



Local Land
Services
Central West



Australian Government



Reading the landscape

Signs of impact in
conservation areas





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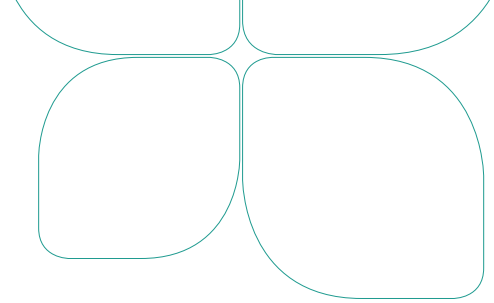
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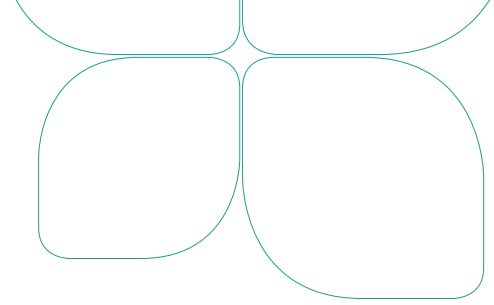


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Introduction



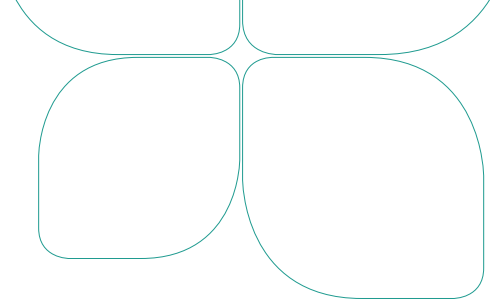
Introduction

Many landholders are interested in conserving native vegetation and habitat for wildlife on their properties. The condition of remnant native vegetation on private property in Central West NSW varies considerably. Very few areas are 'intact' (close to their original state), with most sites having had some level of disturbance in the past. Most sites require ongoing management to repair past damage and to prevent future degradation.

Restoring native vegetation and habitat features can be a slow process and it is often hard to tell if management efforts are having the desired effect. This guide outlines some of the key indicators that you should look for to determine if the health of your conservation area is improving or declining.



Identifying signs of impact in conservation areas helps to guide management actions that will improve or maintain the health of the vegetation and habitat. Credit: Mikla Lewis.



What is reading the landscape?

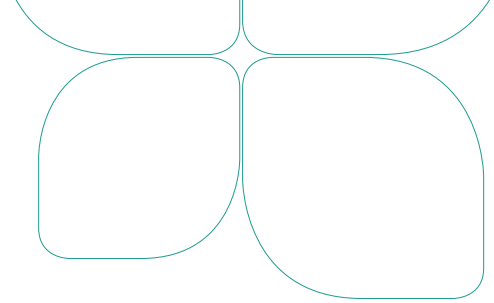
Reading the landscape is about looking for signs or clues that help to piece together what is happening in the landscape. This guide focuses on signs of both positive and negative impacts within conservation areas.



Credit: Simone Cottrell/ OEH.

It is important for landholders to be able to 'read the landscape' and recognise and understand the signs of vegetation and habitat decline as well as what is impacting their sites. This insight is needed so that conservation and restoration efforts can be focused and appropriate action can be taken to prevent further decline and loss of both plant and animal species.

It is also important that landholders can recognise positive signs of improvement so they know when they have made good management decisions and can continue to do so.



How do I read the landscape?

Reading the landscape is a relatively easy task, provided you spend time walking through your conservation area and making regular observations. As you become more familiar with the different signs, you should be able to walk into your conservation area and 'tell a story' of what has happened since you were last there. This will then help you to determine if the health of the area is improving or declining.

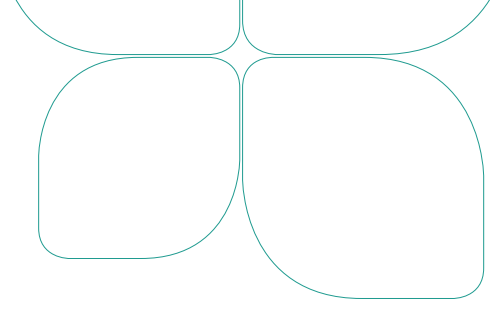
It is important to remember that sites that have had a higher level of disturbance in the past will require a longer period of time to recover and may take longer to show signs of improvement.



Regularly walking through your conservation area and taking a closer look at it will help you to become more alert to the signs of impact. It may be helpful to record what you see (perhaps by taking photos or writing it in a diary) so that you don't forget it next time. Credit: Mikla Lewis.



**Signs when
things are
going right....**



Signs when things are going right....

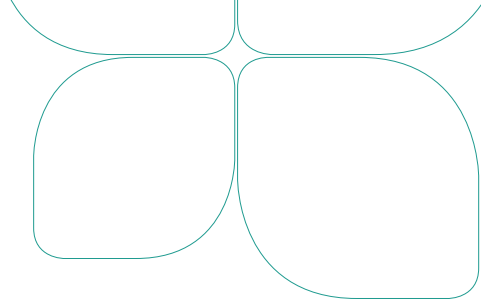
Some key signs that your management is having a positive impact and the health of the vegetation and habitat is improving are outlined in this section. If you see these things happening, you're on the right track and should continue your existing management. Don't forget to keep monitoring the conservation area to ensure things continue to improve.

Biotic soil crusts

Lichens and mosses are some of the first things to recolonise an area after disturbance and can indicate that a previously disturbed site is now beginning to repair itself.



*Biotic soil crusts are the first sign of recovery.
Credit (bottom): Mikla Lewis.*



Regeneration and increased vegetation cover

New plant growth is the next sign that things are heading in the right direction. Regeneration should be occurring across all native overstorey, understorey and groundcover species. However, the first layer to regenerate is often the ground layer. This then provides a more favourable medium for the germination of native trees and shrubs.



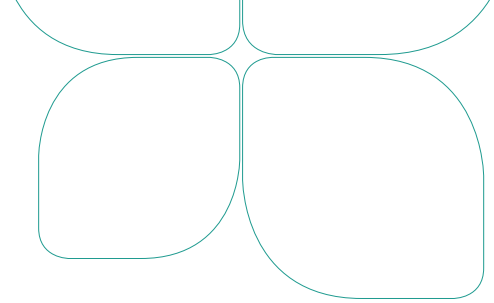
Acacia shrub regenerating. Credit: Mikla Lewis.



New growth! Credit: Mikla Lewis.



Down the track, regeneration will lead to an increase in the overall amount of native vegetation within your conservation area. Credit: Mikla Lewis.



Increased plant species diversity

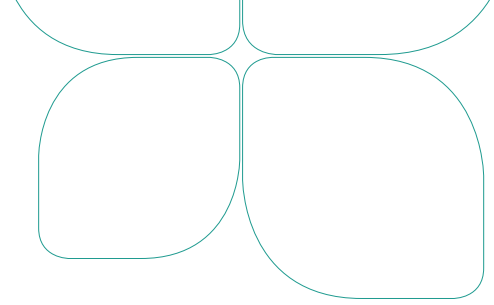
As the health of the vegetation community improves, it is likely you will start to see different plant species emerge, with perennial natives beginning to dominate. This may take some time, particularly if the site was heavily disturbed in the past. Likewise, if the site was fertilised, the level of phosphorus in the soil may still be too high for many native plants to survive and it may be some time before new plants emerge. A list of reference books is provided at the back of this guide to help you identify the plants in your conservation area.



Plant diversity in the ground layer is a positive sign.



The diversity of the vegetation should reflect that of the original vegetation community but, in general, the greater the species diversity, the better. Your Local Land Services Officer can help you to determine what species should be present.



Fringe lily



Donkey-ears

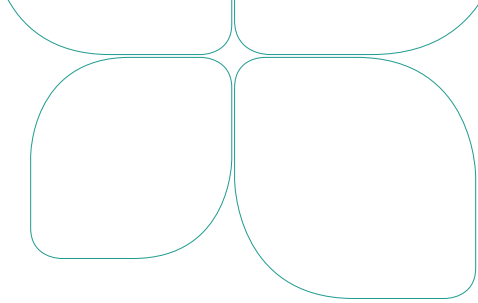


Green spider-orchid



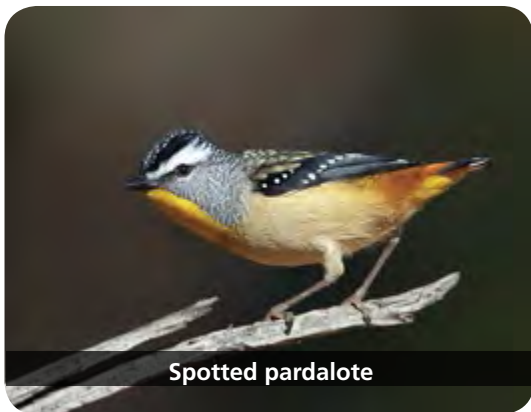
Bearded orchid

Sensitive plants such as orchids and lilies are often the last groundcover plants to re-colonise an area but they are well worth the wait! Credit: Mikla Lewis.



Increased animal species diversity

Another great indication as to whether or not a conservation area is healthy is if a variety of native animals are using it! There should be a good range of species as well as a good number of each species—one species should not dominate the area.



Spotted pardalote



Antechinus

Rewards! It is a wonderful feeling when you spot a different animal using your conservation area. Credits: Peter Jacobs (top) and Ken Stepnell/ OEH (bottom).

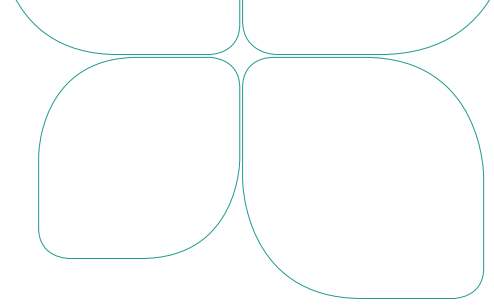


Superb fairy-wren



Eastern yellow robin

Some animal species can act as indicators. For example, the presence of small woodland birds indicates that the understorey is adequate. Credits: John Turbill/ OEH (top) and Rosie Nicolai (bottom).



Caper white butterfly



Ant nest

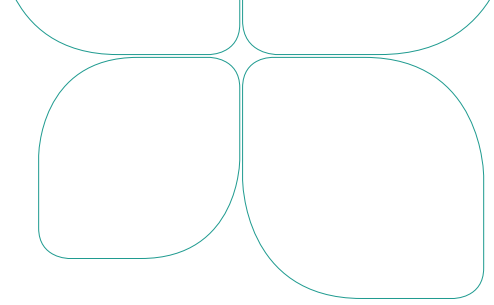


Evidence of dung beetles

Insects may be small but they play incredibly important roles in ecosystem processes such as pollination, nutrient cycling and seed dispersal. Increased insect activity is a positive sign. Credits: Mikla Lewis.

Fauna surveys can reveal the range of animal species using an area. These surveys can be as simple as visual observations of birds, mammals, reptiles, invertebrates and other animals or may be more detailed studies conducted by experts utilising cameras, sound recordings and catch and release traps.

There are a number of field guides listed in the references at the back of this guide to help you identify animals using your habitat. Wildlife can be hard to spot, so it may be easier to look for other signs of their presence such as animal droppings, tracks and remains, nests and burrows or evidence of trampling, grazing and scratching.



Koala droppings



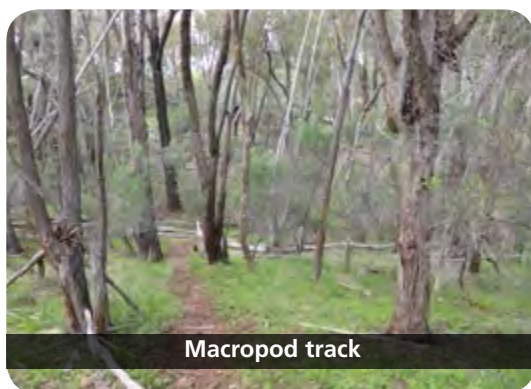
Goanna tracks



Kangaroo skull



Wallaby tracks

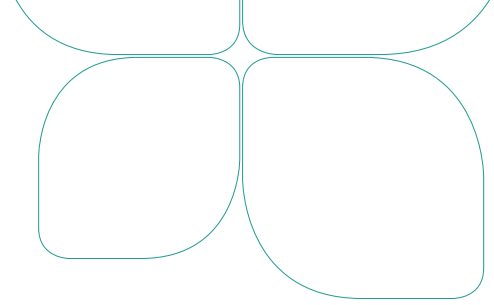


Macropod track

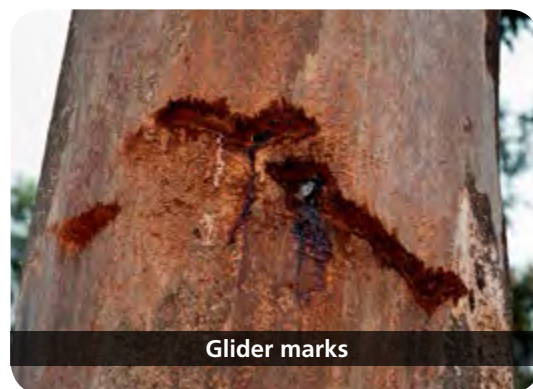


Echidna dropping

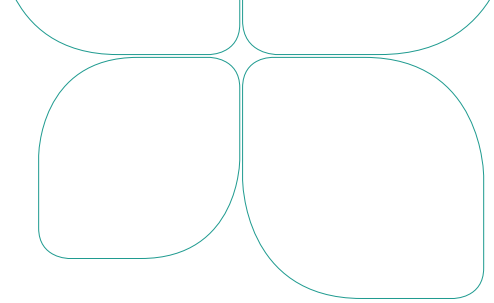
Animal droppings, tracks and remains can tell you what animals have moved through your conservation area. Look in areas where animals might travel, feed or camp. Patches of soft ground or sandy areas such as creek beds will make it easier to identify tracks. Take note of the amount of dung as it may give you an idea of the size of animal populations using the area. Credits: Rosie Nicolai (top left), C. Perrers/ OEH (top right) and Mikla Lewis (middle and bottom).



Nests and burrows provide an indication of the animals that are using your conservation area for shelter and nesting. Credits: Mikla Lewis (left) and Rosie Nicolai (right).



Evidence of **trampling, grazing and scratching** can also provide clues as to what is using your conservation area. For example, the marks left on trees by koalas when climbing or gliders, who use their large incisors to tap into tree trunks to feed on sap, are a useful sign of their presence. Credits: Rosie Nicolai (top left), John Turbill/ OEH (top right), Mikla Lewis (bottom left) and Shane Ruming (bottom right).



Fallen timber and leaf litter accumulating

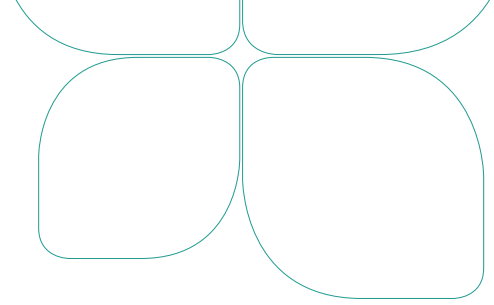
Accumulation of fallen timber and leaf litter is a sign that disturbance has been reduced and natural processes such as nutrient cycling are beginning to function.



Debris plays an important role in nutrient cycling, plant germination and soil stabilisation as well as providing habitat. Look for abundant fallen timber, ranging in size, and a ground layer that contains decomposing leaf litter.



**Signs when
things aren't
quite right...**



Signs when things aren't quite right...

Conservation areas can quickly degrade if they are not managed appropriately. This section outlines some key signs that pressures are upsetting the natural balance and the health of the vegetation and habitat is declining (or just not improving). If something isn't quite right, you may need to change the way you are managing the area or you may just need to give the area more time to recover. You should closely monitor the area to make sure new management actions are having the desired effect.



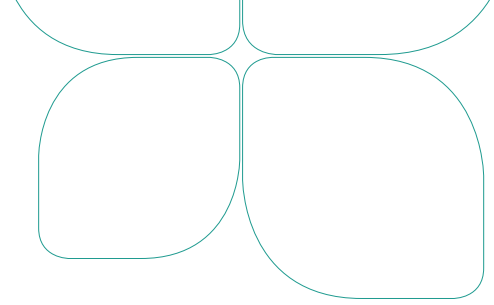
A site overgrazed by kangaroos. Evidence includes plants chewed low to the ground, bare patches, poor diversity in the ground layer and an abundance of kangaroo droppings.

Grazing pressure

When too many animals (domestic livestock, feral animals and/ or native herbivores) are left to graze an area for too long, sites can become overgrazed. This leaves little opportunity for plants to regenerate, which will eventually result in the loss of plant species, groundcover and other vegetation altogether. Insufficient vegetative cover can also lead to land degradation problems such as erosion.



A native perennial grass that has been overgrazed. Plants should not be repeatedly grazed to this level. Total grazing pressure (of native, domestic and feral animals) must be managed. This may mean reducing kangaroo populations and excluding domestic stock (at least until the site recovers) and controlling feral animals.



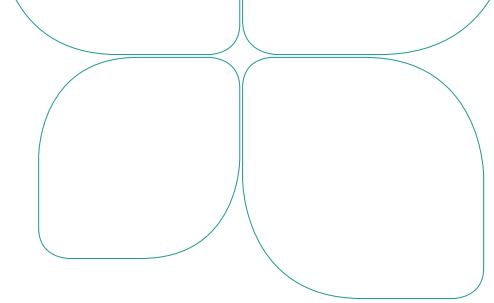
This site is grazed by sheep and is showing signs of grazing pressure with poor groundcover and poor species diversity.



Heavily grazed landscapes often have the native understorey layer missing and an exotic ground layer that is reduced to low cover.



Stock camps can cause issues with the high nutrient levels left behind favouring exotic plants and creating weed hotspots.



Poor plant health

Plants will inevitably die from natural causes. However, if a large portion of the plants within your conservation area appear unhealthy or trees are dying prematurely, you should investigate further to find out the cause. Sick trees will only get sicker if nothing is done. You should also ensure that there is regeneration occurring so that there are younger trees to replace those that die.

Dieback

Tree dieback is a decline in condition that may result in the premature death of the tree. It can be caused by a variety of factors such as insect defoliation, drought, salinity, fungal diseases, herbicide spray drift, girdling of trees by stock, disturbance to the roots, mistletoe infestation, major climatic events (windstorms, hail, fire) as well as natural ageing.

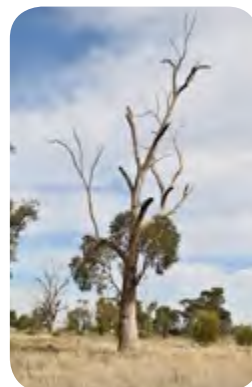
Stages of tree dieback



1. At first, the branch tips die.



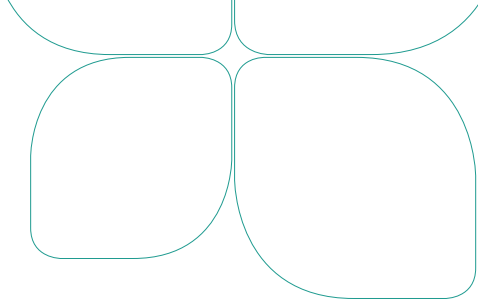
2. Trees that are affected by dieback typically have poor crowns, with sparse foliage and a large proportion of dead branches protruding from the top of the tree. This is followed by extensive defoliation.



3. New shoots will then grow out of the trunk and major branches, as they would after a fire. This survival mechanism is called 'epicormic growth' and it will appear as though the tree is recovering. In most cases it is not. Most epicormic growth will die and root systems will be reduced as the foliage continues to die.



4. Ultimately, the tree will die if the cause of the dieback is not addressed early enough to allow the tree to recover.



Mistletoe infestations

Heavy infestations of mistletoes are a sign that the natural system is out of balance, with controlling agents such as possums, gliders and insects no longer able to maintain a balance between mistletoe numbers and host trees.



Mistletoe in ironbark

Mistletoes are native parasitic plants that naturally occur in almost all types of woody vegetation in Australia. Most trees can handle a few mistletoe plants but heavy infestations absorb too much of the trees water and nutrition and can harm or kill the host tree. An increasing abundance of mistletoe is a sign that woodland ecological health and diversity is declining.

Insect attack

Healthy plants can usually tolerate insect attacks, with new growth and secretion of resin combating the effects of the insect attack. Heavy insect infestations often occur in plants that are already weakened by other factors so may be a sign of poor plant health.



Itchy grubs

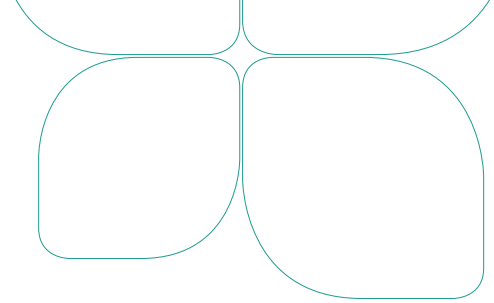


Itchy grub nest in myall tree



Evidence of borers

Insects such as beetles, psyllids, leaf hoppers, scale and caterpillars may be seen defoliating trees while borers may be found attacking the woody parts of plants, particularly species such as wattles and kurrajongs. Credits: Mikla Lewis (top and bottom).



Poor plant diversity

A lack of structural diversity in vegetation communities (for example, no understorey or native groundcover) can indicate that the level of disturbance is/ has been too high and native plants have been unable to regenerate or colonise.



A highly disturbed site that lacks both structural diversity and species diversity. It mainly consists of mature white box trees (all around the same age) and a groundcover of Lucerne. It would take a lot of effort to restore the natural function of this site.

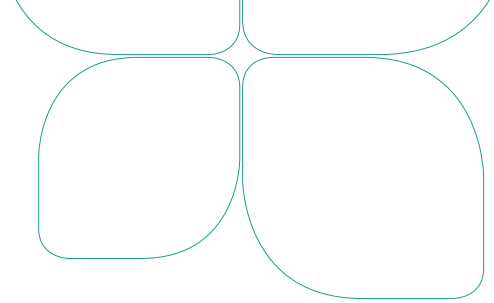
Some conservation areas appear healthy and have good native vegetation cover; however, cover alone does not necessarily tell you whether or not the ecosystem is healthy. You should look at the how many different species there are (the richness) and how many of each species there are (the evenness). Monocultures or sites dominated by one species support fewer animal species and reduce the 'resilience' of the site.



While there is good native groundcover on this site, it consists mainly of one perennial grass species. Grazing this area for a short period of time with a high number of animals would help to create a little bit of disturbance to encourage new growth and provide an opportunity for other species to regenerate.



Following flooding in 2010, river red gums regenerated profusely on this site. While the vegetation may appear to be healthy now, this dense, monoculture of river red gum saplings will cause issues in the future. Thinning may be required to enable the trees to grow to full maturity and to allow groundcover and an understorey to establish.



Poor animal diversity

Conservation areas that contain few habitat features will not attract many animals. As with plants, if one particular species dominates the area, it can indicate an imbalance in the ecosystem.



Noisy miners prefer habitats where there is no understorey or structural complexity. They are an aggressive bird that will drive other, smaller birds out of their habitat. Encouraging regeneration of the understorey or planting some shrub species will help to restore the balance.

Invasive plants

Environmental weeds

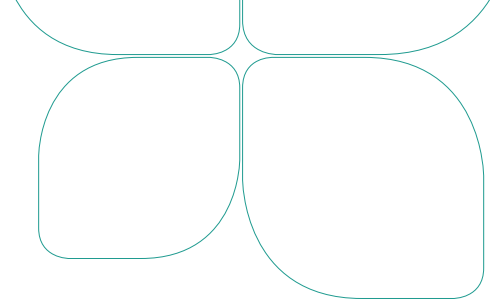
Environmental weeds compete with and displace native vegetation, altering the structure of the vegetation community and habitat for native wildlife. Environmental weeds may be annual or perennial plant species and include

grasses, ferns, climbers, herbs, shrubs and trees. Some species, such as blackberry, have long been considered to be pest plants while other species, such as Lucerne are highly valued for agricultural purposes.

Sites that have a groundcover dominated by annual weeds often indicate a history of set stocking and fertiliser use.



Environmental weeds such as African boxthorn and blackberry can quickly spread and choke out native vegetation. They are large shrubs with woody stems and spiky foliage, making them difficult to control. Credit: Craig Hunter (top).



Perennial weeds such as these are of particular concern because they can be difficult to control. Credits (clockwise from top left): Harry Rose, Eyeweed, Harry Rose, John Tann, Rosie Nicolai and John Tann.

Invasive native scrub

Invasive plants do not necessarily have to be exotic. Many native tree and shrub species can invade vegetation communities or regenerate densely following disturbances (such as overgrazing). Invasive native scrub (INS) growth can be so thick that it prevents sunlight filtering through to the ground level, inhibiting the regeneration of other species of native plants and leaving the soil bare and prone to erosion.

INS significantly alters the composition of the vegetation community and limits both the carrying capacity of the land for livestock and the availability of habitat for wildlife. The dense forest can also make property access difficult and may harbour pest species such as goats, foxes, cats and pigs.



White cypress pine



Broad-leaf hopbush and silver cassia

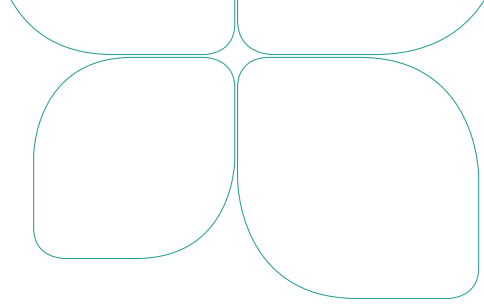


Bimble box

Some of the invasive native scrub species listed for the Central West Local Land Services area.



Invasive native scrub (INS) is a serious issue in the Central West region, adversely impacting habitats, farm production and wider landscape health.



Mistletoe

As previously discussed, heavy infestations of native mistletoes can also indicate that the natural system is 'out of balance'.



Credit: Mikla Lewis.

Identifying invasive plants

Identifying exotic weeds, particularly nationally and regionally significant weeds as well as being able to recognise when invasive native scrub and mistletoes are becoming a problem is important. Reference books that can assist with weed identification are listed at the back of this guide or talk to your Local Land Services Officer.



Learning to correctly identify plants is an important skill. The plant on the top may look like a capeweed, when in fact it is a native plant commonly called 'Austral bear's ear'. The plant on the bottom is also a native—a Narrawa burr, which is often confused for exotic solanums such as silver-leaf nightshade. Credit: Mikla Lewis.

Invasive animals

Feral animals

Feral animals such as pigs, goats, rabbits and deer can destroy native vegetation and habitat through trampling, grazing, wallowing, rubbing and digging. These actions may also lead to land degradation issues such as erosion.



Foxes, cats and wild dogs prey directly on native animal species.



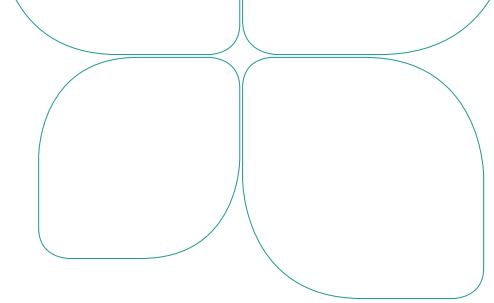
Credit: Keith Gillett/ OEH



Credit: Mark Irvin/ OEH



Credit: OEH



Other introduced species such as European honey bees displace native wildlife by occupying habitat, such as tree hollows, and may interfere with pollination mechanisms.

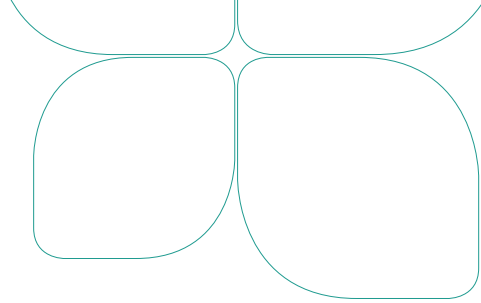


Over-abundant native herbivores

Habitat destruction due to pest animal species is not limited to introduced species. Large populations of kangaroos can quickly degrade habitat by overgrazing an area.



Credit: Mikla Lewis



Identifying invasive animals

Fauna surveys can be used to detect the presence of pest animal species; however, there are other signs, such as animal droppings, tracks, burrows and other evidence of destruction, that can help you determine what is wreaking havoc in your conservation area.

There are a number of field guides listed in the references at the back of this guide to help you identify the animals that are using your habitat.



Footprint of a fox (top) and dog (bottom)



Eastern grey kangaroo tracks



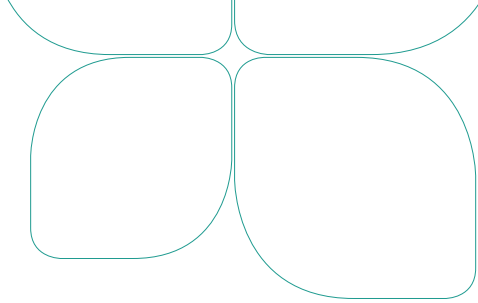
Fox digging



Eastern grey kangaroo droppings



Fox dropping



Cat tracks



Bird feathers and cat droppings

Credit: Mikla Lewis



Rabbit warren

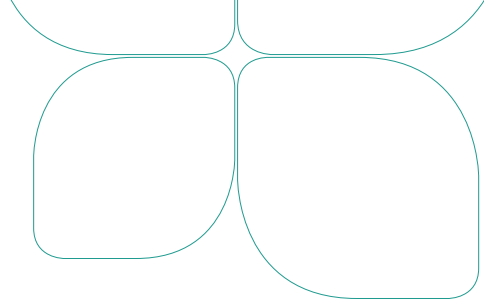


Rabbit droppings



Goat droppings

Credit: John Turbill/ OEH.



Feral pig tracks



Feral pig wallow



Feral pig dropping



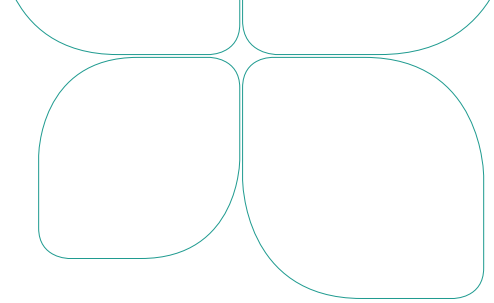
Feral pig rubbing



Feral pig tusk marks



Pigs, foxes, dogs and kangaroos are known for pushing under fences.



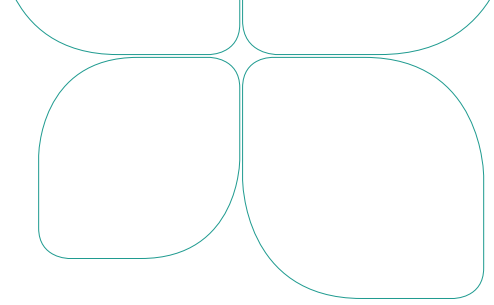
Land degradation

Land degradation issues such as erosion, salinity, poor soil structure and soil fertility issues can affect aspects of habitat health such as plant growth, species composition and water quality. Being able to recognise the early signs of these problems and predict where they may arise is important in order to reduce the impact of these issues.

Erosion



Look at the erosion potential of both the conservation area and the adjacent landscape (particularly uphill or upstream). Look for hazards and contributing factors such as bare earth or poor groundcover, compacted soils, lighter/ dispersible soil types and long or steep slopes. Credits: Mikla Lewis.

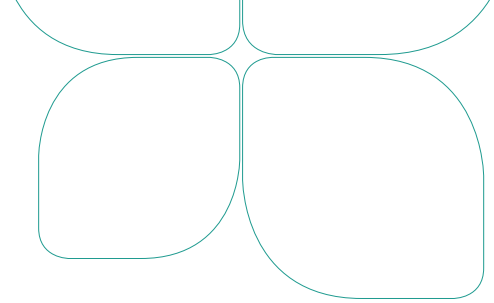


Early signs of erosion include small rills or gutters that form after rain. Credits: Mikla Lewis.



Signs of major erosion problems include active gullies and streambank erosion. Credit (bottom): Mikla Lewis.





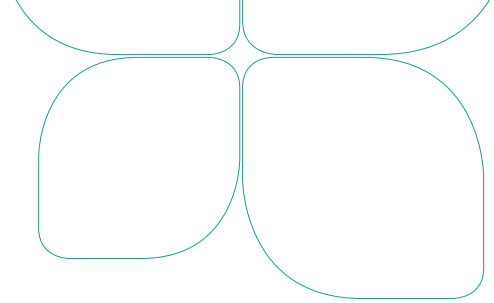
Salinity



Sites that are impacted by salinity (discharge sites) are usually in low lying areas or at a break of slope in the landscape where the watertable has risen, bringing salts close to the surface. Underlying geological constraints can also cause the symptoms of salinity to show up elsewhere.
Credit (above): OEH



Electro-magnetic induction surveys and soil testing can help to assess or confirm salinity issues.



Annual beard grass



Couch grass



Spike rush

Symptoms of salinity to look for include tree dieback, waterlogged soils, poor plant growth, bare earth, erosion, salt crystals on the soil surface and indicator plants such as sea barley grass, annual beard grass, couch, spike rush and strawberry clover. Credits: Harry Rose (top) and John Tann (middle and bottom).

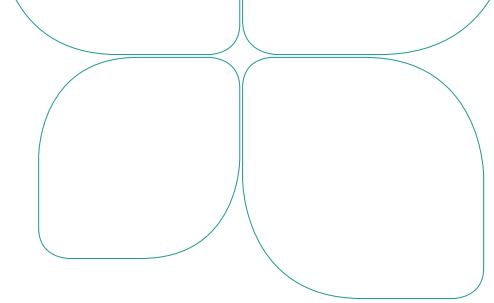
Soil structure and fertility issues



Hard-set, compacted soils can make plant germination and growth difficult.



Annual exotic plants often dominate the groundcover of sites that have been fertilised in the past. The fertile soil is ideal for fast-growing, exotic annuals but many native plant species cannot tolerate high levels of phosphorus. Sheep camps can create similar conditions.



Poor water quality

Water quality can provide an indication of the health of aquatic habitats. Look for signs such as algal blooms in wetlands and dams, which can indicate an imbalance. Sedimentation of water bodies can indicate an erosion problem in the surrounding landscape or an altered water-flow regime. Water testing can be undertaken to confirm suspected water quality issues.



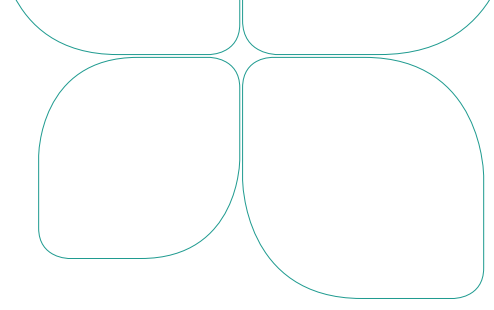
Blue-green algae. Credit: Rosie Nicolai.



Sedimentation of a waterway. Credit: Mikla Lewis.



Other signs and considerations



Other signs and considerations

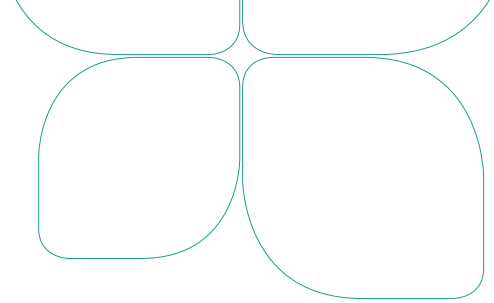
Aboriginal cultural heritage

The Central West landscape is rich in Aboriginal culture and history. Aboriginal people have lived on and cared for this country for thousands of years. They have an inherent ability to 'read the landscape' and manage natural resource assets in a sustainable manner.

Evidence of Aboriginal occupation can be found across the landscape. Many landholders have identified Aboriginal heritage sites on their properties.

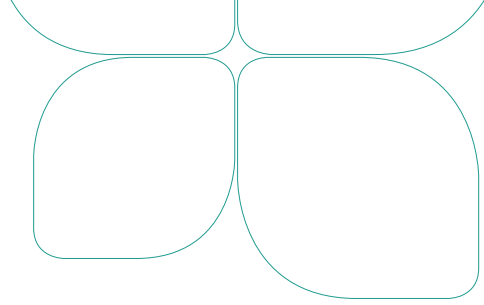
If you find Aboriginal heritage sites or objects on your property and you are interested in finding out more about Aboriginal cultural heritage on your land, contact your Local Land Services office. The Local Land Services Aboriginal Communities Officer can offer advice and connect you with appropriate people.





Aboriginal heritage sites may include visible items like scar trees, tools, grinding grooves and flints.

Other highly significant but less visible sites can include hearths (historic firepits), ochre quarries and unique landscape forms.



Unwanted visitors

Quite often, conservation areas in remote areas attract members of the public wanting to collect firewood, dump rubbish or utilise the area for recreational activities. These activities can degrade the quality of the area so be sure to look out for signs of humans too.



Firewood collection



Rubbish dumping



Motorbike tracks

Signs of natural events

Natural events such as flood, fire, hail and windstorms can also impact native vegetation and habitat areas (in both positive and negative ways). Natural events are usually one-off or irregular events, giving plant and animal populations time to recover in between disturbances. In some cases, they may even benefit the site by creating fallen timber (windstorms), encouraging regeneration (fire) or depositing nutrients and seed (floods).

Following are some signs of natural events that you should be aware of as they may help to explain symptoms within your conservation area.



Charred timber, coppicing, epicormic growth and abundant regrowth are all signs of past fire events. Credits: Mikla Lewis (top) and Simone Cottrell/ OEH (bottom).



Debris and flattened vegetation indicate water movement and flooding. Credit (bottom): Mikla Lewis.

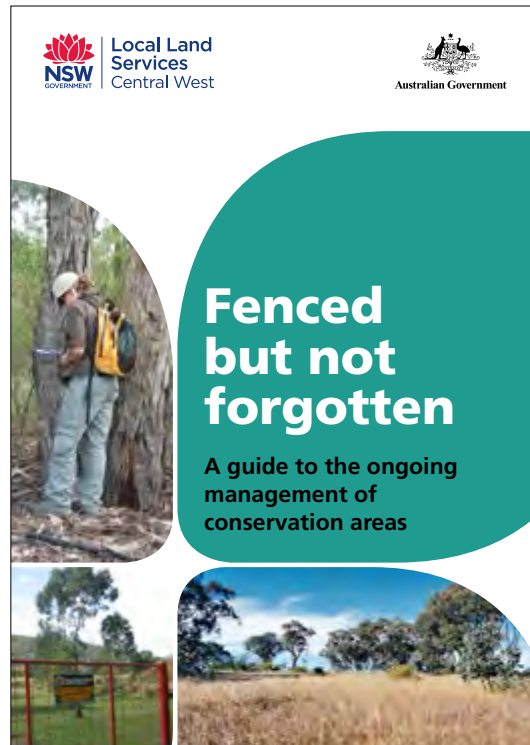


Wind storms result in fallen timber and debris, broken branches and even uprooted trees. Credit (top): Mikla Lewis.

Implications for management

Once you have pieced together what is happening in your conservation area by reading and understanding the landscape signs, you can then make some decisions about what you need to do in order to protect and/ or restore the native vegetation and other habitat features within it.

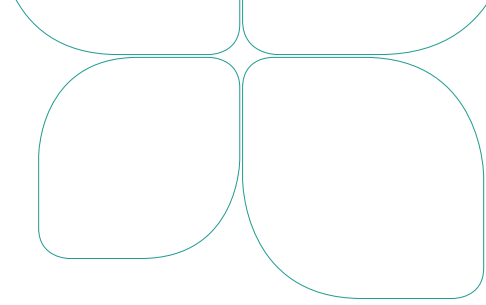
Central West Local Land Services have developed an information guide titled 'Fenced but not forgotten—a guide to the ongoing management of conservation areas', which goes into more detail about the ongoing management of conservation areas. The guide includes information on grazing management, managing invasive animals and plants, encouraging regeneration and plant diversity, stabilising land degradation issues and restoring other habitat features as well as monitoring techniques. For a copy of the guide, please contact your Local Land Services office.



For information on managing conservation areas on your property, ask your Local Land Services Officer for a copy of 'Fenced but not forgotten: a guide to the ongoing management of conservation areas'.



Appendix



Appendix

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Some images used in this publication were obtained under creative common on 16 June 2016 from:

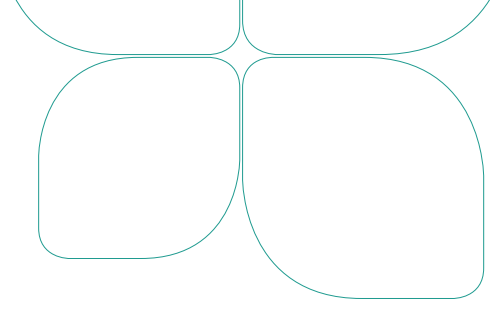
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Further reading

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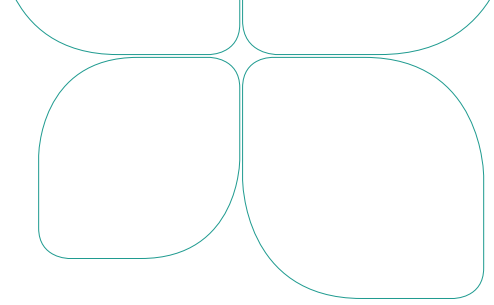
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