native vegetation:

- eucalypts of various ages
- a shrub layer
- mostly grassy ground layer, with a range of native grasses, native legumes and other native herbs; largely free of weeds and introduced grasses
- abundant fallen timber
- 60–100 species of native plants
- 30–40 species of native birds (mostly insectivores) including thornbills (2–5 species), robins (1–5), whistlers (1–2), pardalotes (2), honeyeaters (2–10), treecreepers (1–2), and a number of others such as owls, flycatchers, kingfishers, doves and birds of prey
- more than a dozen mammals, including echidna, gliders (1–5 species), bats (2–8), marsupial mice (1–3), and kangaroos, possums and wallabies
- up to 10 species of reptiles, including geckos, legless lizards, goannas, snakes and pythons, and lizards, and a diverse range of insects.

Native grassland: the most important factors are that they are free from weeds and introduced grasses and the ground cover is composed of native species.

What are the benefits of remnant bushland?

Remnants can protect an area from rising watertables and salinity (related to wide-scale clearing) *and* provide a home for threatened species *and* contain a vegetation community that is now extensively cleared *and* be part of a corridor connecting two larger areas of native vegetation. Such areas are highly significant.

Protecting remnants is also the cheapest and easiest way to help improve land degradation and enhance the environment. The easiest way to protect remnants is to keep stock away and maintain the environment in its natural condition.

Who cares about understorey?

Most people are aware there's a big problem with tree decline in rural Australia. We're often less aware that the decline in understorey species has been even more severe.

Wattles are often the only understorey species we see.

In nature, the understorey can be very diverse — perhaps 30 understorey species to three or four tree species on a hectare of natural woodland.

What can understorey plants do for you?

- Shade and shelter — you can use understorey species in planted shelter-belts, along fence lines and along creek lines. Most of them grow rapidly, providing stock with shade and shelter faster than trees. The understorey also shelters young tree seedlings.
- Improve soil fertility — wattles, native peas, casuarinas and some other understorey species fix nitrogen in the soil; understorey species, related micro-organisms and insects such as ants are important in nutrient cycling — getting organic matter back into our poor soils.
- Provide food and shelter for natural pest controllers — many insect-eating birds find shelter and food — such as flower nectar — in understorey species.
- Offer fast erosion control along steep slopes, creeks and drainage lines.
- Help build native vegetation corridors throughout the rural residential landscape for healthy native plant and animal populations.
- Increase the density of insectivorous animals such as bats, flycatchers, wrens, warblers.
- Offer windbreaks to reduce weed seed spread.
- Shade out weed species.



What can you do?

- Conserve existing understorey in areas not dedicated to production and encourage natural regeneration by temporary or permanent fencing. Conserving is always easier than replanting. Some species are hard to establish or will not grow on disturbed sites.

OR

- Plant or direct-seed a mixture of understorey species, preferably species adapted to the area. This is particularly good advice when sowing in a paddock or along a waterway where exotics can spread and crowd out natives.

See list of understorey species suitable to this region in the appendices.

Strategies for bringing back native vegetation

Natural regeneration

Fence off existing vegetation to exclude stock. Stock prevent regeneration by eating young seedlings. Single trees in paddocks with stock camped underneath tend to produce richer foliage. This makes them more attractive to leaf-eating insects that defoliate the trees.

Fencing is necessary to exclude or better manage stock in sensitive vegetation areas. Fencing is generally the greatest cost in managing or establishing vegetation. Costs vary depending on the type of materials used and the type of animal you wish to exclude. Local retailers and fencing contractors can give you an idea of the costs of materials and/or labour per km.

Fence to encourage natural regeneration. Suitable areas could be around clumps of native trees in paddocks, corners of paddocks, rocky or steep areas, ridge lines, erosion-prone areas and creek banks. Natural revegetation may take a while but is inexpensive, hardy and has a more natural appearance than tree-planting projects.

Restrict fertiliser use. Native species are not adapted to a nutrient-rich environment. The 'dieback' of mature farm trees has been linked to a well-fertilised paddock environment, and associated with other symptoms of an unbalanced ecosystem such as increased insect attack. Applying excessive fertilisers can also result in high nutrient runoff into waterways and an increased risk of aquatic weeds, algae and eutrophication.

Encourage many species of trees and understorey plants.

Accept that there will be some damage done by leaf-eating insects. Resist the urge to spray.

Light grazing in established areas of native vegetation may promote greater variety in the understorey.

Be patient. It will take years for disturbed sites to recover their balance.

What happens with Eucalypt dieback?

You lose natural pest control

Natural deaths of ageing trees

It is often difficult to separate the symptoms of natural ageing from those of dieback. These trees usually have thinner, more irregular crowns, many dead branches and hollows.

Dieback results from a lack of understanding of the insect ecology surrounding paddock trees.

Pasture improvement can lead to dieback

Eucalypt foliage with enhanced nutritional value (particularly available nitrogen) can promote greater numbers and survival of leaf-eating insects. More nutritious foliage can result from: increased soil fertility beneath trees due to pasture improvements and livestock manure; trees being under stress; and trees having a greater proportion of younger leaves (e.g. epicormic shoots).

The understorey promotes natural pest control

Understorey trees and shrubs play a vital role in tree health, and the fact that they have disappeared from many rural landscapes directly affects dieback. Research has shown that densities of insect-eating birds in areas affected by dieback are about 10% of those in a healthy woodland. Wasps and flies that parasitise scarab larvae rely for food on flowering understorey plants, such as Blackthorn (*Bursaria spinosa*) and Tea-tree (*Leptospermum* spp.).

How to take care of dieback

Don't panic — retain dieback-affected trees, which may still recover. Even dead trees are valuable for wildlife, especially old ones with hollows.

Save dieback-affected trees with methods such as pollarding (cutting off the major branches and allowing the tree to re-sprout) or, depending on the cause of dieback, injecting systemic insecticide.

Retain any and all juvenile eucalypts — this will mean never ploughing, applying herbicide or sowing exotic pasture around existing trees or in other areas where juvenile trees are common. Keep the area as native pasture.

Control livestock.

Retain and protect bushland across the landscape, link remnants — encourage areas larger than 20 hectares as habitat for a range of bird species. These will help control insects and maintain ecosystem function.

The importance of ground cover in preventing dieback

It might not seem important, but in all cases the quality of the ground layer is a critical factor in:

- determining the health of isolated trees, and
- their ability to regenerate.

If the ground cover is dominated by native species, then older trees will more easily recover and regenerate. If the ground cover is weedy, or dominated by introduced grasses, recovery and regeneration will be difficult to promote.

Be aware of the dynamics in the paddock — competition for soil moisture

Weeds and vigorous introduced grasses like Phalaris intercept a lot of soil moisture before it can be taken up by trees. The introduced grasses develop a dense sward, which suppresses tree regeneration.

*conserving is always easier
than replanting*

Do you want to save a large old tree or two and encourage new growth?

Temporary fencing is one of the best solutions for managing isolated trees to 'give them a break' and to encourage growth and regeneration. The fenced areas should be twice the size of the tree canopy. After two or three years, young seedlings may have grown above browse height. The fence can then be moved to another remnant tree area.

Tree Preservation Orders

Some areas will have Tree Preservation Orders in place. This Order prohibits the ringbarking, cutting down, topping, lopping, removing, injuring or wilful destruction of trees with a height greater than 3 metres and a branch spread at any height exceeding 3 metres, without the consent of council.

A Tree Preservation Order permits prosecution of people who contravene, or cause or permit to be contravened, the Tree Preservation Order.

See also *Native Vegetation Conservation Act (NSW)*

The pros and cons of pines

What is the argument for using native species in the rural residential landscape as screens, shelter-belts, woodlots and erosion control compared to pines?

But is it really just a matter of consumer preference? Apart from agroforestry and commercial wood production issues, what are the advantages and disadvantages of growing pines compared with fast-growing natives?

Advantages:

- fast-growing (and cheap)
- useful for timber
- drought-tolerant (dependent on pine species)
- hardy; no serious pests or diseases
- food source for some bird species whose native habitat has been eliminated, e.g. Black Cockatoos
- when planted next to native bush or grassland, can provide shelter for birds and mammals who continue to feed in the native vegetation
- positive aesthetics for some tastes.

Disadvantages:

- weed potential; the invasion of pine wildings into native bushland and their ability to overwhelm remnant native vegetation on road verges are well documented
- inferior habitat for native species
- do nothing to help repair fragmentation of native bushland (fragmentation is severe in most built-up parts of the UMC)
- don't recover from a fire; native tree species usually recover
- can blanket out considerable areas to grass or understorey species through needle drop and shading
- can shelter invasive, exotic weeds
- negative aesthetics for some.
- Fragmentation — reducing remaining bushland to bits and pieces without linking corridors — makes many native plant and animal species increasingly vulnerable to pest, disease and adverse climate conditions.

Mistletoe — friend or foe?

Mistletoe is a symptom of declining eucalypt health, rather than the cause of a tree to decline. It may be more prevalent in isolated paddock trees.

Mistletoe is a parasite

Mistletoes are partial parasites which obtain mineral nutrients and water from the host plant. Many parasites have co-evolved with the Australian flora and fauna and mimic their host plants. You'll find them attached to a wide range of species including eucalypt, acacia, casuarina, banksia and introduced trees.

Parasites and pathogens are likely to take advantage when plants are stressed by other factors such as changed soil nutrient status, soil compaction, salinity, fertiliser use, and insect or fungal attack. Research has concluded that mistletoe may kill plants outright, but they more often die from a combination of stresses.

On the other hand...

Mistletoe is also a vital part of the food chain in our ecosystems. All parts of this parasite are eaten by native wildlife.

Flowers and nectar from the mistletoe offer a reliable food source for many species of birds and its berries are the main food of the Mistletoe Bird and some honeyeaters.

Parrots such as rosellas act as natural control agents of mistletoe because they eat copious amounts of berries but, unlike the Mistletoe Bird, they do not pass the embryonic seed in the berries in their droppings.

Leafy mistletoes are favoured food plants of various marsupial species such as the Brushtail and Ringtail Possums. Butterflies also rely on mistletoe for food.

Control

Pruning is the only reliable short-term control measure where mistletoe appears to be getting out of hand.

In the long term, eradication is not desirable because of its importance to native fauna.

Source: Excerpted from *Greennote 18*, produced by Greening Australia



Roadside vegetation management

Native vegetation along roadsides, railways and stock routes provides important wildlife corridors and habitats. In some areas road reserves contain the only (or best) examples of local remnant vegetation. Property fences have saved them from grazing and clearing.

In the Upper Murrumbidgee Catchment, surveys of remnant road reserves have categorised areas as having high, medium or low significance. Detailed maps are now in the hands of the ACT and regional local governments.

Some governments have taken action and others will hopefully do the same. For example, the ACT Government has prepared a Roadside Management Strategy, and Cooma–

Monaro Shire Council's Roads Strategic Business Plan includes strategies for sustainable roadside management.

Mowing the sides of roads also makes them more attractive to Kangaroos who like short green pick. Whilst the mowing may make them easier to see it also encourages them to the roadside where the vegetation is low, green and palatable.

Be aware of any council Tree Preservation Orders and the *Native Vegetation Conservation Act on roadsides*.

- Limit clearing to 0.5 m on either side of the track.
- Clear by felling rather than dozing to limit disturbance of topsoil.

Designated parts of catchments cannot be cleared — these include:

- slopes generally greater than 18 degrees
- land within 20 m of a river, stream, lake, lagoon or swamp
- any land that is environmentally sensitive or liable to soil erosion, siltation or land degradation.

THE RIGHT TREE IN THE RIGHT PLACE

by Geoff Butler

The European settlement of Australia has wrought many and sometimes irreversible changes to the Australian landscape. As a result of our requirement for food and fibre and to support our current living standards, immense tracts of native vegetation communities have been destroyed or greatly modified in the course of urban, industrial and agricultural development. This was done with little regard for what we now understand as sustainability, either for human endeavours or for other species and ecosystems. To achieve long-term sustainability in Australia, there will have to be some significant attitudinal changes within the community. One change which could be achieved with minimal fuss, cost or inconvenience is planting the right tree in the right place. Exotic trees are unfortunately being widely planted in rural residential subdivisions and farms, with little thought to the long-term repercussions of their use. Some of these repercussions are:

Weed invasions

Some exotic species currently being widely used are Monterey Pine (*Pinus radiata*), White Poplar or Cottonwood (*Populus alba*), Lombardy Poplar (*Populus nigra* 'Italica'), various willows (*Salix* spp.), Rowan (*Sorbus aucuparia*), various Brooms and Tree Lucerne (*Genista*, *Cytisus* and *Chamaecytisus* spp.) and Privets (*Ligustrum* spp.) amongst others.

These species are proving highly invasive of natural vegetation communities and neighbouring property, including public lands. It is strongly recommended that any invasive species, such as those mentioned, not be used in rural areas. (The pros and cons and economics of pine plantations would involve separate discussion.)

Landscape changes

A major finding of international visitor surveys is that visitors come for our wide open spaces, rural vistas and our different plants and animals. Our landscapes, flora and fauna and natural heritage generally earn us immense amounts of overseas income.

As a community we need to recognise the value of landscape as an asset, and repair and enhance it where we can. The establishment of exotic trees throughout rural Australia is greatly compromising this asset.

This is not to suggest that all exotic trees have no use or should not be planted; it comes down to a matter

of placement. Some rural residents find the dryness and rough nature of the local natural landscapes too harsh, and embark on softening programs, and extend this over their whole properties. The results promise to be environmentally damaging in the longer term with invasive species spreading across the landscape. Surely the benefits of the green oasis are best confined to the near surrounds of the residence, where they can fulfil the need for softer surrounds.

Far better for the long term to utilise native species for shelter-belts around the edge of paddocks or property, which link with neighbouring remnant vegetation or plantings. This will contribute very significantly to retaining that unique 'Australianess' of our rural landscapes, a feature that is rapidly being lost in rural residential landscapes.

Biodiversity protection

By planting native vegetation we can make some reparations for our past 'environmental footprint' and improve foraging and breeding habitat for wildlife into the future, as well as meeting all farm and recreational block requirements for shelter-belts and aesthetics. Remember, it takes four to five human generations (100–120 years) for most Australian trees to begin forming hollows suitable for habitat for many fauna species, and some species are totally dependent on native vegetation to survive.

Further advice on suitable plant species can be found in this book, or obtained from your local council or Landcare group.



DIVERSITY = STABILITY

One farmer's story

John Weatherstone of 'Lyndfield Park' in Gunning has become an enthusiastic convert to the value of planting native species, including understorey species, on the family farm.

"I believe that successful environmental rehabilitation depends very heavily on inclusion of understorey species. One of the most important principles in environmental management is that DIVERSITY = STABILITY.

"We fenced off a 15-hectare paddock to revegetate, plus a smaller area for regeneration, a few years ago. Although these areas had been fertilised lightly and grazed for decades, we have been quite surprised at the number of native shrubs that have returned, presumably from seed that had laid dormant in the soil for years. (*This would be likely to occur only in areas that were not covered in dense perennial pastures.*)

"With the range of wattles and grevilleas we have planted, some are flowering at almost every time of the year, keeping birds in the area.

"Another group of often-despised plants that are good for birds are the prickly shrubs, such as *Acacia genistifolia*,

Hakea sericea, *Bursaria lasiophylla* and some of the prickly grevilleas. They provide birds with nesting sites and shelter from feral cats, foxes and hawks."

John has successfully planted native species shelter-belts for his stock and advises:

"Use some fast-growing wattles but include some long-term trees. Many of the wattles may well replace themselves with seedlings if the area is kept fenced off. It is also valuable to include some smaller shrubs and understorey plants for stopping draughts and to provide a more diverse habitat for wildlife."



John's complete story can be found in "Lyndfield Park looking back moving forward" Published in 2003 downloadable from www.lwa.gov.au

So you want to plant trees on your block?

Weather, weed control and appropriate species are the most important factors in getting trees and shrubs established. Persistence over a number of years also helps.

Steps for revegetation

- Decide on the aim of the revegetation project and choose the site. Consider the appropriateness of revegetation. Is your area a natural grassland in which case trees may struggle to survive long term.
- Select the best method and timing — direct seeding and planting tubestock are common choices but you will probably want to consider the site, long-range weather forecasts, and availability of equipment and cost.
- Prepare the site.
- Select the species.
- Plant or sow the seed.
- Manage grass and weed growth around the plants until the plants are established.

Choosing the site

Often revegetation projects are planned for less productive sites such as hilltops, waterlogged areas or sensitive sites such as banks of watercourses, and along roads and fence lines. If there is stock, the site will need to be fenced or otherwise protected during establishment, but you won't need individual tree guards. Consider the possible linkages to existing native vegetation or revegetation corridors in your area.

Direct seeding

Direct seeding involves drilling or sowing seed directly into the ground. It can be done using a specifically designed direct-seeding machine or by hand-sprinkling of seed into loose soil. With direct seeding you can sow many species at

once, resulting in a more natural look. Competition allows the stronger, healthier plants to survive.

Direct seeding is generally quicker and cheaper than planting seedlings and is used extensively by Greening Australia. It is not suited to very steep or rocky areas where equipment access and operation are difficult.

Preparation

If the site is grassy, graze or slash and then spray long strips (1.2 m wide and 4 m apart) with knockdown herbicides (e.g. Glyphosate) in autumn. The following spring, spray the grass again before seeding. Generally sites for direct seeding are not ripped.

the seed from many species can be grown without special treatment

Seed

You can collect or purchase seed. Some with hard coatings, such as acacia seed, will need to be heat-treated before sowing.

When?

Seeding is likely to be most successful in spring (preferably September) when soil moisture levels are higher and the temperature is increasing, although autumn may also be possible in some years.

Sowing rates and survival

Be aware that survival rates for directly-sown seed are low — commonly less than 1% of eucalypt seeds sown will mature into trees. Wattles are estimated at about 5%. This clearly affects sowing rates.

Using tubestock

Another method of revegetation is to plant seedlings grown in tubes (long narrow containers with an open bottom). Again these are best planted in spring, although it is possible to plant small numbers at other times when hand watering is an option.

Planting tubestock is more expensive than direct seeding but is suitable for rocky and steep sites where direct seeding may not be possible. Where only a small amount of seed is available it may be better to use that seed to grow tubestock than to direct-seed.

Preparation

Graze or slash the grass and then deep-rip the soil along the contours during summer to improve water penetration. Several rows of plants will provide a more effective windbreak than a single rip-line.

Spot-spray the sites in autumn with a knockdown herbicide (in a circle at least 1.2 m diameter and 3–5 m apart). Repeat this spraying in spring about two weeks before planting. A tractor wheel driven over the rip-line will help it to collapse if it is still open when you are ready to plant.

***tubestock: look for small hardy plants
6–9 months old and 10–30 cm high***

Seed and propagation

You may want to try propagating tubestock from seed collected from existing native trees and shrubs. The seed from many species of eucalypts, casuarinas, melaleucas, leptospermum, callistemons, and banksias can be sown without any treatment.

However, hard-coated seeds, e.g. from hakeas and from some species will need to be treated before sowing. Place in a container, pour boiling water over them and leave to soak for up to 24 hours.

Sow seeds into tubes containing potting mix that drains freely. Try a mix of coarse river sand, loam and peat (or coconut fibre or leaf mould) in equal parts. Another source suggests commercial potting mixes sold under the Standards Australia logo or a home-made mix of three parts loam, two parts coarse sand and one part composted animal manure.

Refer to the literature below for more detailed information on sowing seed in trays first or sowing directly into tubes and other tips.

Cover the seeds with a thin layer of coarse river sand and water with a gentle spray. Water the tubes regularly. When the seedlings are 10–30 cm, they should be hardened off by placing them in full sun and watered less often. They are then ready to plant.

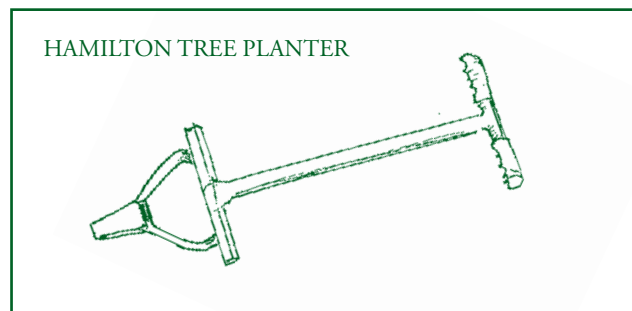
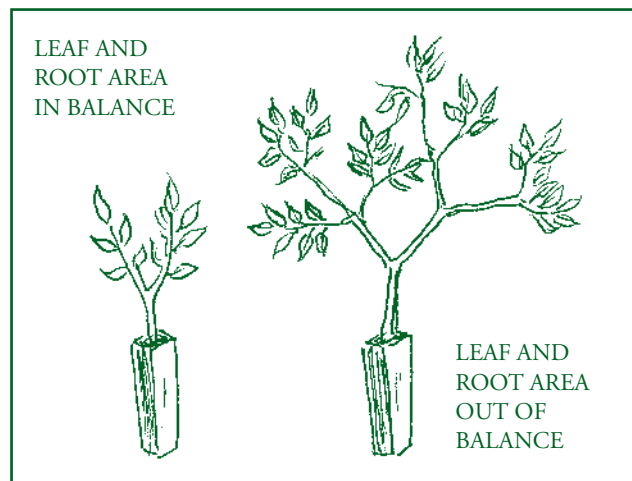
Buying your tubestock

Tubestock can also be purchased from a number of local nurseries. Look for small hardy plants 6–9 months old and 10–30 cm high. Bigger plants in small tubes are not necessarily a better buy.

Planting

Water tubestock well before planting. The tubes can be placed in a wheelbarrow half-full of water so they are given a good soak while they are waiting to be planted.

If you have large numbers of tubestock to plant, it is probably



worth using a Hamilton tree planter. This tool makes a hole in the ground exactly the size and shape of the tube, but be careful of rocks. The seedling can then be removed from its tube and dropped into the hole with a minimum of soil disturbance.

Very little watering is needed when planting with this method. However, where the soil is very wet, dry or hard, you will need to use more conventional planting methods.

Position the seedling in the hole with the roots straight down and the stem no deeper in the soil than it was in the tube. Make sure that there are no air pockets around the root ball.

When do you water?

Water immediately after planting. Hardy species will not need to be watered again after this unless there is a drought in the following summer.

Tree guards

Tree guards can protect plants from hot and cold winds and may make a big difference to the survival rate of tubestock in the first year. Two-litre milk or juice cartons anchored with two stakes make effective tree guards and are less prone to blowing away than commercial plastic varieties.

There are disadvantages to tree guards apart from cost: seedlings tend to have less well-developed root systems and lush leaf growth (which may attract insects).

Selecting species

The resources at the back of this book include lists of native plant species suited to the region. For best results use:

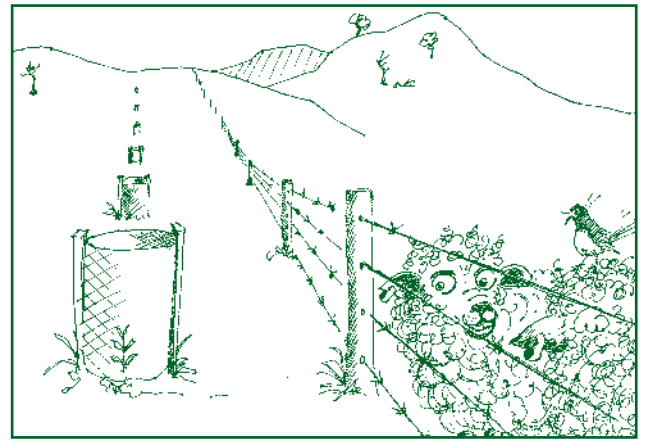
- species suited to the conditions of the site (a species suited to wet conditions is unlikely to survive on a hilltop)
- a mix of species (lessening the risk of total failure)
- both trees and understorey species to increase biodiversity, decrease pest problems and attract birds.

Greening Australia recommends using 30–40 species when direct-seeding. Look around your area and talk to your neighbours about what species have grown well on their properties. Don't be afraid to experiment.

Managing grass and weeds after planting

Planting or seeding is just the beginning of a revegetation project. Your seedlings will do better without competition from grass and weeds for moisture and light. Native pasture is generally easier to control than improved pasture, particularly Phalaris.

Grass and weed control includes mulching, hand weeding, shielded herbicide spraying or soil scalping. It may take several years before your seedlings can fend for themselves.



How about an acacia woodlot?

Acacias are a pioneer species. They are usually the first to regenerate from seed or suckers after soil disturbance by fire or cultivation. It is this rapid early growth that makes them so useful for soil stabilisation, visual screens and shelter-belts.

Acacias adapted for drier, saline and waterlogged sites can be used for strategic discharge and recharge planting within degraded catchments.

Acacias are legumes and can use atmospheric nitrogen for their own growth and to return nitrogen to the soil. While rates of nitrogen fixation are low, early results from a mixed planting of *Eucalyptus globulus* and *Acacia mearnsii* indicated that the presence of the acacia does improve foliar nitrogen in the eucalypt. Inoculation with rhizobia (soil bacteria) which assist nitrogen fixation is under investigation.

Firewood

Most acacias make excellent fuel wood and charcoal.

Suitable species in this area include *A. decurrens*, *A. mearnsii* and *A. melanoxylon*.

Posts

A niche market exists for *A. mearnsii* posts complete with undamaged bark. They are used in salt water as oyster pegs or racking and have been a stable resource for the south coast oyster industry since World War I.

Other prospects...

Aboriginal people have used specific temperate acacias as sources of wood for weapons, implements and fires; leaves for medicinal purposes as a wash or smoke therapy (fumes from heated leaves are a healing agent); seed for food; gums for ointments, infusions and glues; and bark for infusions, bandages, ropes and sandals.

(Excerpted from a paper by Suzette Searle, formerly of CSIRO Forestry and Forest Products. The CSIRO has been assessing trials of suitable acacia species in the ACT and environs for fuel wood and farm forestry.)

Bigger than a woodlot: farm forestry with natives

Primary producers may realise many benefits from small, well-managed plantations of native hardwoods. Benefits include timber products — firewood, fence posts and high-value sawn timber. Other benefits include stock shelter, erosion control and native habitat.

Plantations can grow a mixture of species such as wattles, eucalypts and casuarinas. Such mixes create rich bird habitat, look great and still realise a product. The latter means intensive management to promote straight stems without low branching.

Local native species that produce high-value timber and provide on-farm benefits include:

<i>Allocasuarina verticillata</i>	Drooping She-oak
<i>Acacia implexa</i>	Lightwood
<i>A. falciformis</i>	Hickory
<i>A. decurrens</i>	Green Wattle
<i>A. mearnsii</i>	Black Wattle
<i>A. dealbata</i>	Silver Wattle
<i>Casuarina cunninghamiana</i>	River She-oak
<i>Eucalyptus sideroxylon</i>	Mugga Ironbark
<i>E. polyanthemos</i>	Red Box
<i>E. melliodora</i>	Yellow Box
<i>E. macrorhyncha</i>	Red Stringybark

GETTING ON TOP OF PHALARIS

and tips on establishing native trees

Phalaris has been widely used in the Gearys Gap/Wamboin area. It is hard and vigorous and is now the dominant grass in most areas. Hilary Kent and John Merritt describe below how they have tackled the problem of growing Australian native trees in Phalaris paddocks.

Phalaris is too vigorous and dense to permit direct seeding. We plant tubestock. Wherever possible we rip some months before planting. In our case that means calling upon an obliging neighbour who attaches a single-tine plough to his tractor. We then apply Roundup along both sides of the rip-line to create a metre-wide Phalaris-free strip.

The dead Phalaris is left in the ground to help conserve moisture and inhibit grass growth. If it is removed, it is quickly replaced by wild sorrel, which has the capacity to choke young trees almost equal to that of the Phalaris itself. Moreover, in time, the Phalaris will always come back. Thus we also add mulch to the rip-lines. Often we use Phalaris hay, cut after the seeds have fallen. It is durable and effective.

Growing tips

We grow our own tubestock or purchase it from local nurseries. Some more frost-tender trees, however, will not survive unless they are relatively well advanced before planting. Casuarinas, for example, need to be at least a metre in height.

We prefer to plant in spring after rain. The strategy has been to plant a mixture of eucalyptus species to minimise the effects of insect attack, and acacias to add nitrogen to the soil and provide wind protection for the slower-growing species. We water every three weeks during the first summer and weed and mulch until the trees are well established. The established trees reduce the Phalaris growth themselves.

Phalaris must be eaten down or slashed if it is not to become a fire hazard.

The good and bad of sheep

We run sheep which eat down the grass, but they can be hard on trees. For some time we experimented with a variety of individual wire tree guards which we anchored with steel pickets. The guards worked well while the trees were young, but not so well once the trees began to acquire breadth and height. They restrict lateral growth and sheep learn to climb up the sides. There was no alternative but to fence our windbreaks and to build largish squares or circles of ringlock around solo trees.

When the foliage of our paddock trees is above sheep height, we remove the ringlock and use chicken wire sheaths to protect the trunks. (Light plastic mesh works just as well.) The sheath needs to be anchored, otherwise the sheep will push it upwards and nibble in the areas of the trunk thus exposed.

Persistence does pay off. Most of our five- to six-year-old paddock trees are now without protection of any sort and are strong enough not to be affected by sheep rubbing against them.



CONTACTS



Murrumbidgee Catchment Management Authority

Phone 02 6932 3232
Queanbeyan Phone 02 6229 7700
Cooma Phone 02 6452 4150
Yass Phone 02 6118 6010
www.murrumbidgee.cma.nsw.gov.au



Southern Rivers Catchment Management Authority

Phone 02 4224 9700
Braidwood Phone 02 4842 2594
Cooma Phone 02 6452 1455
www.southern.cma.nsw.gov.au

Greening Australia Capital Region

Phone 02 6253 3035 www.greeningaustralia.org.au

Grassy Box Woodlands Conservation Management Network

Phone 02 6298 9709 www.gbwcmmn.net.au

FloraBank

www.florabank.org.au
Phone 02 6202 1600
c/- GA PO Box 74 Yarralumla ACT 2600

Australian Native Plant Society

www.nativeplants-canberra.asn.au
PO Box 217 Civic Square ACT 2608

Friends of Grasslands

Phone 02 6241 4065 info@fog.org.au
PO Box 987 Civic Square ACT 2608

REFERENCES



Eddy, D., Mallinson, D., Rehwinkel, R. and Sharp, S. (1998) *Grassland Flora: A Field Guide for the Southern Tablelands (NSW & ACT)*.
Eddy, D. (2002) *Managing Native Grassland: A Guide to Management for Conservation, Production and Landscape Protection*.

White Box, Yellow Box, Blakely's Red Gum Woodland Fact Sheet — available from NSW National Parks and Wildlife Service on 02 6229 7000

NOTES:

MANAGING YOUR PROPERTY

WEEDS

Weeds

Weeds are highly competitive plants that can rapidly establish and exclude other plants. They degrade natural systems and agricultural land, and choke waterways. Weeds are increasing in numbers and distribution in much of the Upper Murrumbidgee, due to natural and human influences. Weeds nearly always have a high level of seed production and seeds that are easily dispersed.

Weeds and their seeds can arrive at your property in many ways – with stock feed, with stock and on vehicles. Water, wind and your garden are other methods and weeds will take advantage of poor land management where ground is bare.

Weed responsibility

Most major weeds have been declared as noxious/pest plants under NSW and ACT legislation. All landholders, including governments, are responsible for controlling these weeds on their land. Councils are the weed control authority and employ weed inspectors who have the right to enter and inspect your property. They can issue notices to carry out weed control and can fine you for not controlling weeds.

Lists of noxious weeds in your area are available from your local council and are all listed on their websites along with many more resources to assist with weed management.

Some problem weeds in the UMC

- Serrated Tussock
- African Lovegrass
- St John's Wort
- Nodding Thistle
- Blackberry
- Chilean Needle Grass
- Scotch Broom
- Paterson's Curse
- Sweet Briar.

Learn to recognise them.

Weed management

Plants become weeds because they have a high level of seed production with easy dispersal, and are highly competitive with a lack of natural controls. Agricultural weeds have had a significant impact on the Upper Murrumbidgee Catchment since the 1920s.

Causes of weed infestations:

- deliberate introduction of weeds for other purposes, e.g. willows for bank stabilisation
- land managers' lack of awareness and inability to identify weeds
- poor land management, e.g. overgrazing
- herbicide resistance due to over-reliance on one or several chemicals
- cost of control methods.

The effects of poor weed management can include:

- loss of native species
- reduced land productivity
- increasing control costs as weeds spread
- loss of habitat for native animals
- soil degradation.

The distribution and density of weeds in the UMC indicate an upward trend for both the spread of well-established weeds and the emergence of new problems.

Serrated Tussock is an example of a serious weed

Serrated Tussock is considered an important weed in the UMC, and is estimated to infect 50% of the Monaro. It is difficult to identify and the seeds can spread great distances by wind. Most major infestations are in steep, non-arable areas with poor soil fertility and low rainfall. Degraded sites also attract Serrated Tussock.

How to identify Serrated Tussock:

- perennial grass
- deep-rooted tussock
- very fine leaves (0.5 mm)
- turns goldy yellow in autumn/winter
- flowers from October to January
- as the flower stems emerge and spread, the tussocks have a purple overtone from the colour of the seed stems
- over summer the seedheads elongate and 'weep' over to the ground. The bent-over seeding stems are blown onto one side away from the prevailing wind
- a small white encircling 'flap' occurs where two leaf blades meet.

The name leads one to look for serrated or rough leaf edges (margins). This method should **not** be used as many native grasses also have serrated margins. (This has led to many native tussock populations being sprayed out.)

Serrated Tussock control

Manual or spot-spraying techniques can be used for light infestations. There are chemical controls available for Serrated Tussock, but usage rates and timing can vary from district to district and season to season.

Is it a weed or a native grass?

There are many very good publications on weed identification and management. **The Molonglo Catchment Weed Information Pack** is a great place to start.

If you need help contact the Weeds Officer at Council or at your nearest NSW DPI.

Willow alert

Willows have been planted along Australian waterways for many years and land managers have used them for erosion control.

Things have changed with the introduction of both male and female versions of aggressive hybrids — sold as fast-growing windbreak, or stream bank stabiliser material. Their prolific seed dispersal and ability to hybridise with a wide range of other species threaten major problems along rivers and streams in the UMC.

Willows:

- out-compete other plants
- block creeks and rivers, altering flow and causing erosion
- take up large amounts of water, lowering creek levels
- shade watercourses in summer, while in autumn leaf fall lowers water quality.

Willow seedlings have multiplied rapidly due to the introduction to Australia of both male and female plants of species such as the Black Willow (*Salix nigra*) and hybrid willows from New Zealand (*S. matsudana* x *alba*).

Other willow species that are causing problems include:

- Grey Sallow (*S. cinerea*)
- Crack Willow (*S. fragilis*)
- Basket Willow (*S. x rubens* — includes the species *S. fragilis* x *alba* and *S. fragilis* x *alba* var. *vitellina*).

A few species such as the common Weeping Willow (*S. babylonica*) do not produce viable seed and are considered by some to be less of a problem. However, female trees may be capable of crossing with males of another species, creating hybrids that may become major environmental weeds.

Willows have been declared a weed in NSW and the ACT. Landholders should avoid planting the female of the willow species within 300 metres of streams, rivers or farm dams (because of runoff). Some male willows also produce seed and it is difficult for the lay person to tell male from female willows.

UMCCC has produced a publication titled *Willow management – a strategy for the upper Murrumbidgee catchment, 2010* which collates past and present knowledge of willows and their management. The publication makes recommendations for willow management in the Upper Catchment, looking at a whole-of-catchment picture as well as subcatchment priorities. Copies are available from the UMCCC.

The best strategy is: don't plant willows.



Weed control methods

Manual methods are the most efficient and direct for smaller invasions of environmental weeds. If plants are too numerous or too difficult to remove, their seedheads or fruiting bodies can be removed by hand.

If that's not sufficient, consider:

Grazing regimes

An appropriate grazing regime can control introduced annuals like Barley Grass, Great Brome and *Vulpia* in areas of native vegetation. Grazing (by goats) can also be effective for blackberry control.

Competition

Maintaining healthy native pastures or sowing deep-rooted perennials are effective strategies — along with tree revegetation, spot-spraying and removal of seedheads — in the control of weeds like Serrated Tussock, which thrive on degraded sites. Seek advice from your local Council or departmental weeds expert.

Herbicides

Herbicides can play an important role in the control of environmental weeds, particularly if used in conjunction with non-chemical approaches (above). Several application techniques are available and these are described below:

Spraying

Spot-spraying or spraying a broad area of infestation is an effective tool against weeds. But make sure you don't wipe out the vegetation you want to keep as well. Bear in mind the impacts of broad scale herbicide application on wildlife, birds and water quality.

Cut and paint

This involves cutting the weed tree with a bush-saw or chainsaw, and applying herbicide to the stump. The herbicide must be applied *immediately*, but need not be painted over the whole stump area — just to the outside edge or 'cambium layer' of the tree, so that it can be immediately translocated down to the roots.

Stem injection

The herbicide can be injected into the stem of the weed tree.

Frilling

Frilling involves cutting small notches around the trunk of the weed tree, into which herbicide is applied.

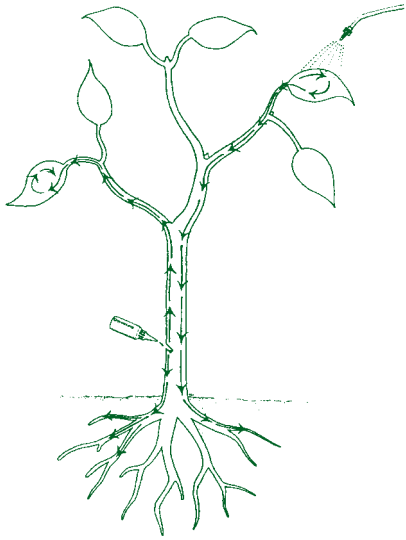
Stem-painting

The same principles as 'cut and paint' can be used on vines and smaller weed plants.

Mechanical control

Where the vegetation is almost entirely composed of large weed species, and there are no native plants left on site, larger machinery can be used to clear this vegetation. Elsewhere, avoid the use of machinery.

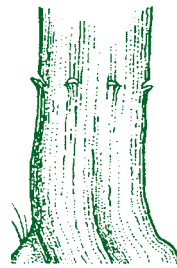
Integrated weed management is the best way to achieve long-term weed control with minimal environmental impact. It involves using a combination of the methods mentioned above that are most suitable for your property.



Herbicides can be applied by a number of methods, but all have the aim of travelling down the plant body to the roots. Herbicides should therefore be used when the plant is actively growing.



Cut and paint is an effective way of removing tree weeds.



Frilling



Stem painting

REFERENCES



Eddy, D., Mallinson, D., Rehwinkel, R. and Sharp, S. (1998) *Grassland Flora: A Field Guide for the Southern Tablelands (NSW & ACT)* — should be able to help you distinguish between the noxious weed Serrated Tussock and the harmless natives Poa Tussock and Wallaby Grass, all of which people generally call tussocks.
Environment ACT and the Conservation Council of the South-east Region and Canberra, *Garden Plants Going Bush* — good colour identification guide of environmental weeds.

Available at: http://www.tams.act.gov.au/_data/assets/pdf_file/0010/133588/Garden_plants_Going_Bush.pdf

Kerruish, D. and Nilsen, T. (2010) *Willow management - a strategy for the Upper Murrumbidgee catchment, 2010*

Molonglo Catchment Group

Phone 02 6299 2119 or
email coordinator@molonglocatchment.com.au
www.molonglocatchment.com.au

NOTES:

MANAGING YOUR PROPERTY

WATER

Managing riparian zones

The riparian zone is the area directly influenced by the river or creek, generally extending from the normal river level to the floodplain. Riparian vegetation plays a significant role in riverbank stability, water quality and biodiversity.

Aerial photos and other evidence indicate that native riparian vegetation is declining. This decline leaves stream banks more vulnerable to erosion and weed infestation. Grazing management and revegetation are underway in some areas to protect this sensitive zone but other areas are still under pressure.

Careful stocking to protect stream banks

When stock rely on streams for their water supply, significant disturbance to soil and vegetation may occur. Stock cause stream bank erosion (resulting in soil loss and water quality decline), graze and trample vegetation, inhibit plant regeneration and cause faecal pollution of water.

Ideally stock should not have direct access to rivers, stream or creeks. Stock should have fenced and managed access points or off-stream watering sites i.e. tanks and troughs should be installed.

CASE STUDY

LIVESTOCK CONTROL NEAR CREEKS, STREAMS AND RIVERS

Why should stock be kept off stream banks?

- they eat, trample and destroy the vegetation that protects banks from erosion and nutrient inflow
- they compact the soil making plant growth difficult.
- they push soils off steep banks
- they make tracks, which can concentrate the flow of water down the banks causing erosion
- they may injure themselves falling over steep banks.

Why should stock be kept out of streams?

- they eat, trample and destroy water plants and reeds that control erosion and provide fish habitat
- they stir up mud
- they can get bogged and trapped in mud
- they can transfer and receive diseases
- they contaminate the water with excess nutrients from manure
- they destroy instream habitat critical for native fish and crustaceans

How will stock get a drink if they can't get to the stream?

You can install:

- a paved gravel ramp down to the water, preferably on the inside of a bend
- a bore and tank in the paddock
- a dam in the paddock
- IDEALLY a pump, tank and trough in the paddock.

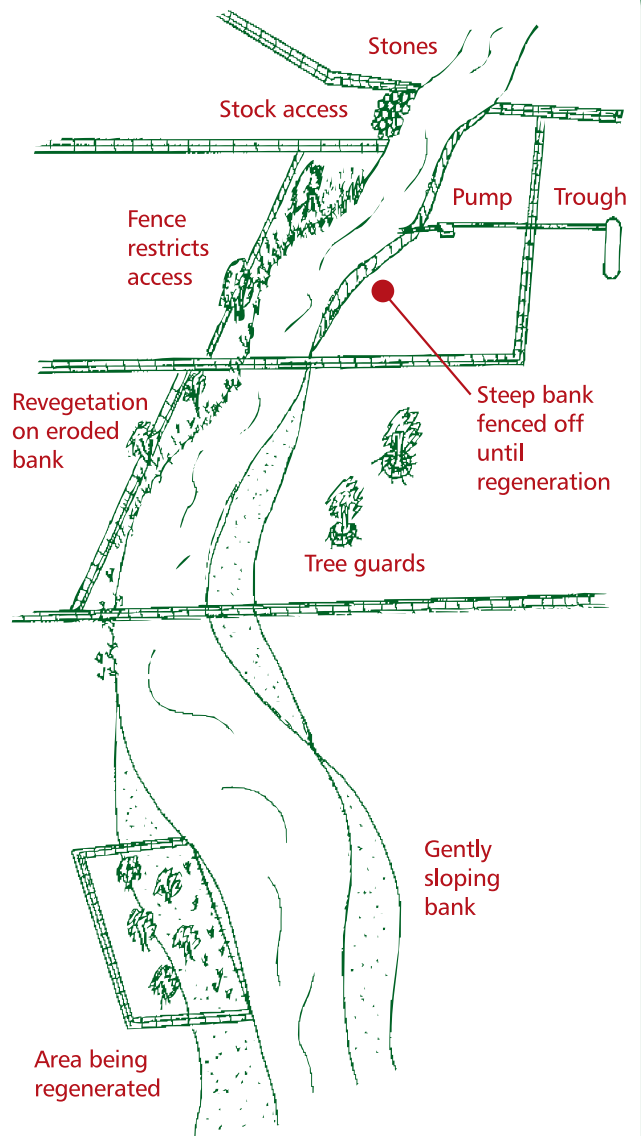
How do you manage a fenced-off area?

- short-term grazing 'crash grazing' by stock can be used once vegetation is established
- weeds will need to be controlled as per the surrounding paddocks.

How do we pay?

There are grants available to assist with off-stream water provision and fencing. Contact the NSW Office of Water, Murrumbidgee Catchment Authority or Greening Australia.

Source: Adapted from RIVERWISE notes AGDEX 572, DLWC



Cause of riparian zone degradation

- Recreational activities
- Invasion and competition by pest species
- Land management practices, i.e. grazing and cropping
- Erosion
- Channel realignment

Effect of riparian zone degradation

- Flow regulation
- Weed invasion
- Loss of topsoil and livestock trampling
- Reduced water quality
- Reduced biodiversity
- Reduced aesthetic value
- Loss of windbreak and shelter
- Reduced aquatic flora and fauna
- Unstable stream banks

Aquatic plants and animals

Native aquatic flora and fauna are part of a healthy river system. Native aquatic vegetation is noticeably absent from many inland rivers and this is a contributing factor in increased sediment and nutrient load, including in the UMC. (Aquatic habitats in the extensive gorges and the subalpine areas are considered generally diverse and in good condition.) Changes to the river ecosystem can be attributed mainly to human intervention including reduced flow, increased erosion and the introduction of exotic species (willows, carp, trout).

Restoring or developing wetlands and dams for clean water

Many rural blocks have wetlands of some kind — a dam, a creek, that boggy patch down in the far corner. These areas can be a wonderful habitat for wildlife and aesthetically pleasing as well as a source of water for farm activities.

Water quality depends on what is happening further upstream. Signs of poor-quality water are murkiness, odour, salinity and excessive growth of algae.

Strategies to improve water quality:

- Fence stock out of dams and creeks. Consider pumping drinking water for stock to troughs in less fragile areas where stock will do less damage.
- Avoid use of fertilisers, herbicides and pesticides in areas around dams and waterways.
- Revegetate your wetlands: reeds, sedges and rushes at water edges, grasses and shrubs on the banks. These help remove extra nutrients from the water, improving water quality, and create habitat for wildlife.
- Consider the whole water catchment area, both upstream and downstream. Actions you take will affect the water quality for others further downstream.

Dam care

- Clearing of trees and understorey increases soil erosion. Soil erosion causes dams to fill with silt
- Water flowing through areas that are heavily grazed or fertilised picks up nutrients and silt. The water will be muddy and poor quality.
- Grasses and shrubs can filter out soil particles, animal droppings and fertiliser before the water reaches the creek or dam.

Rules for new dams

Water allocation in NSW has become tighter with the spread of irrigation and increased rural development. Subdivision dams play a role by diverting water that would otherwise flow to streams and rivers.

The NSW Farm Dams Policy gives all landholders the right to capture and use a harvestable right of runoff on their property. This must be done in consultation with the NSW Office of Water.

Existing domestic and stock dams constructed before 1 January 1999 are not affected by this ruling. However, new domestic and stock dams as well as dams of whatever age built for commercial irrigation purposes must abide by the new legislation. There is also an exemption for small properties that received development consent before 1999.

Blue-green algal blooms in farm dams and waterways

Blue-green algal blooms can cause unpleasant smells and tastes in the water and produce a variety of toxins including liver toxins, neurotoxins and endotoxins which cause skin irritations. The toxins can persist for weeks, and are a potential health risk if they are swallowed or if they contact the body.

Algal blooms may vary in colour from green to blue, red, brown, dark green to black. Some will be easily seen as a scum while others will be spread evenly throughout the water or even concentrated at depth.

(Blue-green algal blooms are not always toxic. Those that are may change their toxicity slowly over a period of weeks to months)

What causes algal blooms?

A combination of factors:

- high concentrations of nutrients such as phosphorus and nitrogen
- warm stable air and water temperatures – although blooms can form in cool weather too
- low wind speeds and little turbulence

The factor over which landholders have most control is the level of nutrients washing off paddocks and out of their homes into their dams and local waterways.

Effects on animals

There are reported livestock deaths due to the toxic effects of blue-green algae. As not all toxic algae produce blooms that are readily recognisable, stock deaths and illness should be reported.

Dogs are very susceptible to blue-green toxins, especially if they swim in an algal bloom.

Effects on humans

The toxins produced by blue-green algal blooms can cause nausea, headaches, vomiting, abdominal pain, diarrhoea, gastroenteritis and even paralysis. Boiling affected water will kill the algae but will NOT destroy the toxins and in some cases will cause more to be released in to the water. Some have even been known to become more dangerous as a result of boiling.

TURNING A DAM INTO A WILDLIFE SANCTUARY

Jennie and Chris Curtis have been restoring an old farm dam that was badly degraded by heavy stock use.

When we began this project the dam was a shallow, muddy mess in the middle of an eroding, treeless paddock. We wanted to improve the water quality and attract wildlife. The first step was to exclude stock from the area. We also decided to excavate and extend the dam to create an island and a variety of water depths.

Contrary to the advice of the contractor, we wanted to have an irregular shape and to keep as much of the original edge of the dam as possible, as there were a few rushes growing there despite the devastation.

In the first year without stock, the grass grew back over areas of bare soil around the dam that had been eroding.

This helped catch the silt that had previously been pouring into the dam and reduced the salt scald below the dam. We noticed many frogs, tadpoles and small fish.

Reeds and rushes grew back along the original edges of the dam and began to spread along the new edges, helping to stabilise the earthworks. In the second year a pair of wild ducks raised ducklings on the island. We were amazed at how much the appearance of the dam improved without doing much except keeping the stock out.

We have planted windbreaks on the eastern and western sides of the dam to provide shelter. Eucalypts and grevilleas have been planted on the island to provide shelter and safe nesting places for birds. We also planned to add dead logs on the island and install more tea-tree and callistemons around the edges of the dam.

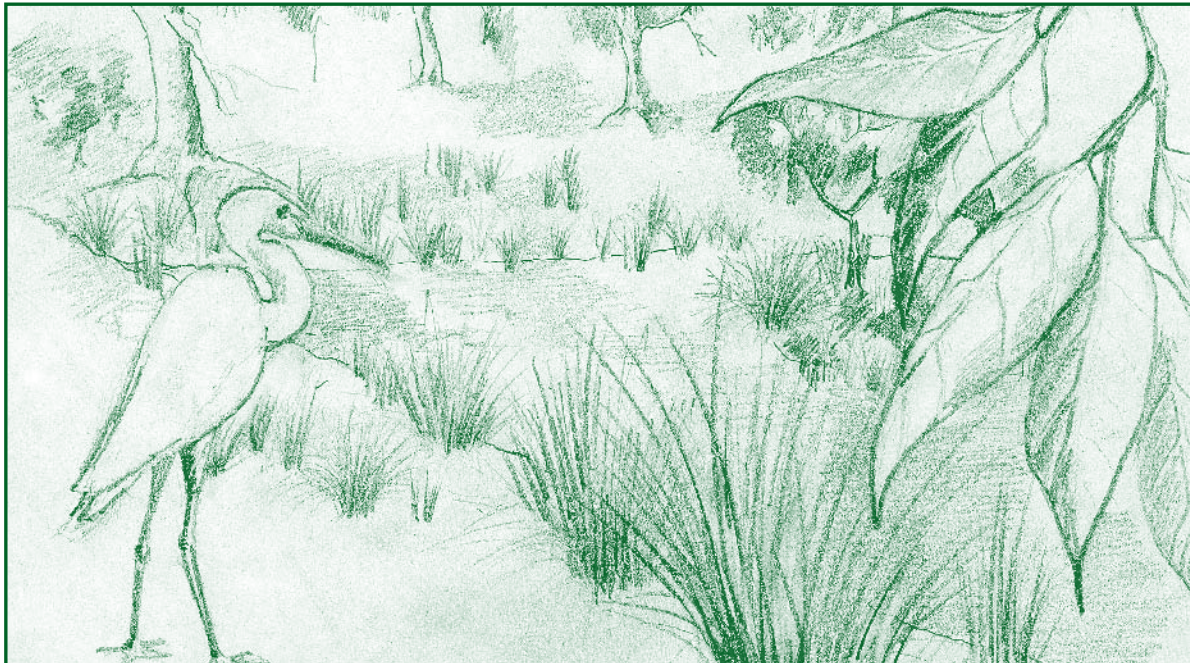


ILLUSTRATION: RICK BEAVIS

NOTES:

TRACK EROSION

Roads and access tracks on the bush or hobby farm block can cause substantial erosion and threaten water quality if they are not carefully designed and maintained.

Construct for minimal erosion and maintenance. That means:

- DRAINAGE, DRAINAGE, DRAINAGE (see diagrams below)
- plant or maintain vegetation beside the track, even on the track
- follow the lie of the land
- minimise cut and fill
- if you have to cut into a bank, make the cut straight up and down unless it is higher than 1.5 metres
- avoid soil and vegetation disturbance
- minimise pushing soil around with your tractor blade.

Keep grades gentle:

- grades should generally be 10% — about 6 degrees
- cross-banks will scour out above this grade
- grades greater than 7% (4 degrees) will need special drainage works such as lining of table drains, etc.

Outfall drainage

Tracks should have a cross-fall to shed water.

This should normally angle away from the hillside, except where a built-up bank is unstable or higher than 1.5 metres.

Cross-banks

If outfall drainage isn't enough to control runoff, cross-banks can be a good, cheap long-lasting solution.

A cross-bank (also known as a 'whoa boy') is like a large speed hump built across the track. It is formed by digging a trench 20–30 cm deep on a slight slope across the track and using the excavated earth to form a bank on the downhill side.

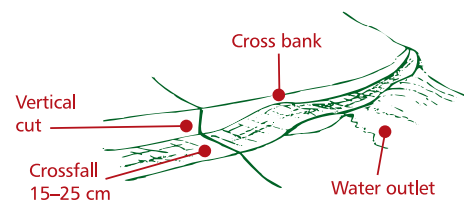
How to make a cross-bank

Rip the road for one or two tractor lengths to the outlet point you have chosen. Then push the loose earth down the roadline to form a bank, commencing at the uphill side of the road and working across to the outlet side. A long, shallow excavation is best.

If you need to cross a drainage line...

... use fords, culverts or bridges. Fords cost less and can often be built with little disturbance to the stream bed or banks. If you do use culverts, make sure they are aligned as closely as possible to the natural drainage lines.

Shallow depressions and swampy areas can often be stone-paved or laid with logs side by side across the wheel tracks.



Some drainage techniques



Construction of a cross-bank

CONTACTS



ACT - Department of Territory and Municipal Services (TAMS)

GPO Box 158, CANBERRA CITY, ACT 2601
Macarthur House,
12 Wattle St, LYNEHAM ACT 2602
Canberra Connect 13 22 81
www.tams.act.gov.au



NSW Office of Water Department of Environment, Climate Change and Water.

Queanbeyan: 02 6229 7000 11 Farrer Place
Queanbeyan
Sydney Head Office: 02 8281 777
information@environment.nsw.gov.au
www.environment.nsw.gov.au

REFERENCES



Sainty, G.R. and Jacobs, S.W.L. (1994) *Water-plants in Australia* (3rd edition) — field guide to many Australian plants growing in wetlands.

Wollondilly Phosphorus Action Committee leaflet *Blue-green Algal Blooms in Farms and Waterways* (contains useful preventive strategies and identification chart).

Blue-green algae – general information
www.nrw.qld.gov.au

Greening Australia (1991) *Improving Your Farm Dam*

Greening Australia, *Greennotes #20: Revegetating*

APPENDIX A: PLANT SPECIES

The following plants are local to the area or suited to this region. Plant sizes are intended as a guide only. Actual size will depend on the individual plant and the site conditions. Many other species can also grow here but you should always check factors such as frost hardiness and drainage required.

Species	Common name	Size	Well-drained areas	Moist to wet	Understorey	Local or regional	Fast-growing	Bird-attracting
Trees								
<i>Acacia dealbata</i>	Silver Wattle	5–20 m	x	x	x	x	x	x
<i>Acacia decurrens</i>	Early Black or Green Wattle	10 m	x		x	x	x	x
<i>Acacia falciformis</i>	Hickory Wattle	12 m	x		x	x		x
<i>Acacia implexa</i>	Lightwood	15 m	x		x	x		x
<i>Acacia mearnsii</i>	Late Black Wattle	15 m	x		x	x	x	x
<i>Acacia melanoxylon</i>	Blackwood	30 m		x	x	x		x
<i>Acacia obliquinervia</i>	Mountain Hickory	15 m	x			x		x
<i>Acacia parramattensis</i>	Sydney Green Wattle	10 m	x				x	x
<i>Acacia rubida</i>	Red-stemmed Wattle	2–10 m	x		x	x	x	x
<i>Allocasuarina littoralis</i>	Black She-Oak	10 m	x			x		x
<i>Allocasuarina verticillata</i>	Drooping She-Oak	10 m	x			x		x
<i>Brachychiton populneus</i>	Kurrajong	10 m	x			x		x
<i>Callitris endlicheri</i>	Black Cypress Pine	15 m	x			x		x
<i>Casuarina cunninghamiana</i>	River She-Oak	30 m		x		x	x	x
<i>Casuarina glauca</i>	Swamp She-oak	20 m		x			x	x
<i>Eucalyptus aggregata</i>	Black Gum	10–20 m		x		x	x	x
<i>Eucalyptus bicostata</i>	Eurabbie	large tree	x				x	x
<i>Eucalyptus blakelyi</i>	Blakely's Red Gum	10–24 m	x	x		x	x	x
<i>Eucalyptus bridgesiana</i>	Apple Box	8–20 m	x			x	x	x
<i>Eucalyptus camphora</i>	Mountain Swamp Gum	8–20 m		x		x	x	x
<i>Eucalyptus dives</i>	Broad-leaved Peppermint	8–20 m	x			x		x
<i>Eucalyptus elata</i>	River Peppermint	20 m	x	x			x	x
<i>Eucalyptus globulus</i>	Blue Gum	Up to 30 m		x			x	x
<i>Eucalyptus leucoxylon</i>	White Gum, Ironbark	5–30 m	x					x
<i>Eucalyptus macarthurii</i>	Paddy's River Box	20 m	x				x	x
<i>Eucalyptus macrorhyncha</i>	Red Stringybark	15–30 m	x			x		x
<i>Eucalyptus mannifera</i>	Brittle Gum	6–20 m	x			x	x	x
<i>Eucalyptus melliodora</i>	Yellow Box	12–30 m	x			x		x
<i>Eucalyptus moorei</i>	Narrow-leaved Sally	5–14 m	x				x	x
<i>Eucalyptus nicholii</i>	Narrow-leaved Peppermint	medium tree	x				x	x
<i>Eucalyptus nortonii</i>	Mealy Bundy	8–16 m	x	x				x
<i>Eucalyptus paliformis</i>		12 m	x				x	x
<i>Eucalyptus parvifolia</i>	Small-leaved Gum	5–10 m		x			x	x
<i>Eucalyptus pauciflora</i>	Snow Gum	10–20 m	x	x		x		x
<i>Eucalyptus radiata</i>	Narrow-leaved Peppermint	12–45 m	x			x		x
<i>Eucalyptus rossii</i>	Inland Scribbly Gum	8–20 m	x			x		x
<i>Eucalyptus rubida</i>	Candlebark	15 m	x	x		x		x
<i>Eucalyptus sideroxylon</i>	Mugga, Red Ironbark	10–20 m	x					x
<i>Eucalyptus scoparia</i>	Willow Gum	10–15 m	x	x				x
<i>Eucalyptus stellulata</i>	Black Sallee	5–14 m		x		x	x	x
<i>Eucalyptus viminalis</i>	Ribbon Gum, Manna Gum	25–50 m	x	x		x	x	x

<i>Species</i>	Common name	Size	Well-drained areas	Moist to wet	Understorey	Local or regional	Fast-growing	Bird-attracting
Small trees/large shrubs								
<i>Acacia doratoxylon</i>	Currawang	3–8 m	x			x	x	x
<i>Acacia howittii</i>	Sticky Wattle	6 m	x				x	x
<i>Acacia pravissima</i>	Ovens Wattle	3–8 m	x	x		x	x	x
<i>Acacia pycnantha</i>	Golden Wattle	8 m	x			x	x	x
<i>Bursaria lasiophylla</i>	Blackthorn	3–6 m	x		x	x		x
<i>Callistemon sieberi</i>	River Bottlebrush	2–7 m		x	x	x		x
<i>Eucalyptus cinerea</i>	Argyle Apple	7–15 m	x			x	x	x
<i>Eucalyptus crenulata</i>	Buxton Gum	4–12 m		x			x	x
<i>Eucalyptus polyanthemos</i>	Red Box	7–25 m	x			x		x
<i>Leptospermum brevipes</i>	Slender Tea-tree	8 m		x	x	x	x	
<i>Leptospermum lanigerum</i>	Woolly Tea-tree	6 m		x	x	x	x	
<i>Melaleuca armillaris</i>	Bracelet Honey Myrtle	7 m	x	x			x	
<i>Melia azederach</i>	White Cedar	7 m	x	x				x
Medium to small shrubs								
<i>Acacia boormanii</i>	Snowy River Wattle	4 m	x	x	x		x	x
<i>Acacia buxifolia</i>	Box-leaf Wattle	2 m			x		x	x
<i>Acacia cardiophylla</i>	Wyalong Wattle	2–5 m	x		x		x	x
<i>Acacia cultriformis</i>	Knife-leaf Wattle	3 m		x	x		x	x
<i>Acacia fimbriata</i>	Fringed Wattle	5–8 m	x				x	x
<i>Acacia flexifolia</i>	Bent-leaf Wattle	1 m	x		x		x	x
<i>Acacia floribunda</i>	White Sallow Wattle	5 m		x	x		x	x
<i>Acacia genistifolia</i>	Early Wattle	1.5 m	x		x	x		x
<i>Acacia retinodes</i>	Wirilda or Swamp Wattle	3 m		x	x		x	x
<i>Acacia siculiformis</i>	Dagger Wattle	1–4 m		x	x	x		x
<i>Acacia uncinata</i>	Weeping Wattle	1–3 m	x		x		x	x
<i>Allocasuarina nana</i>	Dwarf She-Oak	2 m	x		x			x
<i>Baeckea linifolia</i>	Weeping Baeckea	1.5–3 m	x	x	x			x
<i>Baeckea virgata</i>	Twiggy Heath Myrtle	4 m	x	x	x		x	x
<i>Banksia ericifolia</i>	Red Honeysuckle	4 m			x			x
<i>Banksia marginata</i>	Silver Banksia	5 m	x		x	x		x
<i>Banksia robur</i>	Swamp Banksia	3 m	x	x	x			x
<i>Banksia spinulosa</i>	Hairpin Banksia	2 m	x		x			x
<i>Bauera rubioides</i>	River Dog-rose	1 m		x	x			x
<i>Callistemon citrinus</i>	Crimson Bottlebrush	4 m	x	x	x			x
<i>Callistemon citrinus cultivars</i>	(many named varieties)	4 m	x	x	x			x
<i>Callistemon linearis</i>	Narrow-leaved Bottlebrush	3 m	x	x	x			x
<i>Callistemon pallidus</i>	Lemon Bottlebrush	5 m		x	x			x
<i>Callistemon pinifolius</i>	Pine-leaf Bottlebrush	2 m	x	x	x			x
<i>Callistemon pityoides</i>	Alpine Bottlebrush	2 m	x	x	x			x
<i>Callistemon subulatus</i>	Bottlebrush	3 m	x	x	x			x
<i>Callistemon viminalis</i>	Weeping Bottlebrush	4–5 m	x	x	x			x
<i>Correa reflexa</i>	Native Fuchsia	1.5 m	x		x	x		x
<i>Grevillea arenaria</i>		2.5 m	x		x	x	x	x
<i>Grevillea lanigera</i>	Woolly Grevillea	1.5 m	x		x		x	x
<i>Grevillea rivularis</i>	Carrington Falls Grevillea	3m	x	x	x		x	x
<i>Grevillea rosmarinifolia</i>	Rosemary Grevillea	2 m	x		x		x	x

<i>Species</i>	Common name	Size	Well-drained areas	Moist to wet	Understorey	Local or regional	Fast-growing	Bird-attracting
<i>Grevillea victoriae</i>	Royal Grevillea	2 m	x		x		x	x
<i>Hakea dactyloides</i>	Finger Hakea	2–4 m	x		x		x	x
<i>Hakea eriantha</i>	Tree Hakea	3–4 m	x		x		x	x
<i>Hakea lissosperma</i>	Mountain Hakea	2–5 m	x		x			x
<i>Hakea microcarpa</i>	Small Fruit Hakea	2 m	x		x	x		
<i>Hakea nodosa</i>	Yellow Hakea	3 m	x	x	x			x
<i>Hakea salicifolia</i>	Willow-leaved Hakea	5 m	x		x		x	x
<i>Hakea sericea</i>	Silky Hakea	4 m	x		x	x	x	
<i>Indigofera australis</i>	Austral Indigo	2 m	x		x	x	x	
<i>Jacksonia scoparia</i>	Dogwood	3 m						
<i>Kunzea ambigua</i>	Tick Bush	3–5 m	x		x		x	x
<i>Kunzea ericoides</i>	Burgan	4 m	x	x	x	x	x	x
<i>Kunzea parvifolia</i>	Violet Kunzea	2 m	x	x	x	x	x	x
<i>Leptospermum juniperinum</i>	Prickly Tea-tree	3 m		x	x	x	x	
<i>Leptospermum multicaule</i>		1 m		x	x	x	x	
<i>Leptospermum myrtifolium</i>	Heath Tea-tree	1.5 m		x	x	x	x	
<i>Leptospermum obovatum</i>	River Tea-tree	2–3 m		x		x	x	
<i>Lomatia myricoides</i>	Long-leaf Lomatia	5 m	x	x		x		x
<i>Lythrum salicaria</i>	Purple Loosestrife	1.5–2 m		x		x		
<i>Melaleuca decussata</i>	Totem-poles	2 m	x	x	x		x	x
<i>Melaleuca ericifolia</i>	Swamp Paperbark	5 m		x	x		x	
<i>Melaleuca lateritia</i>	Robin Red-breast	1.5 m	x	x	x		x	x
<i>Melaleuca parvistaminea</i>	Shoalhaven Tea-tree	2 m	x	x	x	x	x	
<i>Melaleuca thymifolia</i>	Thyme Honey-myrtle	1 m		x	x			x
<i>Prostanthera lasianthos</i>	Victorian Christmas Bush	4 m	x	x	x	x	x	x
Ground covers, grasses and reeds								
<i>Carex appressa</i>	Tall Sedge	1 m		x		x	x	
<i>Correa 'Mannii'</i>	Mann's Correa	0.6 m	x	x	x		x	x
<i>Daviesia latifolia</i>	Hop Bitter Pea	1.5 m	x		x	x		
<i>Daviesia leptophylla</i>	Slender Bitter Pea	1.5 m	x		x	x	x	
<i>Daviesia mimosoides</i>	Narrow-leaf Bitter Pea	1–2 m	x		x	x	x	
<i>Dodonaea viscosa</i>	Hopbush	3 m	x		x	x	x	
<i>Grevillea juniperina</i>	Juniper Grevillea	0.5–2 m	x	x	x	x	x	x
<i>Hardenbergia violacea</i>	False Sarsaparilla, Coral Pea	0.5 m	x		x	x	x	
<i>Lomandra longifolia</i>	Mat Rush	0.6 m	x	x	x	x	x	
<i>Phragmites australis</i>	Common Reed	2 m		x	x	x	x	
<i>Poa labillardieri</i>	Poa Tussock Grass	0.5 m	x	x	x	x	x	
<i>Pultenaea subspicata</i>	Bush Pea	0.2 m	x		x	x		
<i>Typha sp.</i>	Cumbungi	2 m		x		x	x	
<i>Xerochrysum viscosa</i>	Golden Everlasting	0.2 m	x		x	x	x	

APPENDIX B: UNDERSTOREY SPECIES

Following is a list of some understorey species appropriate to this region. There are more varieties of many of these species but you should always check factors such as frost hardiness and drainage required.

Acacia —

<i>mearnsii</i>	Late Black Wattle
<i>melanoxydon</i>	Blackwood
<i>rubida</i>	Red-stem Wattle
<i>dealbata</i>	Silver Wattle
<i>boormanii</i>	Snowy River Wattle
<i>decurrens</i>	Early Black or Green Wattle
<i>flexifolia</i>	Bent-leaf Wattle
<i>genistifolia</i>	Early Wattle
<i>uncinata</i>	Weeping Wattle
<i>implexa</i>	Lightwood
<i>floribunda</i>	White Sallow Wattle

Banksia —

marginata, spinulosa, ericifolia

Bursaria lasiophylla

Xerochrysum viscosum

Callistemon citrinus

Daviesia mimosoides

Grevillea —

arenaria, juniperina, victoriae, rosmarinifolia

Hakea sericea, dactyloides

Hardenbergia violacea

Indigofera australis Austral Indigo

Kunzea ambigua

Lomandra longifolia Mat Rush

Leptospermum lanigerum Tea-tree

Pultenaea subspicata Bush Pea

Dillwynia is another pea species

For wet areas

Acacia retinodes Wirilda or Swamp Wattle

Callistemon sieberi Alpine Bottlebrush

Leptospermum myrtifolia Heath Tea-tree

Melaleuca ericifolia Swamp Paperbark

Useful tree species for shelter-belts and elsewhere are

Cypress Pine (*Callitris endlicheri*), She-Oaks (*Allocasuarina verticillata* and *littoralis*), and River She-Oak (*Casuarina cunninghamiana*).

APPENDIX C: LISTED THREATENED SPECIES

These lists may seem lengthy, but they are not a complete count of threatened flora and fauna in the catchment.

Threatened fauna		
Name	Description	Known habitat/some areas
Pink-tailed Worm Lizard (<i>Aprasia parapulchella</i>)	Brown-grey with a long pinkish or red-brown tail. Length to 25 cm. (Vulnerable)	Sloping areas with flat surface rock and native grasses along river corridors. Locally: Barracks Flat (Queanbeyan), Googong Dam foreshores, Murrumbidgee River and Molonglo River. Associated with colonies of small black ants.
Striped Legless Lizard (<i>Delma impar</i>)	Up to 30 cm long (mostly tail), grey-brown, distinguished by dark lines running down the length of the body. (Vulnerable)	May be found in natural grassland habitat dominated by tussock-forming species such as Kangaroo Grass, Spear Grass and Wallaby Grass. Also found in grasslands modified with exotic species. Locally: near Sutton; also in native grasslands near Gungahlin and the Majura and Jerrabomberra Valleys in the ACT, Yass, Goulburn and Cooma.
Little Whip Snake (<i>Suta flagellum</i>)	Up to 40 cm long. Light tan with black 'fishnet' pattern on scales and black markings on head. (Vulnerable)	Open woodland, natural grassland and rocky habitat. May be found under rocks and logs on well-drained hillsides. (Feeds on small skinks, frogs and invertebrates.)
Golden Sun Moth (<i>Synemon plana</i>)	Day-flying moth often mistaken for a butterfly (seasonal November–December). Females orange, black and white. (Endangered)	Native grasslands — native Wallaby Grass essential. Locally: the Ginninderra Road area north of the ACT, also native grasslands at The Poplars and Letchworth in Queanbeyan.
Rosenbergs Monitor (<i>Varanus rosenbergi</i>)	Yellow and black goanna up to 2 metres in length. Distinguished from more common Lace Monitors by narrow bands across tail. (Vulnerable)	Found in dry open forest and grassy woodland habitats. Shelters in burrows, hollow logs and rock crevices. Found only in a couple of areas of NSW — one is the escarpment around Queanbeyan and towards Lake George; and west of Bungendore.
Superb Parrot (<i>Polytelis swainsonii</i>)	Large grass-green parrot. Males have yellow forehead and throat with red band between head and breast. (Vulnerable)	Seasonal visitor which nests in hollows of large trees near watercourses, in open woodlands, or in dead or living isolated paddock trees, during late spring and early summer. Locally: in the Wallaroo Rd area between Yass Shire and the ACT, also in Sutton area.
Common Bent-wing Bat (<i>Miniopterus schreibersi</i>)	Black-reddish brown bat to 6 cm in length. (Vulnerable)	Found in well-timbered valleys foraging on small insects above the tree canopy.

<i>Threatened fauna</i>		
<i>Name</i>	<i>Description</i>	<i>Known habitat/some areas</i>
Other micro-bats threatened by loss of native forest habitat Great Pipistrelle (<i>Falsistrellus tasmaniensis</i>) Greater Long-eared Bat (<i>Nyctophilus timoriensis</i>)	(Vulnerable) (Vulnerable)	Found in forested habitats in Tinderry Nature Reserve and in Kosciuszko National Park. Found in dry open woodlands and River Red Gum forests, locally in Tinderry Nature Reserve.
Koala (<i>Phascolarctos cinereus</i>)	(Vulnerable)	Found mainly in Ribbon Gum (<i>E. viminalis</i>), Red Stringybark (<i>E. macrorhyncha</i>), Brittle Gum (<i>E. mannifera</i>) and Scribbly Gum (<i>E. rossii</i>). Limited numbers recorded south of Queanbeyan along the ranges, and the area west of Brindabella National Park, substantial numbers north of Bungendore.
Tiger Quoll (or Spot-tailed Quoll) (<i>Dasyurus maculatus</i>)	Males up to 7 kg and females 4 kg. Dark brown fur and white spots. (Vulnerable)	Habitats include rainforest, tall open forest and coastal heathland. Makes dens in fallen hollow logs or among large rocky outcrops. Locally: in the escarpment forests south and east of Queanbeyan, and in Tallaganda State Forest and Brindabella National Park.
Barking Owl (<i>Ninox connivens</i>)	Medium-sized owl, smoky-brown above and whitish below. (Vulnerable)	Name from distinctive 'wook-wook' call. Inhabits dry open forests and woodlands, foothills and timber along watercourses, and in forests and woodland penetrating into more open country. Nests in hollows in large old eucalypt trees, roosts in tall densely foliated understorey trees.
Giant Burrowing Frog (<i>Heleioporus australiacus</i>)	Large frog, dark-brown to bluish-black with yellow spots on sides. (Vulnerable)	Inhabits a wide variety of forest, woodland and heathland, but not open country or farmland. Also forages in forest several hundred metres from streams and waterways. Locally: recorded from just north of Tinderry Nature Reserve.
Freckled Duck (<i>Stictonetta naevosa</i>)	Dark grey-brown, narrow slate-grey bill, speckled with off-white markings. (Vulnerable)	Inhabits permanent freshwater swamps and creeks. During drier times, moves off ephemeral breeding swamps to large, permanent open waters such as lakes and reservoirs. Locally: on Lake George and around Bungendore.
Olive Whistler (<i>Pachycephala olivacea</i>)	Small to medium-sized, grey, brown, and olive with white throat. (Vulnerable)	Mainly inhabits higher altitude (above 500 m) eucalypt forests, migrating in winter from the mountains to the lower altitudes. Prefers mountain scrubs where it feeds on berries and insects. Locally: along wooded ridges within Tallaganda State Forest, also in Brindabella National Park and at Lake George.
Regent Honeyeater (<i>Xanthomyza phrygia</i>)	Medium-sized, blackish bird, boldly marked with yellow and with brilliant flashes of yellow in the wings and tail. (Endangered)	Regular visitor, dependent on box-gum woodland habitat. Relies on opportunistic nectar sources. Found in the western edge of Tallaganda State Forest and anywhere preferred eucalypt species are flowering.
Swift Parrot (<i>Lathamus discolor</i>)	Streamlined green parrot with a dusky red spike-shaped tail, red forehead and throat, and red underwings seen in flight. (Vulnerable)	Regular visitor from Tasmania. Like the Regent Honeyeater, the Swift Parrot is dependent upon box-gum woodland habitats and also eats nectar of winter-flowering eucalypts. Usually seen flying very fast through woodlands in flocks.

Some other recently listed threatened woodland birds found in the Upper Murrumbidgee Catchment include Brown Treecreeper, Hooded Robin, Diamond Firetail, Speckled Warbler.

Threatened Flora

Austral Toad-flax (<i>Thesium australe</i>)	Biennial forb to 30 cm long. (Vulnerable)	Found in grassland or grassy woodland, grows among tussocks often in damp sites, flowers from November to January. Parasitic on Kangaroo Grass.
Button Wrinklewort (<i>Rutidosia leptorhynchoides</i>)	Perennial herb with yellow button-like head 8–15 mm wide. (Endangered)	Found in grassland or open grassy woodlands.
Tarengo Leek Orchid (<i>Prasophyllum petilum</i>)	Orchid with fragrant pinkish-mauve to greenish flowers to 30 cm tall. (Endangered)	Woodland or grassland in fertile soil.
Small Purple Pea (<i>Swainsona recta</i>)	Perennial herb 30 cm high, purple pea-like flowers. (Endangered)	Found in grassy understorey of woodlands and open forests. One of the largest known populations is in Palarang Shire.
Pale Pomaderris (<i>Pomaderris pallida</i>)	Compact rounded shrub 1–1.5 m high, pale green-white leaves covered in soft star-shaped hairs; small pale-yellow flowers. (Vulnerable)	Usually grows in shrub communities surrounded by Brittle Gum and Red Stringybark or Callitris woodland.
Creeping Hop-bush (<i>Dodonaea procumbens</i>)	Prostrate shrub to 1.5 m in diameter, distinctive fruit up to 13x10 mm with 3–4 wings. (Vulnerable)	Grows in open grassland or fringing eucalypt woodland, associated with Snow Gum and Yellow Box; often colonises road embankments.

Other threatened plant species in the UMC include:

- Mauve Burr-daisy (*Calotis glandulosa*)
- Monaro Golden Daisy (*Rutidosia leiolepis*)
- Silky Swainson-pea (*Swainsona sericea*)
- Bredbo Gentian (*Gentiana bredboensis*)
- Buttercup Doubletail Orchid (*Diuris aequalis*)
- Crimson Spider Orchid (*Caladenia concolor*)
- Tesselated Orchid (*Caladenia tessellata*)
- Silver-leaved Gum (*Eucalyptus pulverulenta*)
- Small-leaved Gum (*Eucalyptus parvula*)
- Trailing Monotoca (*Monotoca rotundifolia*)
- Wee Jasper Grevillea (*Grevillea iaspicula*)
- Yass Daisy (*Ammobium craspedioides*)

There are 3 listed threatened ecological communities in the region:

- Grassy Box Woodlands, Temperate Native Grasslands and Montane Wetland.

You might like to start with some of the hardy survivors:

Wet areas – *Eucalyptus camphora*, *Eucalyptus aggregata*, *Eucalyptus stellulata*, *Eucalyptus viminalis*, *Acacia dealbata*, *Acacia pravissima*, *Callistemon pallidus* and *Melaleuca ericifolia*.

Dry areas – *Eucalyptus macarthurii*, *Eucalyptus mannifera*, *Eucalyptus viminalis*, *Eucalyptus pauciflora*, *Eucalyptus nicholii*, *Banksia marginata*, *Acacia dealbata*, *Acacia decurrens*, *Acacia boormanii*, *Acacia cardiophylla*, *Acacia mearnsii*, *Acacia rubida*, *Acacia implexa*, *Hakea* species and *Grevillea* species.



USEFUL CONTACTS

Upper Murrumbidgee Catchment Coordinating Committee

www.umccc.org.au
PO Box 1348 Dickson ACT 2602
Phone 02 6207 2999

Government Contacts in the Upper Murrumbidgee Catchment

The Snowy River Shire Council

PO Box 143, BERRIDALE NSW 2628
Phone 02 6451 1195 Fax 02 64563337
Email records@snowyriver.nsw.gov.au
Web address <http://www.snowyriver.nsw.gov.au>

Cooma–Monaro Shire Council

PO Box 714, 81 Commissioner St, COOMA NSW 2630
Phone 02 6455 1777 Fax 02 6455 1799
Email council@cooma.nsw.gov.au
Web address <http://cooma.nsw.gov.au>

Palerang Council

PO Box 348, 10 Majara Street, BUNGENDORE NSW 2621 OR
144 Wallace St, BRAIDWOOD NSW 2622
Phone 1300 725 025 (within council area) 02 6238 8111
Fax 02 6238 1290
Email records@palerang.nsw.gov.au
Web address <http://www.palerang.nsw.gov.au>

Queanbeyan City Council

PO Box 90, 257 Crawford St, QUEANBEYAN NSW 2620
Phone 02 6299 6000 Fax 02 6298 4666
Email council@qcc.nsw.gov.au
Web address <http://www.qcc.nsw.gov.au>

Upper Lachlan Council

PO Box 10, 44 Spring St, CROOKWELL, NSW 2583 OR
PO Box 42, 123 Yass Street GUNNING, NSW 2581 OR
29 Orchard St TARALGA NSW 2580
Phone 02 4830 1000 Fax 02 4832 2066
Email council@upperlachlan.nsw.gov.au
Web address <http://www.upperlachlan.nsw.gov.au>

Yass Valley Council

PO Box 6, 209 Comur St, YASS NSW 2582
Phone 1300 553 652 or 02 6226 1477 Fax 02 6226 2598
Email council@yass.nsw.gov.au
Web address <http://www.yass.nsw.gov.au>

ACT - Department of Territory and Municipal Services (TAMS)

GPO Box 158, CANBERRA CITY, ACT 2601
Macarthur House, 12 Wattle St, LYNEHAM ACT 2602
Phone Canberra Connect 13 22 81 www.tams.act.gov.au

Department of Environment, Climate Change and Water – includes NPWS, NSW Office of Water & Environment Protection Authority (EPA) NSW

Queanbeyan: Phone 02 6229 7000
11 Farrer Place Queanbeyan

Sydney Head Office: Phone 02 8281 777
information@environment.nsw.gov.au
www.environment.nsw.gov.au

Pollution Line Information & pollution incidents
Phone 131 555

NSW Department of Primary Industries - part of Industry and Investment NSW

Queanbeyan 28 Morisset St Queanbeyan
Phone 02 6298 0888
Cooma 39 Bombala St Cooma Phone 02 6452 3411
Yass 25 Waroo Rd Yass Phone 02 6226 2199
www.dpi.nsw.gov.au

Fire

NSW Rural Fire Service

www.rfs.nsw.gov.au Phone 1800NSWRFS 1800679737

Yass Southern Tablelands Zone

14/10 Laidlaw St Yass Phone 02 6226 3100

Queanbeyan Lake George Zone & Head Office

10 Ellerton Drive Queanbeyan Phone 02 6297 1840

Cooma Monaro Team

11 Geebung St Cooma Phone 02 6455 0455

ACT Emergency Services Authority www.esa.act.gov.au

123-125 Carruthers St Curtin ACT 2605
Phone 02 6207 8444

ACT Fire Brigade Phone 02 6207 8363

ACT Rural Fire Service Phone 02 6207 8609

Other agencies

Livestock Health and Pest Authorities (LHPA)

Head Office 161 Kite St Orange NSW 2800
Phone 02 6391 3242

Braidwood – Court House Building 170 Wallace St
Braidwood Phone 02 4842 2536

Yass – 13 Mitchell St Yass Phone 02 6226 1155

Cooma – 5 Dawson St Cooma Phone 02 6452 1122
www.lhpa.org.au

Murrumbidgee Catchment Management Authority

Phone 02 6932 3232 (Wagga Wagga Head Office)

Yass: Phone 02 6118 6010

Queanbeyan: Phone 02 6229 7700

Cooma: Phone 02 6452 4150

www.murrumbidgee.cma.nsw.gov.au

ActewAGL (for matters relating to water supply in the ACT and Queanbeyan region)

GPO Box 366 CANBERRA CITY ACT 2601
Phone 13 14 93

**IN EVENT OF FIRE OR
EMERGENCY RING 000
(24 HOURS)**

USEFUL CONTACTS

Some non-government organisations

Greening Australia Capital Region

Phone 02 6253 3035 www.greeningaustralia.org.au

Grassy Box Woodlands Conservation Management Network

Phone 02 6298 9709 www.gbwcmm.net.au

FloraBank

www.florabank.org.au Phone 02 62021600
c/- GA PO Box 74 Yarralumla ACT 2600

Australian Native Plant Society

www.asgap.org.au PO Box 217 Civic Square ACT 2608

Friends of Grasslands

Phone 02 6241 4065 info@fog.org.au
PO Box 987 Civic Square ACT 2608

WILDCARE Queanbeyan Inc. (NSW animals only)

Phone 02 6299 1966 PO Box 1404 Queanbeyan
communications@wildcare.com.au

RSPCA ACT (ACT animals only)

Phone 1300 477 722
Wildlife Phone 0413 495 031
12 Kirkpatrick St Weston
PO Box 3082 Weston Creek ACT 2611

ACT Snakes and Kangaroos and Domestic Animal Services.

Phone Canberra Connect 13 22 81

Conservation Council of the ACT Region

www.consact.org.au
3 Childers St ACTON ACT
Phone 02 6229 3200

Landcare Networks (made up of individual landcare groups)

Yass Area Network of Landcare Groups
www.yan.org.au

PO Box 23, Yass NSW 2582 Phone 02 6226 1433

Upper Murrumbidgee Landcare Committee

PO Box 1573, Fyshwick ACT 2609
coordinator@umlc.org.au

Molonglo Catchment Group

PO Box 1573 Fyshwick ACT 2609 Phone 02 6299 2119
www.molonglocatchment.com.au

Ginninderra Catchment Group

PO Box 446 Holt ACT 2615 Phone 02 6278 3309
www.ginninderralandcare.org.au

Southern ACT Catchment Group

PO Box 2056 Kambah ACT 2902 Phone 02 6296 6400
www.sactcg.org.au

Waterwatch

Phone 13 22 81 www.act.waterwatch.org.au

Produced with the assistance of funds made available by:



ACT Government
ACT Environment Grant 2009–10



Molonglo Catchment Group



Upper Murrumbidgee Landcare Committee



ActewAGL
ACT Regional Source Water Protection Program



Cooma-Monaro Shire Council



ACT Waterwatch



Gearys Gap Wamboin Landcare Group

THIS BOOK IS PRINTED ON PRECISION: Precision is PEFC Certified and made from elemental chlorine free bleached pulp sourced from sustainably managed forests and non controversial sources. It is manufactured by an ISO 14001 certified mill using renewable energy sources.