A guide to managing and restoring wetlands in Western Australia

Livestock

In Chapter 3: **Managing wetlands**

Version 1

Australian Government

Department of Environment and Conservation

Our environment, our future

Introduction to the guide

Western Australia's unique and diverse wetlands are rich in ecological and cultural values and form an integral part of the natural environment of the state. *A guide to managing and restoring wetlands in Western Australia* (the guide) provides information about the nature of WA's wetlands, and practical guidance on how to manage and restore them for nature conservation.

The focus of the guide is natural 'standing' wetlands that retain conservation value. Wetlands not addressed in this guide include waterways, estuaries, tidal and artificial wetlands.

The guide consists of multiple topics within five chapters. These topics are available in PDF format free of charge from the Western Australian Department of Environment and Conservation (DEC) website at www.dec.wa.gov.au/wetlandsguide.

The guide is a DEC initiative. Topics of the guide have predominantly been prepared by the department's Wetlands Section with input from reviewers and contributors from a wide range of fields and sectors. Through the guide and other initiatives, DEC seeks to assist individuals, groups and organisations to manage the state's wetlands for nature conservation.

The development of the guide has received funding from the Australian Government, the Government of Western Australia, DEC and the Department of Planning. It has received the support of the Western Australian Wetlands Coordinating Committee, the state's peak wetland conservation policy coordinating body.

For more information about the guide, including scope, purpose and target audience, please refer to the topic 'Introduction to the guide'.

DEC welcomes your feedback and suggestions on the guide. A publication feedback form is available from the DEC website at www.dec.wa.gov.au/wetlandsguide.

Contents of the guide

These topics are available in PDF format free of charge from the DEC website at www.dec.wa.gov.au/wetlandsguide.

'Livestock' topic

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When specific reference is made to this topic, the recommended reference is: Department of Environment and Conservation (2012). 'Livestock', in *A guide to managing and restoring wetlands in Western Australia*, Prepared by R Lynch, Department of Environment and Conservation, Perth, Western Australia.

Contents

Case studies

Before you begin

Before embarking on management and restoration investigations and activities, you must consider and address the legal requirements, safety considerations, cultural issues and the complexity of the ecological processes which occur in wetlands to ensure that any proposed actions are legal, safe and appropriate. For more guidance, see the topic 'Introduction to the guide'. In particular, note that grazing constitutes clearing under the provisions of the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 and you may require a permit to graze livestock. For additional detail, see the section of this topic entitled 'Legal considerations'.

Livestock: for the purposes of this topic, the term livestock refers to introduced domestic ungulate (or hoofed) animals. While the focus is on sheep, cattle and horses as these are commonly farmed at or near wetlands, general principles introduced in this topic will also apply to other introduced ungulates such as goats, donkeys, deer, llamas, alpacas and camels. Management of feral populations of these animals is discussed in the topic 'Introduced and nuisance animals' in Chapter 3.

Introduction

The **livestock** industry was one of the first to be established in WA, and it remains extremely important to the state's economy. Since pastoralism first expanded across the state, wetlands have been valued as watering points and areas of good grazing for livestock. As farms became established, many wetlands in agricultural areas were cleared for pasture.

Wetlands contain valuable resources for livestock, including water for drinking and cooling off, trees for shade and shelter and plants that are highly palatable. As a result, wetlands are often used more intensively by livestock than other areas of the landscape, especially when it is dry and during drought. Many factors influence the degree to which livestock may impact upon a wetland, but in many cases, livestock grazing has resulted in significant degradation of wetlands.

Fortunately, livestock management systems better suited to Western Australian conditions are now available and becoming more popular. With livestock grazing forming the main land use across more than 40 per cent of the state, livestock management practices have the potential to affect many of WA's wetlands (Figure1). Sound management of wetlands on grazing land can have benefits for landholders and their livestock, the local community and future generations, because well managed wetlands can provide a range of services valuable to society. Livestock owners can use the management and restoration practices outlined in this topic to minimise the impacts of livestock, improve the condition of their wetlands and, in many cases, improve the health of their animals.

Figure 1. (below) (a) A fenced well-managed wetland in good condition on a horse property near Serpentine. Photo – C Prideaux/DEC. (b) A wetland near Gingin degraded by continuous cattle access. Water is contaminated by sediment, nutrients and faeces, vegetation has been damaged and removed and soils are pugged and exposed. The landowner is currently undertaking fencing to exclude livestock. Photo – R Lynch/DEC.

(a)

(b)

Ten good reasons to keep livestock out of wetlands

Allowing livestock to access wetlands is not only damaging to wetlands, it can also compromise livestock health, reduce productivity and create management problems. Sound livestock management will have benefits for wetlands and positive effects on livestock health and productivity.

1. Livestock contaminate wetland water with urine and faeces, disease-causing organisms and sediments. The poor water quality may cause livestock to reduce their water consumption or refuse to drink from the wetland. Providing alternatives to direct watering from wetlands improves water quality and some studies have found it improves livestock health and productivity.[1]
2. When water levels are low, livestock with no alternative water sources may be forced to wade through mud to drink. Weak or sick animals can become trapped and die.
3. Nutrients from livestock urine and faeces can accumulate in wetland waters and cause excessive algal growth. Blue-green algal blooms caused by excess nutrients in the water can be toxic to livestock.
4. Midges and mosquitoes can be more abundant in wetlands and, in particular, wetlands with poor water quality can be predisposed to nuisance midge populations. Livestock, especially horses, can suffer irritation and allergic reactions to these insects. In some areas, livestock may also be at greater risk of mosquito-borne disease.
5. Livestock kept in waterlogged or muddy paddocks are prone to bacterial and fungal infections. Cattle can experience problems caused by wet mud-covered udders and hooves.[1] Horses can suffer from infections of the hooves and legs such as 'mud fever', 'greasy heel', thrush[2] and sheep from foot rot and fly strike.[3]
6. Parasites such as Barber's pole worm, a serious roundworm parasite of sheep and goats in coastal and high rainfall areas of WA, can survive where pasture remains green over summer.[4] Allowing uncontrolled livestock access to wetlands can exacerbate worm problems and counteract worm control programs.
7. While some wetlands contain palatable native plants, most native vegetation is of low to very low nutritional value. Livestock that spend substantial time grazing coastal wetlands may develop deficiencies in trace elements such as copper and cobalt and require supplementation (R Butler 2009, pers. comm.). Sheep, cattle and horses which graze on stringy and fibrous native vegetation may develop fibrous masses called 'phytobezoars' in various parts of their gut[5] (Figure 2). These can cause obstructions, peritonitis and, occasionally, death (R Butler 2009, pers. comm.).

Figure 2. Phytobezoars inside a sheep gut, formed after grazing on native vegetation. Photo – R Butler/ Department of Agriculture and Food.

8. Mustering and moving livestock can be more difficult when they have access to wooded wetlands, where they can hide.
9. Allowing livestock to access wetlands can spread weeds, which can reduce biodiversity, increase the threat of fire and result in the need for costly weed management.
10. A degraded wetland filled with green, foul-smelling water, blue-green algae which are toxic to humans and livestock, and clouds of nuisance insects, is a management problem, a hazard and an eyesore. In contrast, many people will find a well-managed wetland visually appealing, enjoy the fact that it provides recreational opportunities and attracts native animals such as birds and frogs (Figure 3). A wetland in good condition can be an asset which demonstrates good land management practices and may add value when selling a property or diversifying into farm-based tourism.

How do livestock affect wetlands?

Grazing: feeding on grasses and other low-growing herbaceous vegetation

Ecosystem: a community of interdependent organisms together with their non-living environment. Natural ecosystems provide a range of benefits and services to humans such as clean water, nutrient cycling, climate regulation, waste decomposition and crop pollination

Before European settlement, Western Australian wetlands were grazed by native animals such as kangaroos, wallabies, emus and waterbirds. Native plants have adapted to **grazing** by native animals at natural densities[6] and it is thought that this natural process may be important in maintaining species and structural diversity in some wetlands.[3] However, heavy grazing by any animal will damage native vegetation, regardless of whether it is domestic or commercial livestock, feral animals, native fauna, rabbits or insects.[6]

Livestock access can cause severe degradation of wetlands. Livestock activities can compact and erode the soil, increase runoff and levels of sediments, nutrients and contaminants in wetlands, change the vegetation and degrade the habitats of native animals (Figure 3). These changes can cause serious damage to wetland **ecosystems** (Figure 4). Impacts can be compounded by certain management activities such as clearing of native vegetation for pastures, leaching of farm chemicals, fertilisers and other treatments into water supplies. Other poorly planned activities like carcass burial and inappropriate placement of infrastructure can impact on wetland condition.[7] Well-placed stockyards, waste ponds, roads and storage facilities can improve efficiency and reduce environmental impacts.

Figure 3. Sheep have contaminated this seasonally inundated wetland with faeces and urine, pugged the soils and removed most of the vegetation. Photo – R Lynch/DEC.

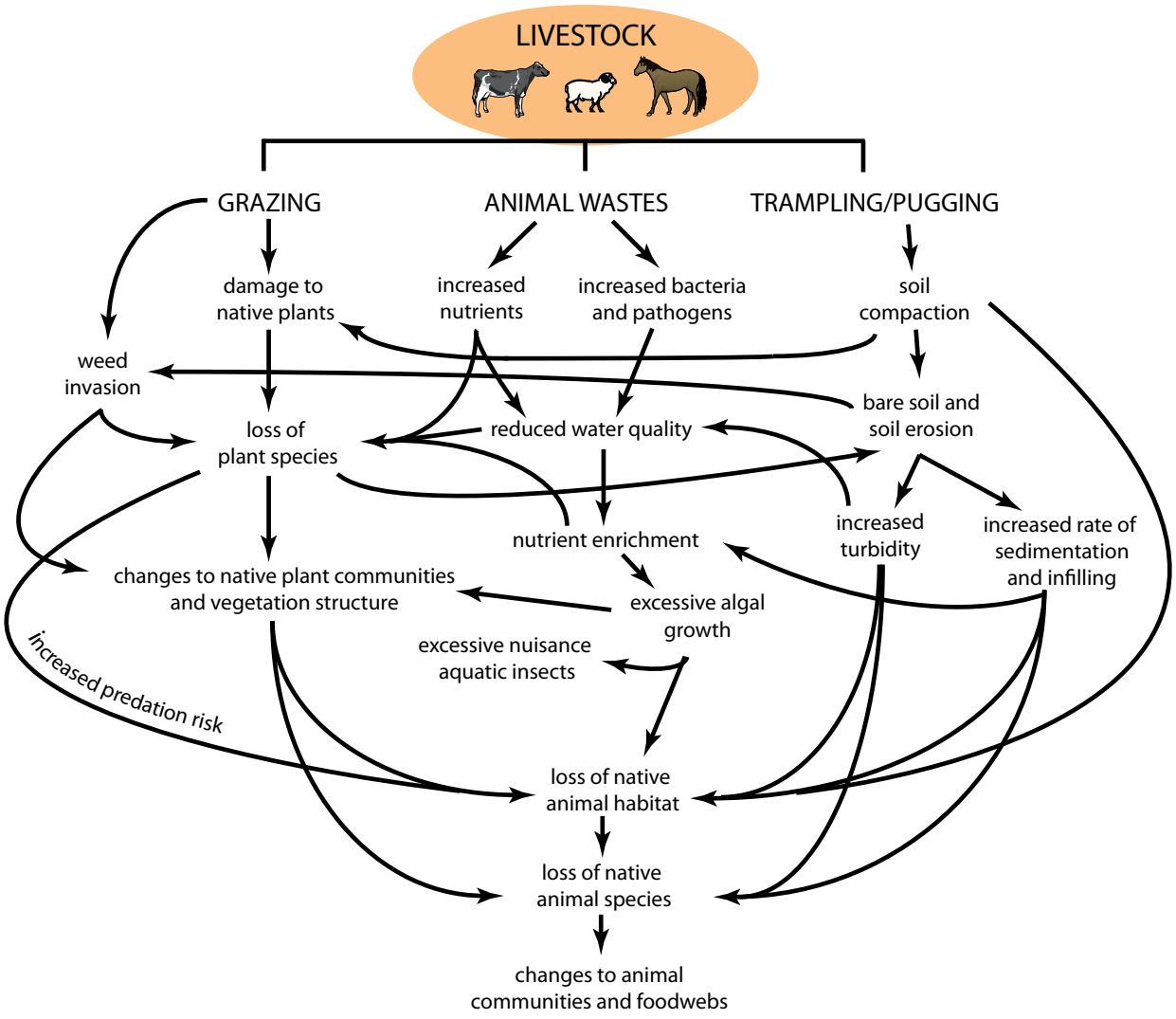


Figure 4. Some impacts of livestock on wetlands.

Effect of wetland type and season

Wetlands differ in attractiveness to livestock depending on the resources present and the time of year. Wetlands with permanent fresh water may be used for drinking by livestock all year round, especially if there are no alternative water sources. This can result in severe impacts on soils, vegetation and water quality (Figure 5). During hot, dry periods of the year and during drought, impacts may be intense as livestock will loiter in wetlands that are shady and cool even when alternative drinking water is available.

Figure 5. This permanent spring near Gingin has been severely degraded by continuous cattle access. Photo – C Mykytiuk/WWF Australia.

Wetlands that are dry at some times of the year may have less livestock activity when they are completely dry. However, this is not always the case, as these wetlands often support a wide variety of very palatable plants both when they are drying out and when dry, and they may be favoured by livestock for grazing at these times (Figure 6).

Figure 6. (below) Large areas of flat, (a) seasonally inundated and (b) seasonally waterlogged wetlands on the Swan Coastal Plain, like these near Dunsborough, were historically cleared for agriculture as they are highly productive. Photos – R Lynch/DEC.

(a)

(b)

Impacts on wetland vegetation

Browse: to feed on leaves, twigs or bark from non-herbaceous (woody) plants, such as trees and shrubs

Livestock do not affect all species of plants in the same way, but the overall effect of uncontrolled livestock grazing is to degrade wetland vegetation. The impact of livestock on wetland vegetation depends on many factors. These include the plant species present, the age and size of individual plants, the type of livestock, the stocking rate, the timing of grazing and environmental conditions such as rainfall.

Unmanaged, livestock will reduce native plant diversity, reduce the structural complexity of vegetation and degrade wetland habitats. These impacts can be compounded by other impacts such as plant diseases, drought, weeds, fire and changes to the natural water regime.[3]

Impacts of different types of livestock

Livestock affect native plants in different ways, due to their physical differences in height, their grazing preferences and the way in which they are able to use their lips and tongues[8] (Table 1). The behaviour of livestock also varies with factors such as herd size, breed and climatic conditions.[9]

Cattle are unable to graze as close to the soil as other species, so the survival of herbaceous species (herbs) is always higher with cattle grazing than sheep.[10] The mobile lips of sheep and the way they use their tongues allow them to feed very selectively. They can easily choose individual leaves over others on the same plant and graze plants very close to the ground.

Goats are similar to sheep in their ability to selectively graze, but prefer a wider range of plants in their diet. They are quite adaptable to different food types and **browse** by climbing high into vegetation to feed. Up to 80 per cent of their diet can be from small trees and shrubs.[8] Goats should always be excluded from wetlands as they cause enormous damage to wetland vegetation.[11]

Table 1. Feeding preferences of cattle, horses and sheep[12,8,3]

Cattle	Horses	Sheep
Are least selective	More selective than cattle	Most selective grazers
Cannot graze as close to the ground as sheep	Tend to be spot grazers, grazing one area close to the ground and leaving other areas for droppings	Can crop vegetation very close to the ground
Prefer plants 10–30 cm in height	Like short grasses and avoid grazing woody plants	Prefer drier vegetation and are more likely to graze on woody seedlings; prefer to graze plants in the following order: herbs, broadleaved grasses, fine-leaved grasses, sedges, and dwarf shrubs
Can reach higher to browse upper stems of shrubs and lower tree branches	Can kill paddock trees by defoliating and bark stripping	Cannot browse shrubs and trees as high as cattle
Will readily enter water to feed on emergent wetland vegetation and can remove whole stands	Will enter water	Do not like to enter water

Physical damage to plants

Livestock grazing damages plants and plants differ in their ability to withstand this impact.

Grazing livestock remove the leaves or foliage from plants (called defoliation) and sometimes uproot the whole plant. This removes nutrients which must then be re-acquired from the soil. Plants may not recover well when nutrient availability is low as defoliation can reduce a plant's ability to take up nutrients when they are in low supply.[13]

Plant species respond to livestock grazing in different ways[14] and differ widely in their ability to withstand the impact of defoliation.[10] For example, a study in which plants were clipped to simulate grazing found that the clipped plants responded in one of three ways. In some species, amount of plant material and reproduction increased, in some the amount and reproduction decreased, and in others the amount decreased while reproduction increased.[15] For some plant species, grazing at low intensity stimulates greater growth, but in general plant performance decreases as grazing intensity increases.[12]

Many wetland plants are sensitive to grazing when they are seedlings and when they are flowering or setting seed. Grazing may impair reproduction by reducing flowering and seed production which results in fewer new plants being produced.[9,10] **Annual** species are usually more tolerant of disturbance because they grow fast and produce lots of seed early. Palatable **perennial** species of **herbs**, shrubs and trees are more vulnerable, because they are comparatively slow-growing and usually require several years to reach reproductive maturity.[16] Seedlings can also be more vulnerable to grazing as their root systems are not fully established.

Livestock graze selectively, choosing the ground layer plants and seedlings they prefer first, along with **palatable** shrub and tree foliage within reach[6] (Figure 7). Grazing animals often prefer new plant growth and revisit grazed patches to feed on regrowth[12], so individual plants can be repeatedly defoliated. Over time, continuous grazing may reduce the capacity of plants to survive, grow and reproduce.

Annual: a plant that normally completes its life cycle (from germination to flowering, seed production and death of vegetative parts) within a single growing season

Perennial: a plant that normally completes its life cycle (from germination to flowering, seed production and death of vegetative parts) in two or more growing seasons

Herb: a small non-woody, seed-bearing plant in which all the above-ground parts die back at the end of each growing season

Palatable: pleasant-tasting

Figure 7. Cattle have grazed and trampled the understorey and created a 'browse line' by eating the low foliage from these paperbark trees in a wetland near Muchea. The cattle have not eaten the less palatable *Astartea* spp. shrubs (on the left).
Photo – C Mykytiuk/WWF Australia.

Livestock also damage plants by trampling, rubbing and ring-barking.Trampling and tracking–can damage and kill **understorey** plants (Figure 8). Rams, bulls and stags like to butt and rub against trees and shrubs, damaging branches and causing death by ringbarking. Horses, which are more active that other livestock, are also notorious for killing isolated paddock trees by stripping bark and foliage, often out of boredom[6] (Figure 9). Other types of livestock will also strip bark, for example, sheep will chew bark and ringbark trees, often in autumn when there is little fibre in paddock feed.[6]

Understorey: the layer of vegetation beneath the main canopy

(a) (b)

Figure 8. Effects of livestock trampling on wetlands. (a) Cattle tracking has damaged a samphire (*Sarcocornia* spp.) wetland community in Capel. Photo – S Priddle/NGH Environmental. (b) Horses have trampled wetland vegetation along a fence line within a paddock near Australind. Photo – R Lynch/DEC.

(a) (b)

Figure 9. Bark-stripping by livestock. (a) Horses have stripped the bark of a tree in a seasonally waterlogged wetland near Capel. Photo – K Wenziker/DEC. (b) Cattle have stripped bark from a paperbark (*Melaleuca* spp.) tree in a wetland on the Swan Coastal Plain. Photo – M Rogers/ DEC.

Some wetland plants and plant communities are more sensitive to livestock impacts than others. The following case study profiles the effect of livestock on samphires.

case study

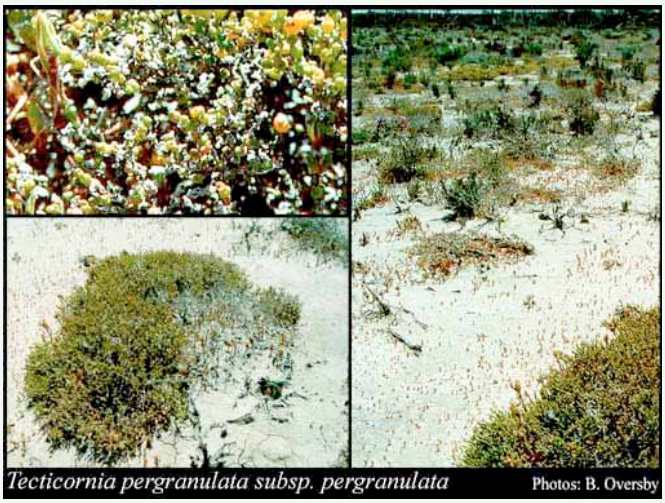
Samphires – grazing-sensitive wetland plants

The name samphire refers to a group of delicate perennial low succulent shrubs including *Sarcocornia, Halosarcia* and *Tecticornia* species. Many saline wetlands in Western Australia support samphires, such as salt lakes, salt pans, salt marshes, coastal flats and saline drainage lines. Many samphire species have evolved to grow in specific areas, under certain conditions in harsh environments and are quite fragile and susceptible to change.[17] Samphires grow actively only during wet periods. Samphires in general produce large quantities of seeds that are held in spongy or woody parts of the plant to be released when conditions are suitable for germination.[17] They germinate after rain when the soil is wet with relatively fresh water.

In general, samphires are high in salt and have low feed value for livestock[18], but sheep will eat samphires if there is fresh water for them to drink and access to supplementary dry food such as crop stubble[17] (Figure 10). Samphires are brittle plants and are particularly sensitive to trampling by hoofed animals. Where grazing and trampling is indiscriminate, samphire plants may be unable to regenerate or re-establish and they can die out.[19]

Where samphire areas are to be grazed, it is best to fence them and only allow sheep to graze for a short period when it is dry and other feed is exhausted. To maximise their recovery, they should be protected from livestock for the rest of the year.[17]

➤ For more information about samphires, see *Samphires in Western Australia.*[17]



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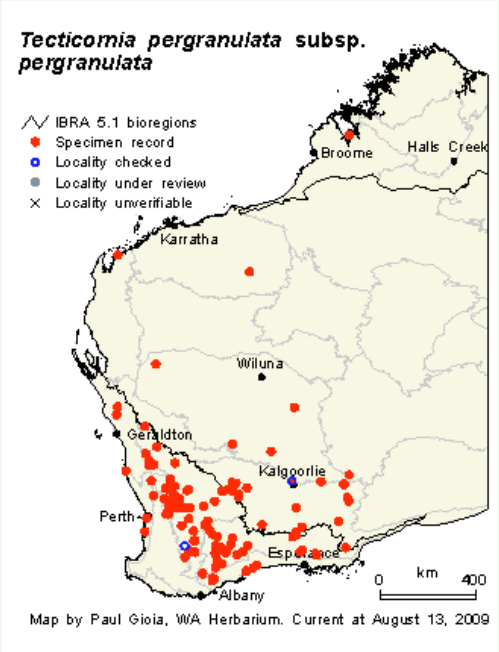


(b)

Figure 10. (a) Blackseed samphire (*Tecticornia pergranulata*) is commonly used as animal feed.[17] Photo – B Oversby; (b) Distribution of blackseed samphire in WA. Image – P Gioia/DEC. Images used with the permission of the Western Australian Herbarium, Department of Environment and Conservation http://florabase.dec.wa.gov.au/help/copyright.

case study

Mound springs in the WA rangelands – wetlands especially vulnerable to livestock grazing

Mound springs are an uncommon wetland type which occurs around permanent groundwater springs. Most of WA's mound spring types occur either in a restricted geographic area or there are a few isolated occurrences.

In the rangelands of WA, existing mound springs are known from the Kimberley region and in and on the edge of the Great Sandy Desert. They occur singularly or in clusters of up to around twenty separated by several metres to tens of kilometres.[20] These wetlands contain 'mounds' formed from peaty organic soil which can rise up to two metres above the surrounding landscape and be up to several hundred metres across.[20] Research at two mound springs in the Great Sandy Desert has shown that organic sediments have accumulated continuously over the past 6,000 years.[21] The mound is often surrounded by a moat of fresh or low salinity water.[20] Mound spring vegetation can range from sedgelands to paperbark (*Melaleuca*) forests to *Sesbania* woodlands to monsoon vine thickets.[20] The plant and invertebrate communities of mound springs are often diverse or unusual and sometimes contain rare plant species which were more widely distributed in the past when the climate was wetter.[20] As well as having significant ecological values, many mound springs have cultural values for local Aboriginal people.

The presence of permanent water, dense vegetation and sometimes shade can make mound spring communities particularly attractive to cattle as well as feral camels and pigs. Mound springs are particularly vulnerable to livestock activity as it damages the vegetation, causes erosion of the fragile peat soils, can promote weed invasion and contamination of the groundwater source. Several mound spring community types have been listed as threatened ecological communities (TECs).

Springs and mound springs can be best protected by fencing them to keep livestock out (Figure 11, see also Figure 31).

Figure 11. Two plant communities within Saunders Spring, an organic mound spring, in the Shire of Broome. Photos – G Daniel/DEC.

Loss of leaf litter

Livestock reduce leaf litter. **Leaf litter** performs several important ecological functions: it breaks down to return nutrients to the soil, it creates habitat for invertebrates and other small animals and it protects the soil surface from the sun. Loss of leaf litter can affect plants by changing the microclimate around them, allowing heat to damage their roots, increasing water loss and reducing their growth.[6] Grazing livestock remove much of the foliage that would become leaf litter and some livestock, such as sheep, even consume leaf litter when other food sources are in short supply.

Leaf litter: dead plant matter including leaves, flowers, nuts, sticks and bark which accumulates on the ground

Diversity: a measure of the number of species of a particular type and their abundance in a community, area or ecosystem. It can refer to a particular group of organisms, such as native plant diversity or frog diversity. The broader term **biodiversity** is used to encompass the whole variety of life forms–the different plants, animals, fungi and microorganisms–the genes they contain, and the ecosystems they form

Figure 12. Leaf litter around shrubs in a wetland. Photo – K Wenziker/DEC.

Weed invasion

Livestock can promote weed invasion of wetlands. There are many wetland weeds that pose serious threats to the condition of WA wetlands. Many weeds also greatly reduce the grazing value of wetlands. Weed seeds may be carried into wetlands in the coats, hooves or faeces of livestock as well as by wind and water.[22] Nutrients in livestock urine and faeces and bare patches of ground created by overgrazing or trampling increase opportunities for weeds to grow.[22]

Many weed species are well adapted to coping with grazing, as they originate from regions of the world where hoofed animals are part of the natural environment. Weeds tend to be good at either growing back quickly or withstanding damage from trampling and grazing. In general, weeds are fast growing and reach reproductive maturity more rapidly than native plants, so livestock grazing often doesn't disrupt reproduction to the degree that it does for native plants.

Weeds have a detrimental effect on native vegetation by competing with and inhibiting growth of established plants, inhibiting native plant regeneration, altering nutrient cycling and reducing native plant **diversity**.[6]

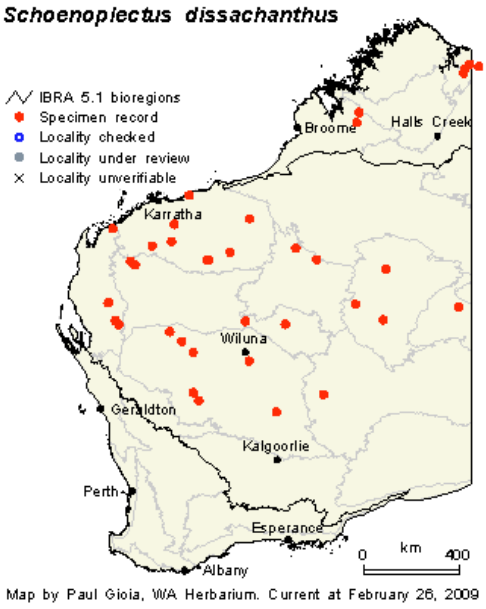
➤ For additional detail, see the topic 'Wetland weeds' in Chapter 3.

Reduction in plant diversity and complexity

Some plant species decline in numbers under continuous livestock grazing while other species increase. Over time this leads to loss of native plant diversity. Livestock activity can cause changes to the abundance and diversity of plant species in a wetland. There is often a decrease in the palatable, grazing-sensitive species (called 'decreasers') and an increase in the number and distribution of unpalatable and grazing-resistant species (or 'increasers').[10] For example, pale spikerush (*Eleocharis pallens*), a perennial sedge found in central Western Australian wetlands, and *Schoenoplectus dissachanthus* (Figure 13), an annual sedge found in central WA and Kimberley wetlands, both decrease under persistent grazing. Bluerod (*Stemodia florulenta*), an erect faintly scented perennial shrub, is a wetland 'increaser'.[18] Many weed species are 'increaser' species.

Figure 13. (below) (a) *Schoenoplectus dissachanthus*, a wetland decreaser. Photo – CP Campbell. (b) *Schoenoplectus dissachanthus* distribution in WA. Image – P Gioia/DEC. Images used with the permission of the Western Australian Herbarium, Department of Environment and Conservation http://florabase.dec.wa.gov.au/help/copyright.

(a)



(b)

Loss of 'decreaser' species and greater dominance of 'increaser' species results in plant communities with lower native plant diversity. Such changes in abundance of native plant species are often a sign of declining land condition.[18]

Over time, uncontrolled livestock activity reduces the vegetation structure of wetland plant communities. Livestock grazing on native shrub and tree seedlings can prevent them from reaching maturity and reproducing. As mature trees age and die naturally, they are not replaced and the **vegetation structure** may change from a wetland with trees to a more open community (Figure 14).

Vegetation structure: the three-dimensional distribution of plant material. It includes the horizontal spacing of plants and the vertical heights or layers

Figure 14. (below) (a) A wetland near Bunbury in good condition showing diversity of plant species and vegetation structure (layers). Photo – R Lynch/DEC. (b) A wetland in the Shire of Serpentine-Jarrahdale degraded by continuous heavy cattle grazing. Ground layer plants have been removed, the soil is compacted, mature trees have aged and died and there are no seedlings to replace them. The bare soil is more susceptible to erosion and colonisation by annual weeds. Photo – E Davies Ward/DEC.

(a)

(b)

Soil damage

Livestock trampling can damage the soil, increase erosion and reduce soil spaces, and decrease water infiltration, nutrient cycling, germination and plant growth. **Pugging** is a highly visible form of soil damage caused by livestock activity in and around wetlands (Figure 15). It occurs as their hooves sink into wet soil, leaving depressions and compacting and damaging the soil surface and microstructure, and leaving it more vulnerable to erosion.[23] Compacted soil contains fewer spaces, known as **macropores**, within the soil. Macropores are important for soil aeration and the activity of microbes and other soil fauna, which play an important role in cycling nutrients and maintaining the condition of the soil. When there are fewer spaces between soil particles, less water can soak into the soil. As a result less moisture reaches plant roots[24] reducing plant growth and vigour. Soil compaction may also damage native seeds stored in the soil, reduce their germination, and reduce the chance of germinating seeds reaching the soil surface. Small pools of water that form in the depressions left by pugging can increase the period of time that plants stay wet, causing poor performance or favouring other species more tolerant of the altered conditions. Soils are at greatest risk of compaction when they are wet and heavily grazed.[23]

Pugging: depressions, hoof prints or 'pug' marks made in wet soil by trampling animals

Macropores: spaces in the soil (usually less than 2 millimetres diameter) that include channels created by cracking, old plant roots and soil fauna (such as earthworms). Macropores indicate good soil structure

Wetland hydrology: the movement of water in and out of, and within, a wetland

(a)

(b)

Figure 15. (a) Soil pugging by cattle in a seasonally inundated wetland near Gingin. Photo – C Mykytiuk/WWF Australia. (b) Soil pugging by horses in a seasonally waterlogged wetland. Photo – M Rogers/DEC.

Changes to wetland hydrology

Livestock tracks and farm infrastructure can degrade wetland ecosystems by changing the natural pattern of water flow to and from wetlands. 'Critical control points' are natural landscape features that act as dams or levees, causing surface water flows to slow, spread and pool, creating wetlands. They range from rock bars across rivers to low ridges of sand which trap water in small intermittently inundated wetlands.[25] Trails made by livestock and tracks for farm vehicles can act as shallow channels which breach (cut through) critical control points. Instead of slowing and pooling in the wetland, water flow is faster and concentrates along these pathways of bare compacted soil. This increases soil erosion and creates problems such as gullies. Depending on the circumstances, these incisions may channel more water and contaminants into wetlands or divert water away from wetlands. In some cases, this process has caused the intrusion of salt water into freshwater wetlands.[26] Altering drainage patterns can affect **wetland hydrology**, which may have major implications for wetland plants and animals and physical and ecological processes.

➤ For additional detail, see the topic 'Wetland hydrology' in Chapter 2.

For example, in the Murchison River catchment and tropical floodplain grasslands of northern Australia, cattle trails to river pools often breach critical control points on grassy floodplains (seasonally inundated wetlands). The water that formerly spread out across the floodplain becomes channelled along the cattle trails, forming erosion gullies which cut back into the floodplain. The changed drainage pattern has negative impacts on ecology and production in the rangelands. Instead of capturing water which can soak into the soil, the floodplains are drained rapidly and less palatable dryland shrubs begin to replace the native grassland community.[26]

Erosion: the gradual wearing away and movement of land surface materials (especially rocks, sediments and soils) by the action of water, wind, or a glacier

➤ For an example of pastoralists working together to reverse the problem discussed above, see the case study about Wooleen Lake in the Murchison River catchment in *Pastoral management options for central Australian wetlands – Fat cows and happy greenies*[18] (p.61).

Why wetlands shouldn't be dug out

Many farmers dig out natural wetlands to increase the depth or permanency of water for livestock use or other reasons. There are several reasons why this should not be done.

- **Using heavy machinery to excavate wetlands causes soil compaction and damage to the soil surface and vegetation.**
- **Disturbing wetland soils in acid sulphate risk areas can cause acidification of soils and water.**
- **Changing the topography (landscape shape) alters the wetland's hydrology and habitats. This may change the types of plants and animals that can occur there.**

It is better to find alternative sources of water, leave these valuable habitats undisturbed and appreciate them for their natural values, such as the wildlife that occur there.

➤ For additional detail about the impact of acid sulphate soils in wetlands, see the topic 'Water quality' in Chapter 3. For additional detail about wetland hydrology, see the topic 'Managing hydrology' in Chapter 3.

Soil erosion, turbidity and sedimentation

Livestock activity can cause soil erosion which degrades wetland habitats. The movement or **erosion** of soil by rain and flooding is a natural process, but this process can be greatly accelerated by livestock. When soil becomes compacted by livestock trampling, less rainfall infiltrates into the soil and more flows over the soil surface. This is compounded by the loss of groundcover to slow the water down and by the presence of livestock trails which channel the water (Figure 16). When more water flows more rapidly across the soil surface, it can remove more topsoil and create fissures and gullies in the ground (Figure 17).

➤ For additional detail about the effects of erosion on wetland water quality, refer to the topic 'Water quality' in Chapter 3.

Figure 16. Livestock trails through the vegetation have created new pathways for the movement of surface water and contaminants into the wetland. Photo – C Mykytiuk/WWF Australia.

Figure 17. Erosion and gullying caused by cattle grazing. Photo – R George/Department of Agriculture and Food Western Australia.

Turbid: the cloudy appearance of water due to suspended material

Soil erosion in a wetland's catchment results in increased quantities of sediment entering the wetland during rain and floods. Fine particles may remain suspended in the water, causing **turbid** conditions. In this 'muddy' state, less light is available to water plants and algae for photosynthesis, which causes reduced plant growth or death. As sediments begin to settle, they smother animals living on the bottom by clogging their gills and causing problems for filter-feeders; coat organic deposits and algae upon which aquatic animals depend for food and cover; and fill in aquatic habitats.[27, 28] Over time, increased erosion and sedimentation can gradually fill in wetland basins.[27]

Erosion is a serious environmental problem, particularly in arid lands managed for pastoral production.[29] The most important factor in reducing erosion is managing total grazing pressure. **Total grazing pressure** describes the combined impact of all grazing animals—domestic, wild, native and feral—on the vegetation, soil and water resources of a particular area.[30] When too many animals are grazing an area, **groundcover** will be reduced by grazing and trampling and the soil will become exposed and vulnerable to erosion.

Groundcover: the percentage of ground covered by plant materials (alive or dead) and leaf litter

Erosion is influenced by other factors including the body weight and type of grazing animal, slope steepness and the ability of the soil type to withstand trampling under wet conditions.[23] Livestock access to steep slopes, particularly by cattle (which are heavier than other species), can result in substantial damage such as collapse or slumping of banks and gullying.[9,14] Some types of livestock, although lighter in body weight, can cause extensive soil damage and promote erosion when allowed access to wetlands, because of their specific behaviours. For example, red deer deliberately create muddy wallows during the mating season, cake mud onto their hides to assist in scratching off their winter coats, and use mud to protect themselves from biting insects at other times of the year.[23] Pigs rapidly damage areas of wetland because they dig, turn over the soil and uproot vegetation while foraging for roots, tubers and invertebrates.

Nutrient enrichment

Livestock faeces and urine entering wetlands can cause nutrient enrichment, algal blooms and nuisance insect problems. Livestock faeces and urine are highly concentrated sources of nutrients, particularly nitrogen and phosphorous. Most Western Australian soils have naturally low levels of nutrients and native plants are adapted to cope with this. Livestock faeces and urine can be detrimental to the survival of some native plants, such as banksias[6], which cannot tolerate high levels of phosphorus.

Livestock faeces and urine are deposited directly in wetlands when livestock are allowed to graze in them. Excess nutrients from livestock faeces and urine, fertilisers and eroded sediments also enter wetlands from surrounding pastures in surface water runoff or by leaching into groundwater that flows into the wetland. Increased nutrients in wetlands (especially nitrogen and phosphorous) can result in excessive growth of water plants and algal blooms (Figure 18). Algal blooms may include blue-green algae, some of which are toxic to humans, pets, livestock and wildlife. They can also can cause taste, odour and aesthetic problems (they look like a green paint-like scum on the water).[27]

Figure 18. An algal bloom in a nutrient-enriched wetland on a cattle property near Muchea. Photo – C Mykytiuk/WWF Australia.

Changes in plant growth can alter the type and quantity of food and habitat available to wetland organisms, affecting food web structure and function, as well as favouring some species over others. Algal blooms deplete the oxygen supply which can result in death of aquatic animals (such as fish kills).[27] Nuisance midge numbers are often higher in nutrient enriched wetlands.

➤ For additional detail, see the topic 'Water quality' in Chapter 3.

extra information

How much faeces and urine?

Horses and cattle produce large amounts of faeces and urine. A standard light horse (450 kilograms) produces approximately 5.5 tonnes of wet faeces and 5.5 kilolitres of urine each year. This volume of waste contains 62 kilograms of nitrogen (N) and 5.5 kilograms of phosphorus (P).[31] If poorly managed, livestock faeces and urine can contaminate both groundwater and surface water[31] (Figure 19).

Figure 19. Grazing horses have removed most of the native vegetation in this seasonally inundated wetland in Kenwick. Horse manure accumulating on the degraded pasture will be washed into the water during heavy rainfall as there is little vegetation to trap it. Photo – M Rogers/DEC.

Contamination by pathogens

Livestock faeces are a source of bacteria, viruses and parasites which can pose serious health risks to humans, livestock and wildlife. Bacteria, such as *Salmonella*, and other harmful disease-causing organisms can enter wetland waters from livestock faeces and urine. Infection can lead to scouring (diarrhoea) and death of livestock. Research has shown that young livestock (particularly foals and dairy calves) have higher rates of infection by the parasites *Cryptosporidium* and *Giardia* and excrete large amounts of infective oocytes or cysts[32,33] which can contaminate water supplies. Some strains cause diarrhoea, and sometimes death, in young or weakened humans, livestock and other animals.

Faecal contamination is likely to be higher when livestock are allowed free access to wetland waters; no alternative drinking water is provided; stocking rates are high; the livestock are deer or cattle (these species are more likely to defecate in the water); or there is no alternative shade available in hot weather.[23] Contamination can also occur when livestock become trapped and die in wetlands or groundwater sources become contaminated by buried carcasses.

Chemical contamination

Unless carefully managed, agricultural chemicals such as herbicides, veterinary chemicals, fuel, oil or solvents can leak or drain into surface water or leach into groundwater. The active ingredients of some worm drenches are toxic to invertebrates (of which many are beneficial to soil health); these toxic drenches can enter the water when they leach out of faeces and urine.[31] Unless carefully managed, spraying herbicides, pesticides or fertilisers onto pastures next to wetlands can cause death of native plants and animals and contaminate wetland waters through run-off and spray drift.

Impacts on native animals

Livestock can impact native animals by trampling them or their nests and degrading the habitats and resources they require. Wetlands in good condition provide a wide variety of habitats and resources such as food, shelter, roosts and breeding sites and are important to a wide range of native animals. When these resources are degraded, some species may not be able to survive or breed (Figure 20). In particular, animal species that breed, shelter or feed on the ground, under leaf litter or in low vegetation may be more affected by loss of food sources, at greater risk of injury or nest damage by livestock trampling or be more exposed to predation due to loss of protective vegetation cover.[3] For example, on floodplains in south-eastern Australia, frog and bird communities varied with livestock grazing intensity.[34] Frog diversity, the numbers of some species of tadpoles and frogs and the numbers of small insect-eating birds (which depend on insects found in understorey vegetation, fallen logs and leaf litter) were lower where grazing intensity was higher because of impacts of grazing on wetland vegetation.[34,35]

Figure 20. Cattle have damaged this wetland near Harvey and degraded the resources used by wetland animals. The soil is trampled and exposed. The water is muddy and contaminated with wastes. Most native understorey vegetation has been grazed and trampled, except the unpalatable species in the foreground. Photo – R Lynch/DEC.

Aestivating: being in a state of dormancy that occurs in some animals to survive a period when conditions are hot and dry

Trampling also closes spaces and cracks in the ground, collapses burrows and may crush soil-dwelling invertebrates, frogs, tortoises and small mammals.[36] For many intermittently inundated wetlands in semi-arid and arid pastoral lands, the top layer of soil is extremely important when the wetlands are dry, as it contains the dormant stages of aquatic invertebrates, **aestivating** burrowing frogs, seeds and carbon stores until the next time the wetlands are inundated.[37] Trampling can compact and disturb this soil layer and its plant and animal life, and grazing removes the vegetation, exposing the soil to wind erosion.[37]

Grazing livestock also compete for food with native grazers. Livestock grazing may reduce the abundance of important food plants or seeds eaten by certain animals. Native animals often take refuge in wetlands during droughts. As introduced livestock and feral animals also use wetland areas more intensively at these times, native vegetation may become severely overgrazed.

case study

Endangered burrowing crayfish – wetland animals threatened by livestock

The Dunsborough burrowing crayfish (*Engaewa reducta*) is found in seasonally inundated freshwater wetlands between Dunsborough and Margaret River in the south-west of WA.[38,39] The crayfish are small (up to 5 centimetres in length) with large claws that are usually vivid purple or cobalt blue[38] (Figure 21a). They are found in a variety of wetland habitats with moist sandy or loamy soils, including vegetated seeps, swampy plains and swamp headwaters of streams. They construct a complex burrow system that can be several metres deep. At wetter times of the year burrows are marked by conspicuous chimneys of soil pellets (Figure 21b). Their burrows enhance the flow of oxygen, water and nutrients through wetland soils and provide shelter and retreats for other organisms, especially when their habitats dry.

The Dunsborough burrowing crayfish is listed as a critically endangered species under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. The main threats to the crayfish are land clearing, farm dam construction and cattle grazing.[39] Cattle activity leads to soil compaction and erosion, reduces the water-absorbing and water-holding capacity of soils and trampling of burrows. Farm dam construction alters surface and groundwater flows, increases sedimentation and leads to waterlogging or flooding of suitable habitats.

Two very similar species of *Engaewa* crayfish – the Margaret River burrowing crayfish (*E. pseudoreducta*) and the Walpole burrowing crayfish (*E. walpolea*) – are listed as threatened species under Western Australian legislation.[38] Protecting critical habitat with livestock-proof fencing is a key conservation measure for all of these species of crayfish.[38]

Figure 21. (below) (a) The endangered Dunsborough burrowing crayfish (*Engaewa reducta*). Photo – K Rogerson/DEC. (b) A 'chimney' of soil pellets at the entrance of a crayfish burrow. Photo – J Jackson/DEC.

(a)

(b)

Managing livestock in and around wetlands

Sustainable agriculture is defined as profitable agricultural systems that conserve the environment while contributing to the economic and social wellbeing of rural WA.[40] The challenge for landowners and managers is to manage livestock and properties to be both profitable and ecologically sustainable in the long term. In the past, society and markets have not valued wetlands, but this is now changing and landholders whom manage wetlands are expected to ensure they are in good condition. The good news is that sustainable land management has positive outcomes for landowners and their livestock and that there is assistance, such as technical and financial assistance, available to enable landowners to manage wetlands.

There are four main strategies for managing livestock in and around wetlands (Figure 22):

1. Permanently exclude livestock from the wetland – this is the best option for wetlands.
2. Keep the wetland in reserve for special or emergency use only – this is the best of the options for grazing wetlands.
3. Graze the wetland for a short time period as part of a controlled grazing system – a better option than continuous grazing but this needs to be carefully managed.
4. Continuous wetland grazing – this option has the most impact on wetlands.

Livestock properties are very diverse. They range from a single paddock with a few horses for recreational purposes to extensive sheep and cattle enterprises in the WA rangelands. In considering which strategy is most suitable at a site, many factors relating to the property, the landowner's aims, and the nature of the wetlands need to be taken into account. Note that these options refer to livestock grazing systems and not to intensive livestock-keeping such as feedlots.

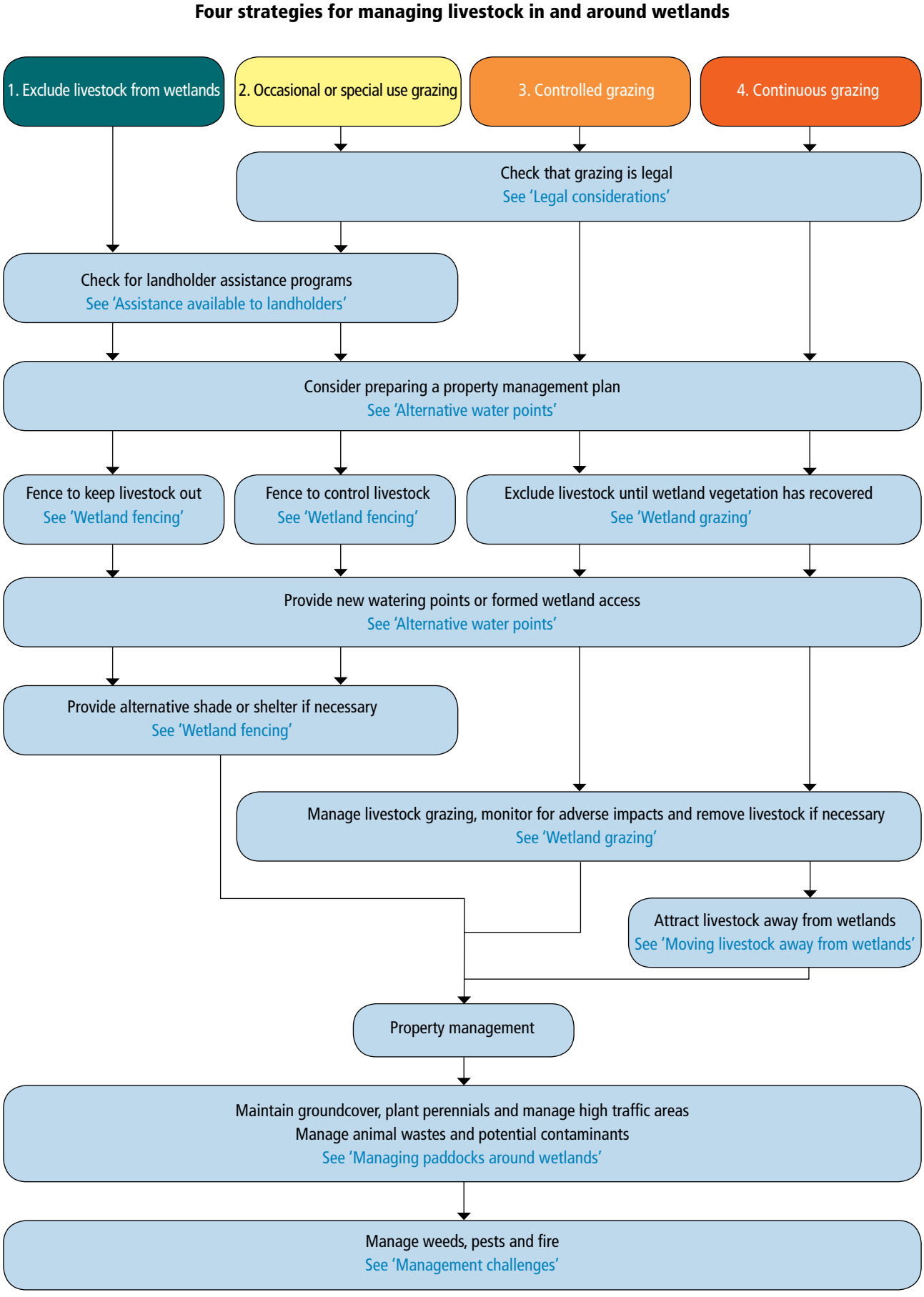


Figure 22. Four strategies for managing livestock in and around wetlands

Assistance available to landowners

Nature conservation assistance programs

There can be significant costs in effectively managing wetlands on livestock properties. Government and non-government organisations recognise that ecologically sound livestock management practices can contribute to the preservation of Western Australia's environment. As it benefits the wider community, a number of organisations have established programs to assist landowners to make positive changes.

➤ Wetland conservation assistance programs are listed in the topic, 'Funding, training and resources' in Chapter 1.

Tax deductions for landcare operations

Landholders or lessees may be able to claim a tax deduction in the year they incur capital expenditure on a 'landcare operation' for land in Australia. Landcare operations cover what were previously known as 'land degradation measures'. Landcare operations include the following activities: erecting fences to keep animals out of areas affected by land degradation, to prevent or limit further damage and help reclaim the areas; erecting fences to separate different land classes in accordance with an approved land management plan; eradicating, exterminating or destroying plant growth detrimental to the land; eradicating or exterminating animal pests from the land; and preventing or combating land degradation other than by the use of fences.

➤ For more information see *Landcare operations tax concessions*[42] from the Australian Taxation Office website (www.ato.gov.au).

Legal considerations

The *Environmental Protection Act 1986* (EP Act) contains provisions for the protection of native vegetation in WA while allowing for approved clearing activities. The native vegetation clearing provisions of the EP Act and the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 came into effect on 8 July 2004 and are administered by DEC. These regulations govern all forms of land clearing. Livestock grazing is clearly identified as a type of clearing, because of its impact on native vegetation. Activities such as increasing the stocking rate on native pastures or grazing regenerated areas will require a permit if an exemption does not apply.

➤ The EP Act and the Environmental Protection (Clearing of Native Vegetation) Regulations 2004[43] can be viewed online at the State Law Publisher's website at www.slp.wa.gov.au. Fact sheets outlining the clearing provisions are available from DEC's website at www.dec.wa.gov.au/nvc.

Farming activities, such as land-use change or intensification, can have the potential to impact upon environmental assets including threatened species and ecological communities, migratory birds, wetlands of international importance, World Heritage properties and national heritage places. Activities which have the potential to impact on these assets need approval under the Australian Government *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The *Environmental Reporting Tool*[44] can provide an indication of whether a particular property is likely to contain any matters of national environmental significance under the EPBC Act.

➤ For more information see *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and *Farming and the national environment law: EPBC Act* fact sheets at www.environment.gov.au/epbc. Other fact sheets are available from the National Farmer's Federation (NFF) (www.nff.org.au/policy/nrm.html). Free advice on how the EPBC Act applies to particular properties is available from the Environment Liaison Officer at the NFF (email: environment@nff.org.au).

Property management planning

Livestock owners can employ a number of strategies to reduce the impacts of livestock on wetlands. A property management plan is a useful way to identify, plan and integrate new strategies into a farming operation. A **property management plan** or whole farm plan is a working plan for the design and management of a property based on its natural resources, the activities undertaken (such as horse breeding or beef production), the manager's goals and financial considerations.[45] A well thought-out and achievable plan can have many benefits including meeting personal and lifestyle goals; maximising the productivity, profitability and sustainability of a property by designing the most effective layout for paddocks, roads, watering points and other infrastructure; and managing and protecting natural resources such as wetlands. Many land managers have taken the steps involved in a property management plan but may not have recorded them in a plan or kept it up to date. A written property management plan is a valuable management tool that maintains a record of information and decisions and can also help with obtaining approvals, funding and tax concessions by demonstrating a duty of care to the environment and natural resources.[45]

➤ See *How to develop a property plan*, available at www.agric.wa.gov.au. HorsesLandWater *Management Guidelines*[45] also provide information about property management planning for horse-keepers. For assistance with property management planning, landholders with small properties (up to 100 hectares) can contact the Small Landholder Information Service (SLIS) at the Department of Agriculture and Food Western Australia or visit www.agric.wa.gov.au. In the rangelands, the Ecologically Sustainable Rangeland Management Program (ESRM) based within the Department of Agriculture and Food can help with property plans. For more information, see www.esrm.com.au.

Some land managers may wish to develop a more detailed plan of management for their wetland. A wetland management plan can also help with obtaining approvals, funding and tax concessions. Various organisations can assist with property planning and wetland management advice. For guidelines on wetland management planning see the topic 'Wetland management planning' in Chapter 1.

Figure 23. Pastoralists engaged in a property planning workshop as part of the Ecologically Sustainable Rangelands Program (ESRM). Photo – L Bayley/Department of Agriculture and Food.

Section 1: Wetland fencing

Fencing is the best tool for reducing the impact of livestock on wetlands. Keeping livestock out of wetlands can reduce erosion and promote livestock safety, protect or improve water quality, regeneration of native vegetation and habitats for native animals. Where it is not feasible to exclude livestock from wetlands, managers can use fencing to control livestock access.

As fencing is often a significant investment it is worth doing well the first time, by planning carefully, choosing good quality materials and using sound construction, as wetland fences often come under extra pressure compared to dryland fences. Issues to consider include the type of livestock, fence location, costs and maintenance requirements. Good access gates may be needed to carry out fire, weed and pest management, and for recreational use and livestock access, if grazing is to be permitted. Where livestock are excluded from wetlands, it is necessary to ensure that they have alternative sources of water, food and shelter.

Fence placement

To protect the whole of a wetland by fencing it involves identifying the whole area of the wetland. For example, a wetland that has surface water for all of the year will have one or more areas that are always under water, as well as areas that are only under water for part of the year. There will also be areas that are waterlogged after the wet season or after cyclonic rain but that eventually dry. As a rule of thumb for fencing purposes, the outer edge of the seasonally waterlogged area following successive wet seasons is the edge of the wetland.

➤ For additional detail on different types of wetlands and determining a wetland boundary, see the topic 'Wetlands in Western Australia' in Chapter 2.

It is best to position fences well above the highest known flood limits. Wetlands are very dynamic environments—that is, they vary over time—and during very wet years, they may cover a much larger area than in dry periods. Placing the fence too close to the edge of the open water can result in flood damage or loss of fences. If possible, locate fence lines where there is low erosion hazard to minimise damage from fence line tracking by livestock.[18]

➤ Determining a wetland boundary can be difficult. For advice about determining an appropriate place to put wetland fencing, contact your local regional DEC office, landcare organisation or NRM wetlands officer.

Fencing an area of dry land between the wetland and the adjacent paddocks helps to buffer wetlands from livestock impacts. Another way to maintain and improve biodiversity is to link wetlands with other areas of remnant vegetation on the property using corridors.

extra information

Wetland buffers and corridors

A buffer is an area of dryland around a wetland that can help to protect the wetland from the impacts of livestock and farm activities, such as chemical and fertiliser drift, wind erosion, nutrient enrichment and weed invasion.

Natural regeneration or replanting a wetland buffer can have other benefits, such as providing a windbreak or shade for livestock outside the fenced area, habitat for native animals and by using water, which may help protect the area from salinity caused by rising groundwater.

For some landholders, allowing for a wetland buffer will be a sacrifice of productive pasture on the wetland margin. However, wetland buffers can be used creatively to provide economic benefits as well as wetland protection. Maintaining or planting the buffer with local native bushland species could be a source of native seed for other local revegetation projects, provide timber, carbon or firewood. Examples which provide future economic benefits include native tree species for timber, carbon or firewood collection, sandalwood (with its host jam trees) or oil mallee for their specific products. It is best to choose species which do not require fertilising or irrigation as these activities will compromise the purpose of the buffer. In each of these cases, harvesting needs to be carefully planned and managed so that it doesn't reduce the function of the buffer or damage the wetland.

➤ For advice about determining an appropriate buffer width, contact your local regional DEC office. For more information about bushland buffers on farms, see the Department of Agriculture and Food publication *Vegetation buffer zones*[46] (www.agric.wa.gov.au).

Wildlife corridors (also known as ecological linkages) are a good way to maintain and improve biodiversity in rural landscapes. Doug and Eva Russell, cattle farmers in Manypeaks, have fenced wetlands and remnant vegetation on their farm (Figure 24). Seventy-three hectares of remnant vegetation and wetlands have been covenanted with the National Trust and their property is registered with DEC's *Land for Wildlife* program. The Russells have used fencing, direct seeding and planting to create vegetated corridors through the cleared farmland which now connect the wetlands and dryland remnants.

(a)

(b)

Figure 24. (a) Doug Russell at a lake on his Manypeaks farm which he has fenced off from cattle. Photo – B Schur/Green Skills Inc. (b) An aerial photo showing (in red) two corridors that have been revegetated to connect fenced wetlands and remnant vegetation. The corridor on the left is along a creek (that flows out of the lake in the foreground) and, in this photo, it had been recently planted. Photo – K Hopkinson/Green Skills Inc.

Fencing for flood-prone areas

When choosing fencing to use near wetlands, it is also important to consider the frequency and extent of flooding that occurs at the site. Fences in wet areas may deteriorate very quickly so putting in expensive fences may be a waste of resources. Instead, portable fencing that can be contracted or expanded to prevent damage to the fence and injury to livestock may be an option where frequent flooding occurs. In wetlands which flow during floods, prefabricated mesh fencing may trap debris like a net and collapse. Plain wire fencing with strainer assemblies either side of the floodway is one option to minimise damage. If it fails, only the section between the strainers will be lost (Tim Saggers 2009, pers. comm.). Lay-down fencing and drop-down fencing are other options for flood-prone areas.[47]

➤ For flood-proof fencing designs see the Department of Water's Water Notes 19 *Flood-proof fencing for waterways.*[47]

Types of fencing

There are many fence designs available to suit different situations. Table 2 compares the advantages and disadvantages of fences commonly used around wetlands. Fences around wetlands can come under extra pressure from livestock (Figure 25) when there is a feed shortage in their paddocks or where there is intensive grazing, so it is essential that they are well constructed. Local knowledge is usually a good guide to local best practice.[48]

➤ Good sources of information on fence types and costs are fencing manufacturers and suppliers (many have informative websites) and local fencing contractors.

Figure 25. Cattle from the paddock on the right have pushed their way through this barbed wire and star picket fence protecting Saunders Spring, a mound spring in the Kimberley, to access the regenerating pasture and wetland vegetation on the left. Photo – G Daniel/DEC.

Table 2. Advantages and disadvantages of common fence types used to exclude livestock from wetlands

Fence type	Advantages	Disadvantages
Plain wire high-tensile fencing High-tensile fencing consists of up to seven tensioned strands of wire usually supported by wooden posts or steel star pickets.	• lower construction costs compared to prefabricated mesh fences • suitable for covering long distances • strong • simple to maintain • longest lasting (up to thirty years) • plain wire (rather than barbed) is less prone to flood damage[49] • less damage to kangaroos (and the fence) compared to mesh fencing	• may deteriorate rapidly if inundated • plain wire is less effective in controlling livestock[49] • can be damaged by livestock and may require electrifying or use of barbed wire for two strands[50] • cheaper for straight sections, more expensive to follow contours[48,51] • plain wires have low visibility and horses in particular have been known to sustain leg injuries from entanglement. Plastic-coated 'sighter' top wires can be used to improve visibility.
Prefabricated mesh fencing These consist of strong 'ready-made' mesh such as Ringlock, Stocklock® and Griplock® suspended between droppers and end posts, often supplemented with one or two plain or barbed top wires. Mesh is manufactured in a range of horizontal wire spacings suited to different types of livestock.	• excellent control for cattle, sheep, lambs and vermin • requires fewer droppers, because the intermediate support is in-built • copes well with minor damage as snapped wires are supported by surrounding mesh	• more expensive than other types of fencing • can be damaged by flooding as it tends to collect more debris than plain wire • may create a barrier for native animals • difficult to repair where many wires have snapped • more damaging to livestock and native fauna (e.g. kangaroos) when they get legs tangled in the mesh
Electric fencing An electric fence consists of a power source/energiser, an earth/insulation system and a post/wire arrangement. Construction can be as simple as electrified tape on insulated poles which can be put in by hand. Alternatively, electric wires can be incorporated into traditional permanent wire fences or added as an outrigger to existing or deteriorated fences. The design of the fence and the shock the animals receive should be matched to the type of livestock and livestock need to be trained or educated to electric fences before they can be relied on.[52] Mains power is the most reliable and least expensive option but is not available in all areas. Solar powered battery energisers are another option.	• cheap to establish[52] • quick and easy to erect and move[52] • low risk of injury or damage to livestock • can follow the contours of the area to be protected, resulting in the need for fewer materials[52] • if inundation is a problem, electric wires can be removed and coiled for storage • cattle will generally require only one well-placed electrified wire	• sheep require three or more electric wires with close spacings between wires • regular inspection and maintenance is important as a short circuit can render a large section of a fence ineffective • native animals and feral goats can cause frequent shorting and high maintenance[51] • need to be kept clear of grass and weed growth, falling branches and debris • not suitable where overgrowth of vegetation is likely • poor earthing and lightning strikes are common problems • not a physical barrier and may not stop aggressive animals • electric fences and energisers can pose a danger to people, especially children, and if people can access the fence warning signs are mandatory • small native animals, such as echidnas and bandicoots, may be killed by electrified wires close to the ground[53]

Native animals and wetland fencing

Wetland fencing may unintentionally exclude or trap native animals. Mesh, barbed, plain and electric wire fences have caused injuries and deaths of bats, kangaroos, wallabies, small mammals, waterbirds (Figure 26), birds of prey and owls.[54] Wetland fences can pose a higher risk of entanglement or injury when they are new, where they cross animal flight paths and tracks into a wetland and where they are less visible at the boundary between low pasture and taller native vegetation.[54] The top and bottom wires are where animals most often come in contact with the fence, with small animals such as echidnas and snakes being killed by electrified wires close to the ground.[53]

Figure 26. Straw-necked ibis (*Threskiornis spinicollis*) are commonly seen in wetlands. This individual died after it became entangled in barbed wire fencing. Photo – A Johnson/Tolga Bat Hospital.

These problems can be minimised by choosing a fence type and location that increases fence visibility and by installing native animal access ways, such as gates. The use of four or five strands of plain wire fencing is considered safer for native animals than barbed wire or mesh and is usually effective for livestock control where stocking rates are not high. Barbed wire fencing can be modified to reduce wildlife injuries by replacing the top two wires with plain wire or covering barbs with tubing such as longitudinally split poly pipe. In areas where entanglement is a problem, fence visibility can be increased by attaching metal tags, old CDs, tin cans or aluminium pie dishes to the top two wires. Other options include solid high-tension nylon sighter wire which glows in the dark and is used mainly for horse fencing.

As well as being injured, kangaroos and emus can cause damage to fences (Figure 27). Allowing them to pass through safely reduces fence damage, repair costs and time spent locating escaped livestock. Kangaroos and wallabies generally cross fences by crawling through lower wires or by digging underneath; generally their least preferred option is to jump over. Prefabricated mesh fencing can be dangerous to kangaroos and wallabies, but even plain wires can cause entanglement if they attempt to jump over or through while being chased. Emus usually try to roll between the wires. Solutions can be relatively simple. A cattle producer in the Murchison found that stringing the bottom wire one foot above the ground let native animals move underneath and reduced damage by kangaroos and emus.[51] Placing the bottom wire 15–20 centimetres from the ground

will allow kangaroos to go under, but it should be noted that lambs will also be able to get under (Tim Saggers 2009, pers. comm.). Owners of a cattle property in Queensland found positioning two end posts separated by a gap too narrow for cattle, allowed animals to move through the high-tensile fence without injury or causing damage.[53] Livestock-proof kangaroo access gates can be installed where kangaroos have dug under a fence along a well-used kangaroo track (Figure 28).

➤ For more information, see *Wildlife Friendly Fencing Guidelines*[53] at www.wildlifefriendlyfencing.com and DEC Fauna Note 32 *Fencing and gates to reduce kangaroo damage.*[55]

Figure 27. Kangaroos have damaged this mesh fence in order to access the wetland. Photo – E Davies Ward/DEC.

Figure 28. A livestock-proof kangaroo gate in a fence around Lake Mealup in the Shire of Murray. Photo – P Wilmot/Lake Mealup Preservation Society.

extra information

Barbed wire fences around wetlands – a problem for brolgas

Barbed wire fences around wetlands can be especially hazardous to large waterbirds.[56] For example, brolga (*Grus rubicunda*) which occur in northern WA, have large wingspans of 2 metres or more, require space for a 'run-up' to gain momentum for take-off and their long legs hang down for both landing and take-off. Fences, especially barbed wire, placed close to wetlands and in flight paths can entangle these and other large waterbirds such as black-necked storks (*Ephippiorhynchus asiaticus*).[56] Young birds and those not familiar with fences are the most vulnerable. Fencing around wetlands can also prevent young flightless brolgas from following their parents between pastures where they feed and roosting and breeding areas in wetlands.

➤ For more information about this issue and alternative fence designs, see the *Australian Crane Network*[56] at ozcranes.net.

Providing alternative shade or shelter

On some farms, wetland vegetation is important for livestock welfare, as it provides shade and shelter for livestock such as newly shorn sheep or ewes with lambs.[57] For this reason landholders can be reluctant to exclude livestock from wetland vegetation, or may choose to place fences very close to the vegetation, so that livestock can shelter.[57] However, in the long term, this approach can cause erosion and jeopardise wetland condition, because livestock will browse the wetland vegetation through the fence. Horses and sheep tend to 'track' along fence lines often causing excessive damage to vegetation and soil in these areas.[45] Alternative shade and shelter can reduce livestock dependency on wetland areas. Constructed shelters may fulfil the requirement for shelter in the short term, with strategically placed, fenced clumps of fast growing native shade trees or perennial shrubs providing a long-term alternative.

➤ Local Department of Agriculture and Food offices can provide advice on appropriate local plant species suitable for livestock shelter.

Natural regeneration or revegetation

If natural processes of the wetland are still functioning (that is, sources of native plant seed are present as soil seed banks or there is native vegetation nearby) and growing conditions are good, wetland plants will regenerate naturally (Figure 29). If the land has been cleared for a long time and native species and seed banks are depleted, revegetation may be a better option.

➤ For additional detail, see the topic 'Managing wetland vegetation' in Chapter 3.

Figure 29. Sandy Lyon, a cattle farmer with a property south of Stirling Range National Park, has fenced off flat-topped yate (*Eucalyptus occidentalis*) wetlands and associated remnant vegetation on his property. There has been prolific regeneration of flat-topped yate and paperbark (*Melaleuca* sp.) trees in some wetlands, rushes and sedges in others. Photo – B Schur/Green Skills Inc.

Section 2: Alternative watering points

When livestock are excluded from a wetland previously used for livestock watering, it will be necessary to provide alternative watering points. Even without the use of fencing, careful siting of alternative watering points can attract livestock away from wetlands, reducing grazing pressure in these sensitive areas and distributing grazing more evenly through dryland pastures. This needs to be planned carefully though as horses and cattle, in particular, like to cool off by standing in water or under trees during hot weather and may enter the wetland despite that fact that alternative water points are available.

Some benefits of providing an alternative watering system include:

- cleaner water, which can promote healthier livestock, less disease, increased growth rates and better wool, milk and meat production
- better capacity to match needs of livestock (for example pregnant or lactating) to the available pasture
- better control of grazing patterns and improved feed utilisation
- reduction in livestock losses due to floods or bogging
- reduced mustering times
- improved wetland condition.[51]

Providing a watering system for livestock can be relatively simple for small properties which have another readily available water source and few livestock. For extensive landholdings with large numbers of livestock that require a lot of water, installing a watering system can be expensive and time-consuming to establish and may involve ongoing maintenance and operating expenses, though the effort can be offset by the many advantages. Careful planning and consideration should be given to the best system for a given property, purpose and paddock layout.[51] The choice of watering system will depend on several factors including:

- the available water source/s
- the amount of water required
- the paddock layout
- the distance between the water supply and watering point and between watering points
- the height difference between the water supply and the watering point/s[51]
- the availability, type and quantity of feed.

➤ Case studies of watering systems used successfully by farmers in different parts of Australia are provided in *Stock and waterways: a manager's guide*.[51]

Water sources

In WA, the Department of Water regulates the use of water from many sources and a permit or licence may be required to take water from a natural surface water source, build a dam or weir, collect water in a dam or drill an artesian bore. Local government approvals may also be required.

➤ More information about farm water supply, licensing and permits can be obtained from regional Department of Water offices or from the Department of Water's Rural Water Planning Team. A range of Department of Water *Water Facts* publications are available at www.water.wa.gov.au.

Also, bear in mind that taking water from the environment, whether it is surface water or groundwater, may adversely affect the wetland you are trying to protect.

➤ For additional detail, see the topic 'Managing hydrology' in Chapter 3.

The quality of alternative water sources needs to be determined before establishing alternative watering points. The quality of the water required by livestock is determined mainly by the total soluble salts (the salinity) it contains. All livestock require access to clean, fairly fresh water, but different livestock have different tolerances to salt levels, and tolerance also varies with circumstances and conditions.[58]

➤ For more information, see the Department of Agriculture and Food's *Water quality for farm domestic and livestock use.*[58]

Water troughs are a common way to provide water to livestock and protect wetlands from trampling and fouling (Figure 30). Livestock prefer to drink from troughs rather than natural water bodies because they don't have to stretch their heads below their feet to drink, which they don't like to do due to their poor depth perception and behaviour adapted for predator avoidance.[59] Troughs need to be cleaned and checked regularly to ensure they provide a continuous supply of clean fresh water, especially in the dry season. Portable and permanent troughs may be manually or automatically filled by water pumped or piped from surface water, rainwater, groundwater or scheme water.

Figure 30. Water troughs provide clean drinking water for livestock excluded from fenced wetlands. Photo – P Maloney/Department of Agriculture and Food.

Surface water

Landholders with legal access to natural surface water may be able to pipe or pump it to other parts of their property (Figure 31). Taking water from or near wetlands needs to be managed carefully to minimise impacts associated with altering the natural water regime of the wetland.

➤ The importance of wetland water regime is discussed in the topic 'Wetland hydrology' in Chapter 2.

Figure 31. This dam has been constructed to reduce the impact of livestock on Saunders Spring, a mound spring wetland in the Shire of Broome. Cattle can access water which is gravity-fed to the dam from the continuously flowing spring, but the wetland (in the background) is protected by fencing. Photo – G Daniel/DEC.

Dams

On larger properties which contain a suitable site, a dam that captures surface run-off can be an effective and environmentally sound option for watering livestock. In general, the soil needs to contain more than 25 per cent clay and should not be strongly structured, friable or self-mulching for dam construction. Dams need to be carefully designed with adequate natural catchment and volume to supply the number of livestock to be watered.

The viability of dams as a water source will depend on factors such as the average annual rainfall, its reliability and the evaporation rate. Evaporation rates across much of WA are very high. For example, typical evaporative water losses from farm dams in the Wheatbelt range from 1 metre per annum in the south-west to 2.5 metres per annum in the north-east.[60] 'Roaded' catchments which direct water flow into dams can be used to increase collection.[61]

Unfenced dams may be subject to the same water quality issues as wetlands where livestock have direct access to the water, so fencing and piping or pumping to nearby troughs may be a good option.

➤ For more information, see *Farm dams in Western Australia.*[62] *Dam design for pastoral stock water supplies*[63] and *Dam construction and operation in rural areas.*[64] In arid areas, see the *WaterSmart pastoralism handbook*.[65]

Groundwater

Abstracting groundwater via a bore may provide a more reliable water source, though bores can be expensive to construct and equip. The availability and quality of groundwater varies from site to site. The cost of groundwater bores will vary according to soil type and the level of the water table.[51]

Domestic water supply

Water from household supplies, such as rainwater tanks or government-provided scheme water, may be an option for small properties with very few livestock.

➤ For more information on water supply issues affecting farms, please contact the Department of Water's Rural Water Planning Team or email ruralwater@water.wa.gov.au.

Water requirements

Water requirements should be determined according to the maximum number of livestock to be watered in each paddock. When planning water requirements, allow for losses by evaporation, and consumption by native and feral animals.[67] Water requirements of livestock vary depending on the type of livestock, environmental conditions (such as temperature and humidity levels), the type of feed they are eating, physiological condition (such as pregnancy or lactation) and the quality of the water. For example, while young cattle require 25–50 litres per head per day, lactating cows feeding on grassland or saltbush require 40–100 or 70–140 litres per head per day respectively. The quantities in Table 3 are a guide to the daily water requirements of some livestock.

➤ To calculate water requirements see *The Pastoral Stock Water Workbook*[66] at www.agric.wa.gov.au. The Department of Agriculture and Food can help landholders estimate costs of maintaining livestock water and make informed decisions about existing and proposed water points.

Table 3. Daily water requirements of livestock in summer[62,69]

Type of livestock	Sheep	Beef cattle	Dairy cows	Bulls	Horses
Litres/animal/day	7	30–45	50–70	Up to 90	45

Paddock layout and water point placement

The installation of a watering system is often a trigger to implement a more efficient paddock layout.[51] Property planning can assist in this process, since paddocks and fence locations can be altered to take advantage of existing water sources or landforms which provide elevation for water storages. In some cases, it may be more practical to establish a new water supply than to pump or pipe it over long distances.

If wetlands are not being fenced to restrict livestock access, water troughs are best installed well away from wetlands to encourage livestock to move away from these areas.[52] Allowing for additional water points at the time of installation will provide backups in the event of problems and builds flexibility into the watering system. Creating a system where watering points can be shut or closed off adds the potential to move livestock around to even up grazing or spell degraded areas by shutting down a particular water point.[51] As a general guide, permanent water points should be placed:

- no more than 3 kilometres apart for effective grazing and animal production, although healthy animals can travel further[51]
- at least 50 metres from waterways, wetlands and drainage channels which feed into them
- away from boggy, fragile or degraded areas, depressions and steep slopes to minimise erosion caused by livestock tracks
- along a fence line (for easy maintenance), rather than the interior of the paddock[52]
- in the shade, to keep algal growth to a minimum.[52]

Pumps and water delivery systems

The location of the water source relative to distribution points will determine the type of watering system that can be installed. Research has shown that the flow rate to a trough is a more important factor for effective livestock watering than the capacity of the trough[52], so this should be taken into account when designing a watering system.

Pumps can be selected based on the pressure and volume of water required. The operating requirements will determine the power required to drive the pump. The main types of pump power are electric, wind, diesel/petrol and solar. Solar pump systems are generally more expensive to install, but are reliable and require little maintenance.[65] They are gaining in popularity in the rangelands as they perform well in summer and are well-suited for water points at remote sites.

➤ A good overview of the different types of pumps and power sources including their applications, advantages and disadvantages is presented in The Kondinin Group's research report *Watering stock from natural sources*[67] and New South Wales Department of Primary Industries' publication *Farm Water.*[68] In the arid rangelands, see the *WaterSmart Pastoralism Handbook*.[65]

Telemetry is a technology that allows remote monitoring of infrastructure. Data is gathered, recorded and transmitted from measuring devices (such as a flow meter at a water point) using radio or cellular phone technology without a person having to be at the location. Telemetry systems are capable of switching pumps on or off, monitoring tank or dam levels, recording rainfall, starting and monitoring generators and medicating water. This allows monitoring when access is restricted (for example during the wet season) and offers substantial savings in terms of travel costs, time, labour and vehicle wear and tear.

➤ For more information, see *Telemetry systems for remote water monitoring control systems.*[69]

Formed wetland access for livestock watering and crossings

If access to the wetland area for livestock watering or crossing is unavoidable (and legal), strategically located formed access points can reduce the impacts of livestock. A fenced compacted rocky laneway that extends down into the water (to the low water mark) is a good method for allowing strategic access (Figure 32). The following guidelines should be considered:

- Choose an area that is relatively flat – this will reduce the risk of erosion as well as being easier and safer for livestock to access.
- The area provided should be the minimum required for the number of livestock that will be using the area.
- Ensure adequate fencing around the area so that livestock are not able to access other sections of the wetland.
- Reinforce the area's surface with gravel or a similar material to reduce the erosion risk. The use of coarse rocky material to create a rough variable surface (that is uncomfortable, but not dangerous, for livestock to walk on) will minimise the time they spend at the water's edge.[70]
- Avoid areas that are well sheltered as this is will increase the likelihood of livestock loitering in the area for longer than is necessary.

Restricted access points limit trampling and grazing of wetland vegetation and may reduce, but do not prevent, faeces and urine and the associated nutrients and contaminants from entering the water. Erosion can occur at the access point if care is not taken with its location, construction and maintenance.[70]

➤ For more information about constructing livestock crossings, see *Livestock management: construction of livestock crossings.*[71]

Figure 32. A fenced laneway with a compacted rocky ramp allows cattle to access and cross a waterway, but minimises damage at the site and protects the rest of the waterway.
Photo – R Thorpe/Chittering Landcare Centre.

Section 3: Wetland grazing

General principles for wetland grazing

Allowing livestock access to wetlands is not recommended, because livestock degrade wetlands. Where grazing wetlands is proposed or is to continue, consider the following points.

Determine whether grazing is legally permitted in the wetland

A permit may be required to start or alter grazing practices in wetlands under the Government of Western Australia's Environmental Protection (Clearing of Native Vegetation) Regulations 2004. Be aware that there may be land use restrictions (including the exclusion of livestock grazing) which apply to wetland and bushland areas protected or restored with grants or funding for soil, water or biodiversity conservation. Local government legislation may also restrict livestock access to wetlands and regulate the type of livestock or stocking rate.

➤ For additional detail, see the previous section in this topic entitled 'Legal considerations'.

Exclude livestock until native vegetation has recovered

It may be important initially to 'spell' a wetland paddock. Spelling involves removing livestock for a period of time so that wetland and buffer vegetation can regenerate either naturally or through plantings. Some additional vegetation management, such as weed control or seeding, may be necessary to get good regeneration results. A good groundcover of native plants is desirable and livestock should be excluded until young trees have gained sufficient height to survive grazing when livestock are re-introduced.[72]

➤ For additional detail, see the topic 'Managing wetland vegetation' in Chapter 3.

Avoid grazing after flood, fire or drought

Grazing after flood events, fire or drought can result in pugging and accelerate erosion of exposed soils. At these times, wetland plant communities are stressed and at their most vulnerable. When rain returns after a drought, livestock should be excluded until plants have had the opportunity to recover. Floods and fires may also stimulate regeneration of native wetland plants and excluding grazing after these events is a great opportunity for native seedlings to establish.

If possible, choose livestock which will cause the least damage

Consider the type of livestock allowed access near wetlands, as some will impact less on wetlands than others. For instance, sheep don't tend to enter water but are more likely to graze low woody vegetation, so might have lower impact on water quality but higher impact on regenerating tree seedlings. Pigs and goats are highly destructive foragers and should never be given access to wetlands.[3]

Monitor the effects of grazing on wetlands

Check wetlands frequently once grazing is in progress, so that problems can be managed. It is important to manage grazing so that there is sufficient vegetation growth and post-grazing stubble to protect soils from erosion and act as a filter strip for sediment and nutrients when it rains. Look for evidence of:

- browsing on shrubs and trees rather than grasses
- bark stripping or other structural damage to trees
- uprooting of wetland plants
- increased water turbidity
- pugged soils
- damage to banks.

These are signs that livestock should be moved out of the area.

➤ For additional detail on monitoring the condition of wetlands, see the topic 'Monitoring wetlands' in Chapter 4.

Riparian: the habitats adjacent to waterways and estuaries

Build flexibility into the grazing management strategy

If possible, have a range of options available to move livestock to another paddock or de-stock, if it becomes necessary. Be willing to change the grazing strategy to achieve the best outcomes. A study of a range of riparian grazing strategies in the United States of America has shown that the commitment of the livestock manager was more important to achieving good land management than the grazing strategy they chose.[59]

Controlled grazing

Livestock exclusion is the best option for maintaining and improving a wetland's nature conservation values. However, if livestock grazing is to occur in and near wetlands, controlled grazing is more likely to minimise damage to these fragile areas than continuous grazing. Under controlled grazing systems, livestock managers may manipulate the paddock size, stocking rate, grazing time and livestock classes or species mix to achieve more even grazing, faster pasture recovery after grazing, persistence of more desirable plant species and maintain pasture productivity for longer.[8] The aim is to support more livestock and produce more meat, milk or wool per unit of land while effectively reducing the environmental impacts of grazing and increasing sustainability of pastures.

A range of controlled grazing strategies have been used successfully for riparian areas[59] which, like wetlands, are vulnerable to overgrazing. Management strategies will differ depending on whether they are being applied to a fenced wetland pasture or to a larger grazing unit which includes unfenced wetlands.

➤ For more information about grazing management options for wetlands in arid and semi-arid areas, see *Pastoral management options for Central Australian wetlands – Fat cows and happy greenies*.[18]

Special use grazing

One of the better options for grazing wetlands is to fence them and keep them as a 'special use' or reserve paddock to be used only for a short period at a particular time of year or for a special purpose such sheltering sheep during severe weather or lambing. In times of a feed shortage or drought, some farmers have opened their fenced wetlands to hungry livestock. It is important to be aware that this usually results in severe damage to wetland vegetation, which may take years to recover.

Rotational grazing

Rotational grazing is one type of controlled grazing system. It involves subdividing larger paddocks into several smaller pastures. Livestock graze a particular paddock for a certain period, and are moved to another paddock to spell the previous pasture.[8] A relatively high stocking rate relative to the size of the paddock forces livestock to be less selective in their grazing and to graze the paddock more evenly, but they are removed before they start to graze plant regrowth and this allows the vegetation to recover.[8] An example of a simple time-controlled rotational grazing strategy rotates livestock between four paddocks in a general program of two weeks grazing and six weeks rest.[73] More complex forms of rotational grazing, such as strip grazing and cell grazing, involve higher grazing intensities, many smaller paddocks and short rotation times (such as 1–3 days) based on the height of remaining plant cover.

When carefully planned, rotational grazing can benefit wetland vegetation by giving it a rest period during which it can regenerate. However, rotational grazing often involves higher stocking rates which can result in rapid degradation of wetlands (see the case study 'The Collards protect wetlands on their cattle property near Gingin' at the end of this topic). Rotational grazing can also benefit wetlands from which livestock are excluded, because it minimises erosion of paddocks adjoining wetlands by maintaining higher pasture cover and reducing the build-up of livestock wastes.

➤ Meat and Livestock Australia (www.mla.com.au) provide a range of fact sheets on rotational grazing.[73] See also *Towards a better understanding of rotational grazing* in Pastoral Memo: Southern Rangelands[74]

Dormancy: a state of temporary inactivity when plants are alive but not growing, i.e. they are **dormant**

When to graze wetlands

The following recommendations can be used to determine the time of year that controlled grazing will have the least negative impacts on wetlands. The recommendations may be contradictory, because grazing will have some impact on wetlands at any time of the year. While it may not be possible to satisfy all of the recommendations all of the time, by monitoring the effects, livestock owners can adapt and improve the controlled grazing strategy used for a wetland over successive grazing periods.

Keep livestock out when soils are wet or drying out

Grazing should be restricted during and after the period of maximum rainfall. This will help to maintain good groundcover during the period when the potential for water erosion and soil loss is greatest.[22] Also keep livestock out of wetlands when they are drying out as this is a time when damage by trampling can be severe.

Avoid grazing when native animals are breeding on the ground or in low vegetation

Disturbance to vulnerable animals such as waterbirds and migratory waders at key times may induce stress, reduce breeding success and cause breeding animals to relocate.

extra information

What are waders?

Wading birds, commonly called waders, are birds that feed on aquatic invertebrates found in shallow wetlands and tidal flats. Some species live in Australia all year round, but some species breed in the northern hemisphere and migrate to Australia for summer period from September to April. Some species are protected under international agreements and the Australian Government *Environment Protection and Biodiversity Conservation Act 1999*. For more information about waders, see the topic 'Wetland ecology' in Chapter 2.

➤ For information about local native wetland plants and animals, contact your regional NRM office, regional DEC office, *Land for Wildlife*, local landcare or bushcare group.

Avoid grazing when plants are germinating, actively growing, flowering and seeding

Grazing is likely to be most damaging to palatable native plants when they are actively growing, germinating, flowering and seeding.[14] Many wetland plants can reproduce from bulbs and tubers under the ground (called **vegetative reproduction**) without producing seed. These species are more vulnerable to grazing when they are actively growing.

Grazing is likely to be least damaging when most of the plants are **dormant**.[14] Different plant species move in and out of **dormancy** at different times and the period of dormancy also varies between regions and according to weather patterns.[14] For example, in south-west WA, the native perennial wetland grass swamp wallaby grass (*Amphibromus nervosus*) grows in winter and flowers from June to November, but matgrass (*Hemarthria uncinata*) grows actively in summer and flowers from December to April.[75]

Many wetland species germinate and seed in response to dry wetland soils being re-wetted. Livestock should be removed after wetting and not be re-introduced until these species have matured and re-seeded.[18]

As there are often many species of native plants within a wetland plant community, it may be difficult to determine the least damaging time to graze because a portion of the plant species in the wetland may be growing, flowering or seeding at all times. Reducing impacts may be a matter of controlling the grazing pressure, duration of grazing and grazing at different times or in different seasons in subsequent years.

➤ Seek advice about your wetland plant community from your regional NRM office, local landcare or bushcare groups to guide decisions about timing wetland grazing.

case study

Using controlled grazing to manage habitat – a trial at Lake McLarty in the Shire of Murray

In Eastern Australia, controlled livestock grazing has been used to achieve specific wetland management goals, such as weed control and fire management.[76] Livestock grazing in wetlands has also been used to maintain habitat suitable for migratory wading birds. Timing, duration and intensity of grazing have been manipulated to slow the spread of invasive aquatic emergent plants, maintain or create patchy vegetation or reduce emergent plant cover and maintain open water.[3]

Under the *Conservation and Land Management Act 1984* and Regulations, grazing is not usually permitted in nature reserves, as it is rarely compatible with nature conservation goals. However, restricted, regulated cattle grazing is planned at Lake McLarty Nature Reserve for the purpose of habitat management.[77] Lake McLarty, which lies south-west of Pinjarra, is a highly modified wetland that has been grazed by cattle since the 1880s, yet provides valuable habitat for many native species, including wading birds. Controlled grazing is to be reinstated on a trial basis, in order to control the growth of introduced pasture grasses and the invasive introduced bulrush (*Typha orientalis*) which threaten to colonise the open water and mudflat habitats favoured by the wading birds. Department of Environment and Conservation scientists will use this opportunity to closely monitor and assess the impacts and benefits of cattle grazing together with the impacts of other habitat management practices, such as regular slashing and use of herbicides.

Figure 33. Lake McLarty, showing introduced bulrush (*Typha orientalis*) growing along the lake edge. Photo – J Jackson/DEC.

Continuous grazing

The capability of any property to support grazing livestock without becoming degraded is determined by a range of factors such as soil type, slope, drainage and rainfall.[45,78] For example, steep land with clay soil that gets soft when wet is more vulnerable to erosion than flat, well-drained land. Land with different capabilities requires different management in relation to livestock.[49] Matching grazing management to land capability reduces the potential for land degradation. For example, creating paddocks on land with good capability and protecting land with low capability such as waterways, steep slopes and wetlands. Mapping land capability classes on a property is a one of the main steps in preparing a property management plan.

The main disadvantage of continuous grazing systems is that uneven animal distribution can lead to overgrazing in certain parts of even lightly stocked paddocks.[79] In paddocks with different land types, livestock will graze some areas in preference to others. To prevent land degradation, grazing management is then constrained by having to lower **stocking rates** to protect the most susceptible parts of a paddock.[79] Wetlands are usually the most susceptible part of a paddock with the lowest land capability, and may also be most favoured by livestock. Having unfenced wetlands in a paddock (i.e. a paddock with mixed land capabilities) can limit the stocking rate for the whole paddock, and will still risk degradation of the wetland and livestock safety. This is a good reason to separate wetlands from other land types using fencing.

extra information

Stocking rate

Stocking rate is the number of animals of a specified class per unit area of land, usually over a specified period of time. Stocking rates are expressed in units of 'dry sheep equivalent' (or DSE) which is the amount of feed required by a 2-year-old 45-kilogram Merino wether to maintain its weight. This is the standard used to express feed requirements of other classes of livestock (Table 4). For example, emus can be stocked at higher rates than sheep or cattle, but horses should be stocked at lower rates than cattle. If feral or native grazing animals are present, they may need to be accounted for in calculating suitable stocking rates. The recommended stocking rate (or **carrying capacity**) is the number of livestock that can consistently be kept on an area of pasture all year round with minor additional feed and without causing environmental degradation.[80]

Table 4. Livestock stocking rate comparisons expressed as Dry Sheep Equivalents (DSE)[81]

Animal to be stocked	DSE equivalent
One pony	8 DSE
One large horse	10 DSE
One breeding ewe	1.5 DSE
One large wether	1 DSE
One heifer	8 DSE
One alpaca (60–70 kg)	0.8 DSE
One large emu	0.7 DSE

It is unlikely that the condition of a wetland that has been degraded by livestock will improve under continuous stocking. To promote regeneration of wetland vegetation, the best strategy is to remove livestock for up to several years, then resume grazing at a lower stocking rate and use other methods discussed in other this topic to achieve a better distribution of livestock.

The capability of a land type will be influenced by its location within WA due to the affect of climatic conditions on plant productivity. As a guide, wetlands, whether inundated or waterlogged seasonally or intermittently, should be stocked at lower rates than the surrounding dryland. In many areas of the south-west, the recommended stocking rates for wetlands will be less than one animal per hectare when stocking animals other than sheep, and will limit the stocking rate for the whole paddock.[80] Meat and Livestock Australia advise not to 'set and forget'.[82] Varying a set stocking strategy between seasons can assist in managing grazing pressure effectively and improve pasture and animal production.

➤ The Department of Agriculture and Food has detailed information about local conditions across the state and can calculate the relevant permissible stocking rates on request. The Department of Agriculture and Food's Small Landholder Information Service provides advice tailored for small landholders. *The stocking rate guidelines for small rural holdings*[80] provides stocking rate guidelines for the Swan Coastal Plain and Darling Scarp areas.

Wetland management in the rangelands

Fencing wetlands

Pastoral enterprises in the rangelands typically graze low densities of sheep or cattle on native vegetation in extensive paddocks that incorporate many different land types. Often livestock are not actively managed beyond annual mustering. Native and feral animals frequently contribute considerably to the total grazing pressure which can lead to overgrazing and erosion.

➤ For more information see *Management of total grazing pressure: managing for biodiversity in the rangelands.*[83]

Managing grazing pressure at unfenced wetlands is rarely achievable. The most effective management for smaller discrete wetlands (such as springs) is to fence them to keep livestock (and other grazers out) and provide alternative water.

Over much of the rangelands the landscape has low relief, and extensive areas of floodplain (often associated with rivers) become intermittently inundated (Figure 34). These areas provide valuable grazing, but are often vulnerable land types. Fencing these land types to control grazing may be a costly improvement, but can improve livestock management, increase ground cover and vegetation condition, reduce erosion and improve water quality.

➤ For more information, read the case study *On the ground: What a difference a fence makes* by the Fitzroy Basin Association www.fba.org.au.

Figure 34. The inundated floodplain of the Lyndon River near Lake MacLeod in April 1998. Photo – L Bayley/Department of Agriculture and Food.

Trap yards

Trap yards, such as total grazing management (TGM) yards, are proving useful to livestock managers in the rangelands. These yards are self-mustering as livestock must enter them to access water points. They trap feral livestock (such as horses, donkeys and goats) and native grazers (kangaroos and emus) as well as livestock, allowing management of total grazing pressure.

➤ For more information, see *Total grazing management yards: A cornerstone for improved station profitability.*[84]

Conservative stocking

In the rangelands, it is common to stock more heavily during optimal weather conditions (such as the growing season following summer cyclonic rains), but these times are often followed by drought. Heavy stocking prior to drought or re-stocking soon after drought (before a pasture has recovered) can lead to degradation of both the vegetation and land.

More conservative stocking during optimal conditions can yield pasture that is better able to sustain grazing during times of drought when it is most needed. Monitoring the condition and productivity of paddocks and wetlands means that management actions can be taken before degradation occurs. If signs of degradation are evident, it is essential to move livestock to prevent further damage. It may be possible to agist livestock to locations outside of rangeland regions during times of drought and until vegetation has recovered.

➤ For more information about managing wetlands in the rangelands, see *Pastoral Management options for central Australian wetlands: Fat cows and happy greenies*[18] and HorsesLandWater's *Management Guidelines – Arid zone*.[85]

Figure 35. Wetlands in the rangelands can provide valuable grazing for livestock if they are fenced, livestock access is carefully timed, total grazing pressure is managed and livestock are removed at the first signs of degradation. Photo – L Bayley/Department of Agriculture and Food.

Section 4: Moving livestock away from unfenced wetlands

Alternative feed points

When given the opportunity, livestock tend to spend much of their time near water.[9] Fencing is the primary method of excluding or controlling livestock access to wetlands, but in some cases fencing is not a practical option. In these situations, it may be possible to attract livestock away from wetlands or discourage them from loitering there. In addition to locating watering points away from a wetland, supplementary hand-feeding or dietary supplements (such as mineral licks, low-moisture energy or protein blocks) can be sited away from wetlands to achieve better grazing distribution.[51] Locations should be chosen using the same guidelines for siting water points.

Behavioural methods of livestock management

Knowledge of livestock behaviour can be used to encourage use of dryland pasture areas.

Seasonal habitat preferences

Livestock have seasonal preferences for using wetland habitats. For example, cattle may move to dryland areas in spring when these have new plant growth, but favour wetlands from summer to autumn for better pasture, a cooler microclimate and shade. Wetlands may be avoided in winter if they are inundated, boggy or colder than the surrounds or may be favoured if they offer shelter from winter winds. Observing seasonal preferences and only permitting grazing in wetland pastures at times when animals are likely to prefer dryland areas can help to protect wetlands from over use.

Turn out locations

A **turn out location** is the site at which livestock are released into a fresh pasture. In large pastures that contain adequate water for livestock, choosing turn out locations well away from overused areas can influence the timing, duration and amount of use by livestock.[59] This technique has been used successfully to reduce pressure on riparian areas and therefore is considered likely to be useful for managing grazing pressure on wetlands. It may be beneficial to change turn out locations each year to vary behaviour patterns.

Low-stress herding

Low-stress livestock handling is a method of herding livestock with prompts rather than force. It involves trained livestock handlers using herding techniques that exploit the natural traits of livestock, encouraging them to stay together and bed down where they are placed.[59] Well-handled livestock prefer to stay together rather than scattering or hiding. This technique is gaining popularity in the United States of America as a tool to control livestock distribution in rangeland areas. Trials have demonstrated that a combination of low-stress herding techniques and strategically placed mineral supplements can be successful in reducing cattle use of riparian areas.[86] Low-stress herding techniques have been used to successfully train cattle to move from riparian areas to dryland areas after drinking.[59] These techniques also have economic and other benefits for livestock and producers.

➤ For more information about low-stress livestock handling in Australia, visit www.lss.net.au.

Section 5: Managing paddocks around wetlands

Manage paddocks to maintain permanent groundcover

Bare patches in paddocks are vulnerable to soil erosion by water or wind. Bare soil in paddocks can increase the risk of horses getting sand colic, and dust can cause respiratory tract infections.[85] Maintaining a healthy groundcover across paddocks all year round will retain topsoil, reduce dust and maintain wetland water quality. Meat and Livestock Australia's sustainable grazing program found that a minimum of 70 per cent groundcover is needed in late summer-early autumn to reduce erosion risk in the temperate high rainfall zones in south-western Australia.[87] The organisation HorsesLandWater recommend all grazing areas have plants at least 3 centimetres high with groundcover of 70 per cent (for soil susceptible to water erosion) or 50 per cent (for soil susceptible to wind erosion).[85]

➤ For information on how to calculate groundcover, see HorsesLandWater *Management Guidelines*.[85]

Perennial pastures

One way to maintain permanent groundcover is to improve pastures by planting deep-rooted perennial plant species. Perennial plants can prevent erosion and reduce nutrient run-off as well as provide a year-round food source for livestock. Perennial pasture grasses are best grazed in a rotation grazing system. They remain green later in spring than annual grasses, allowing longer grazing rotation times, and they are particularly useful in areas that experience medium to low rainfalls.

Introduced perennial pasture species should be selected with caution. Some species have caused seasonal toxicity problems in livestock. For example, signal and panic grasses that are growing rapidly or stressed can become toxic to young sheep.[88] Other perennial species, such as kikuyu (*Pennisetum clandestinum*) and tagasaste (*Chamaecytisus palmensis*), have the potential to become serious weeds in wetlands.

WA has many native species of grass that can be used as alternatives to introduced pasture fodders. Perennial species should be selected with professional advice and evaluated on a trial basis.

➤ For more information on perennial pasture species, contact the Department of Agriculture and Food. Good references include *Perennial pastures in Western Australia*[89] and *Evaluating perennial pastures – a case by case study of perennial pasture use in the south coast region of WA*.[90]

Figure 36. Pastures improved with a mix of perennial species on the margin of a fenced wetland near Gingin. Photo – K Angell/Small Farm Landcare Consultancy.

Figure 37. Kikuyu (*Pennisetum clandestinum*), a perennial pasture grass widely used on horse properties, can become a serious weed in wetlands. Here, kikuyu is spreading from a horse yard into a seasonally waterlogged wetland in Forrestdale. Photo – R Lynch/DEC.

Manage high traffic areas

Any area where livestock congregate, particularly around watering points, but also hand feeding areas, gateways, laneways, shelters and 'stock camps' can experience damage to pasture cover from intense trampling and be at risk of erosion.[45] Horses, which are more active that other types of livestock, tend to loiter at gates and walk along paddock fence lines (especially if they are left in a paddock on their own, but with other horses in the next paddock). Serious damage can be caused in a short time by a stressed horse left behind while companion horses are taken out for a ride.[45] Infrastructure which attracts livestock should be sited on stable ground, avoiding wetlands, paddock corners, clay and sand soils and steep areas.[45] High traffic areas can be permanently surfaced to make them more stable, or a moveable protective pad such as conveyor belt matting can be used to provide temporary surface protection.[45] Regularly moving portable troughs and feed locations is a good option for smaller properties. Temporary electric fencing can be erected to protect damaged groundcover while it recovers.

Manage potential contaminants

Animal faeces and urine

Restricting livestock access to wetlands will minimise direct inputs of animal wastes into wetlands. Well-vegetated dryland buffers between pastures and wetlands will also help by slowing run-off and reducing the volume of sediments, nutrients and faeces reaching wetlands. However, the accumulation of animal faeces and urine on other parts of a property can still cause wetland water quality problems.

While some well-distributed manure will act as a natural fertiliser for pasture plants, too much deposited in one area can enter wetlands through run-off or by leaching into groundwater. Faeces should be regularly collected from areas where it tends to accumulate, such as stables, animal sheds, yards and small paddocks.

Manure composting piles should be sited on hard stand containers, at least 200 metres from waterways and wetlands and well away from drainage lines.[45]

➤ For more information about manure management on horse properties, see *Horse poo – what to do?* at www.horsesa.asn.au.

Animal carcasses can also cause contamination. Livestock carcasses should be buried at least 100 metres from wetlands and not in places where the water table is less than 1.5 metres from the surface.[7] If possible, each carcass should be buried in separate pit and the pits distributed over a wide area.

Chemical contaminants

To avoid contamination of wetlands, agricultural chemicals (including fertilisers, herbicides, veterinary chemicals, fuel, oil and solvents) should be used, stored and handled in accordance with best practice guidelines and regulatory requirements and supplier's directions.

➤ The Department of Water produces Water Quality Protection Notes and guidelines for a range of activities that affect water resources. See *WQPN 35: Pastoral activities in rangelands*[7], *WQPN 33: Nutrient and irrigation management plans*, *WQPN 80: Stockyards* at www.water.wa.gov.au (search in 'Publications') for more information.

Some key points include:

- Livestock drenching and jetting should not be undertaken within 100 metres of a wetland or near waterways.
- Livestock should be kept away from wetlands for at least two days after worm drenching to minimise leaching of drench chemicals from animal faeces and urine.[31]
- Plunge or dipping pools for parasite control are not recommended, but if necessary this should not be undertaken within 200 metres of a wetland and any spills should be immediately contained and disposed of safely.[7]
- Herbicide, pesticide and fertiliser use near wetlands can contaminate them through overspray and spray drift. These chemicals should be used appropriately and with caution. Some herbicides that do not harm aquatic animals are approved for use over water, but may still harm native vegetation in the wetland and its buffer.

  ➤ For additional detail refer to the topic 'Wetland weeds' in Chapter 3.

- If possible, split fertiliser applications into several smaller applications. Using the smallest effective amount, applied at times of enhanced plant uptake, will reduce leaching.[49] Avoid applying fertilisers prior to storms and flooding or to soggy, waterlogged paddocks, as highly soluble forms of nitrogen and phosphorus are flushed by rain into wetlands and waterways.[49]

Section 6: Management challenges

Excluding or controlling livestock access to wetlands can result in significant improvements in wetland appearance and condition and provide benefits to property owners, especially over the long term. As with any change in management practice, it can also create new challenges. Management issues associated with excluding livestock from wetlands include weeds, pest animals and the potential fire risk from increased amounts of vegetation.[51] Accordingly, a variety of nature conservation programs offer financial, technical or labour assistance to eligible landholders.

➤ Refer to the topic 'Funding, training and resources' in Chapter 1 for more information.

Weeds

Many landowners express concern about excluding livestock from wetlands because grazing livestock will no longer keep weeds under control, allowing weeds to flourish and further degrade the wetland. In addition, a common concern is that increased weed and native vegetation regeneration can often make fenced areas difficult to access for spraying and slashing. These are valid concerns, and the exclusion of livestock from wetlands that contain invasive weeds requires planning and ongoing action. In the first few years following the exclusion of livestock, weed control will require a consistent effort. It is difficult for weeds to establish in areas where the native plant cover is intact, so as natural regeneration progresses, weed management is likely to be less time-consuming.[51]

➤ Methods of weed control suitable for use in wetlands are discussed in the topic 'Wetland weeds' in Chapter 3.

Grazing has been used to control highly invasive weeds in some wetlands, such as para grass (*Brachiaria mutica*) in Queensland.[91] If grazing is to be used to control weeds in a wetland, the targeted weed species must not only be palatable, but preferred by the livestock to the native vegetation. Ideally livestock should only be allowed access when soil moisture levels are low enough to avoid pugging. Allow livestock to graze weeds before they set seed, but aim for minimal damage to native vegetation and withdraw livestock as soon as the first signs of this occur. To reduce the spread of weed seeds in manure, livestock can be locked up for a day prior to grazing wetland areas.[51] They will excrete many of the seeds in their faeces while locked up, so fewer weeds are transported into wetlands. Excluding sheep until after shearing will also reduce the weeds transported in their fleece.

Fire hazard reduction

As wetland vegetation regenerates, fire hazard management may be necessary. The use of livestock grazing to reduce potential fire hazard is not recommended as it depends on livestock eating plants which create fuel loads, which is often not the case, and also requires heavy grazing, which is damaging to wetland habitats and vegetation.[3]

Pest animal control

As wetlands regenerate, understorey vegetation becomes denser and may be colonised by more native animals, such as bandicoots. This is a good sign that the wetland is providing good habitat for native animals. However, introduced animals may also use wetland habitats. These, and sometimes native animals, can become a problem if they destroy native vegetation, cause erosion, damage fences, spread diseases or kill livestock. Grazing by rabbits, goats, pigs, kangaroos and native wetland birds can destroy regenerating vegetation and hinder wetland restoration efforts by eating or uprooting plants. Cats and foxes using wetland vegetation as a refuge may also need to be controlled.

➤ Methods of controlling introduced and problem native animals are discussed in the topic 'Introduced and nuisance animals' in Chapter 3.

case study

The Collards manage wetlands on their cattle property near Gingin

In 1973, Ross and Tracy Collard bought a 400-hectare property near Gingin, which they named 'Caladenia Lake Estates', after one of the eight natural wetlands. They cleared much of the property for beef production, but retained areas of wetland vegetation (mainly low open paperbark woodland). They currently run more than 220 head of Red Angus breeder cattle between 'Caladenia' and their nearby property, 'Poverty Nook', which is 160 hectares and also has a wetland.

An intensive rotational grazing system

In 1998, Ross began using a rotational grazing strategy based on a registered system. He subdivided the four original paddocks at Caladenia into thirty-five smaller ones. Under this system, each paddock is intensively grazed by a mob of forty to fifty cattle for no longer than 3 days. The paddock is spelled until the pasture has regrown to a specific stage, which can take between 12 and 30 days, and then grazed again for up to 3 days. Ross found that this system worked well in terms of both livestock and pasture management – there was more feed, stronger plants and better groundcover.

Unintended impacts on the wetlands

Under the old four-paddock system, the margins of the wetlands had provided valuable grazing for the cattle. However, in the new rotational system, the cattle grazed more intensively and ate a wider variety of vegetation, including the wetland plants. It became clear to Ross that the wetlands were rapidly becoming degraded as a result. The cattle "were hammering the wetland … smashing up the tea trees … and the water was disgusting".

Ross was most concerned about the impact on the wetland vegetation and the water quality, as his cattle used the wetlands for drinking. The unfenced wetlands also provided hiding places for the cattle, which made moving them between paddocks more difficult.

Wetland fencing, funding and more fencing …

Ross began fencing some of the wetlands with his own resources, then applied for and received funding from the former Gingin Land Conservation District Committee for fencing to protect more wetlands from livestock. Cattle were excluded (with the exception of the occasional calf) by installing plain wire fences using substantial pine strainer posts with galvanised steel pickets at 10-metre intervals (to provide a visual barrier) and a single electric wire (an earth wire was not necessary).[92] At Poverty Nook, where fires are more frequent, Ross used steel strainer posts around the wetland.

To compensate for fencing the wetlands, Ross then put into practice a pasture improvement program based on a range of perennial species. This yielded a significant increase in the feed available to livestock. In 2007, the Collards applied to World Wide Fund for Nature (WWF) Australia's 'Balancing agricultural production and conservation – wetlands' program. They received wetland management advice as part of a whole farm plan and assessment and monitoring for wetlands and vegetation. With in-kind funding, Ross was able to fence more wetlands and a corridor of remnant vegetation, install a bore, water pump and solar panels, tank, trough and gates and sow 4 hectares of perennials in adjacent pastures.[93]

Figure 38. Red Angus cattle in perennial pastures on the edge of a fenced wetland at the Collard's 'Caladenia' property. The productivity of the perennials has compensated for fencing off wetland areas.
Photo – K Angell/Small Farm Landcare Consultancy.

case study

Next, Ross is planning to put in a new bore and upgrade the water pump for an existing bore at Poverty Nook, in order to provide his cattle with alternative water when he completes fencing off a spring-fed wetland. Ross also hopes that using alternative water sources will help to maintain the natural water regime in the wetlands; he is concerned that groundwater abstraction for other nearby land uses is causing the wetlands to dry out earlier than in previous years.

Few problems with weeds and same old pests

Many landowners have concerns that excluding livestock from wetlands will allow weeds to flourish, but this has not occurred at the wetlands at Caladenia. Ross has ongoing problems controlling rats, mice and foxes, but pest numbers did not increase after fencing the wetlands. Feral pigs occasionally move through the property, causing damage to the wetlands. Ross finds he needs to control kangaroos as they compete with his cattle by consuming a lot of vegetation and sometimes short out the electric fences.

Wetlands for the future

Since fencing the wetlands, the Collards have observed that the water is now clear, rather than clouded with sediment; there has been rapid natural regeneration of wetland trees, shrubs and rushes; growth in three different types of water plants; more frogs; and wild ducks.[92] The Collard family value the wetlands as scenic areas for quiet recreation and for their native plants and animals[92] which includes swans, pelicans, spoonbills, ducks, wading birds, bush birds, owls and frogs. Ross has always thought of their property as their 'grandchildren's farm' and is pleased to be protecting the beautiful wetlands so they can be enjoyed by future generations of his family. He says the wetlands "are just nice places to be".

Figure 39. South Ridge Swamp, a wetland on the Collard's property, is protected from livestock impacts by fencing and total cattle exclusion. Photo – K Angell/Small Farm Landcare Consultancy.

Topic summary

Letting livestock into wetlands can be harmful to livestock as well as destructive to wetlands. Livestock and associated farm activities can degrade wetlands by causing damage to soils, erosion, water contamination, damage to native vegetation, harm to native animals and loss of biodiversity.

Wetlands in good condition can provide valuable services for landowners, their livestock and the wider community. There are a range of incentives to help landholders protect wetlands.

Options for reducing livestock impacts on wetlands include:

- fencing wetlands to keep livestock out
- providing alternative watering points located away from the wetland
- creating formed water access points or livestock crossings
- keeping wetlands for occasional grazing, as 'special use' or reserve paddocks
- grazing wetlands for short periods as part of a controlled grazing system (for example rotational grazing)
- if allowing continuous grazing, spelling paddocks initially to allow vegetation regeneration, reduce stocking rates and de-stock, if necessary
- using other methods to reduce wetland grazing such as supplementary feed points, seasonal preferences, turnout locations and herding.

Management of surrounding paddocks can also reduce impacts on wetlands. Best practice is to:

- maintain permanent groundcover
- consider planting perennial pasture species
- manage high traffic areas
- manage animal wastes and other potential contaminants near wetlands.

It may be necessary to plan strategies to manage weeds, pests and fire.

Sources of more information on managing livestock in and around wetlands

Websites

Small Landholder Information Service (SLIS), Department of Agriculture and Food Western Australia
www.agric.wa.gov.au/content/FM/SMALL/PER_SUMM.HTM
A wide range of advice on managing landholdings up to 100 hectares

Ecologically Sustainable Rangelands Management Service (ESRM), Department of Agriculture and Food Western Australia
www.esrm.com.au
Land management and property planning advice for landholders in the WA rangelands

Horses Land Water community of practice
www.horseslandwater.com
Property management and other advice for horse owners including guidelines for horse-keeping in temperate, tropical and arid areas

Rural water planning program, Department of Water, Western Australia
www.water.wa.gov.au/ (click on 'Doing business with us' then 'Farm and pastoral assistance')
Offers technical advice and publications designed to assist with on-farm water supply issues

Other publications

Department of Agriculture and Food in partnership with Geographe Catchment Council and Western Dairy (2006) *DairyCatch – environmental best practice guidelines.*[94]

NSW Department of Environment and Conservation (2000) *Horse properties on the rural urban fringe: Best practice management guide for keeping horses.*[95]

Glossary

Aestivating: being in a state of dormancy that occurs in some animals to survive a period when conditions are hot and dry

Annual: a plant that normally completes its life cycle (from germination to flowering, seed production and death of vegetative parts) within a single growing season

Biodiversity: the whole variety of life forms–the different plants, animals, fungi and microorganisms–the genes they contain, and the ecosystems they form

Browse: to feed on leaves, twigs or bark from non-herbaceous (woody) plants, such as trees and shrubs

Diversity: a measure of the number of species of a particular type and their abundance in a community, area or ecosystem. It can refer to a particular group of organisms, such as native plant diversity or frog diversity. The broader term biodiversity is used to encompass the whole variety of life forms–the different plants, animals and microorganisms–the genes they contain, and the ecosystems they form

Dormancy: a state of temporary inactivity when plants are alive but not growing, i.e. they are **dormant**

Ecosystem: a community of interdependent organisms together with their non-living environment. Natural ecosystems provide a range of benefits and services to humans such as clean water, nutrient cycling, climate regulation, waste decomposition and crop pollination

Erosion: the gradual wearing away and movement of land surface materials (especially rocks, sediments, and soils) by the action of water, wind, or a glacier

Grazing: feeding on grasses and other low-growing herbaceous vegetation

Groundcover: the percentage of ground covered by plant materials (alive or dead) and leaf litter

Herbs: plants with non-woody stems that are not grasses or sedges. Generally under half a metre tall. Most herbs monocots are herbs.

Land capability: the ability of land to be used for a particular purpose or managed in a particular way without becoming degraded

Leaf litter: dead plant matter including leaves, flowers, nuts, sticks and bark which accumulates on the ground

Livestock: introduced domestic ungulate (or hoofed) animals

Low-stress livestock handling: a method of herding livestock with prompts rather than force

Macropores: spaces in the soil (usually less than 2 millimetres in diameter) that include channels created by cracking, old plant roots and soil fauna (such as earthworms). Macropores indicate good soil structure.

Palatable: pleasant-tasting

Perennial: a plant that normally completes its life cycle (from germination to flowering, seed production and death of vegetative parts) in two or more growing seasons

Property management plan: also called a whole farm plan; a working plan for the design and management of a property based on its natural resources, the activities undertaken (such as horse breeding or beef production), the manager's goals and financial considerations

Pugging: depressions, hoof prints or 'pug' marks made in wet soil by trampling animals

Riparian: the habitats adjacent to waterways and estuaries

Rotational grazing: a type of controlled grazing system. Paddocks are usually subdivided into smaller pastures and grazed at higher intensities for shorter periods (to achieve more even grazing), then spelled (or rested).

Sedimentation: the process by which soil particles (sand, clay, silt, pebbles and organic materials) suspended in water, are deposited or settle to the bottom of a water column

Spelling: of a paddock or pasture, involves removing livestock grazing pressure for a period of time so that vegetation can regenerate

Stocking rate: the number of livestock that can consistently be kept on an area of pasture all year round with minor additional feed and without causing environmental degradation

Total grazing pressure: describes the combined impact of all grazing animals–domestic, wild, native and feral–on the vegetation, soil and water resources of a particular area

Turbid: the cloudy appearance of water due to suspended material

Turn out location: the site at which livestock are released into a fresh pasture

Understorey: the layer of vegetation beneath the main canopy

Vegetation structure: the three-dimensional distribution of plant material. It includes the horizontal spacing of plants and the vertical heights or layers

Vegetative reproduction: a type of asexual reproduction found in plants. Also called vegetative propagation or vegetative multiplication

Wetland hydrology: the movement of water in, out of, and within a wetland

Personal communications

Name	Date	Position	Organisation
AR (Roy) Butler	11/05/2009	District Veterinary Officer, Merredin	Department of Agriculture and Food
Tim Saggers	26/05/2009		Kendenup Fencing Contractors

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