# HEALTHY FARMLAND HEALTHY BUSHLAND

BY KATE HOOPER AND RICHARD GEORGE

Land degradation caused by rising saline groundwaters is one of the most difficult problems in south-western Australia.
But rising water tables do not only affect cleared land; remnants of native vegetation that adjoin cleared land, including some of our national parks and nature reserves, are at risk of becoming severely degraded. Their survival depends upon effective collaboration between farmers, hydrologists and ecologists.

Australians have been clearing native forests and woodlands to establish crops and pastures since the earliest days of settlement. In south-western Australia more than 17.5 million hectares of land previously occupied by a continuous cover of native vegetation have been cleared for agricultural land.

The removal of this deep-rooted perennial vegetation and its replacement with shallow-rooted crop and pasture plants have fundamentally changed the surface and groundwater hydrology of the entire South West—on a scale that is only just beginning to be appreciated.

Before clearing, most of the area's limited rainfall was used by the vegetation; very little water filtered down through the soil, and groundwater systems were non-existent in some areas. Also, there was little surface run-off because the vegetation very effectively trapped and

used the water. The South West's native vegetation has evolved over millions of years to cope with dry seasonal conditions. For example, some mallees have vase-like branches that catch rainfall and direct the water to the base of the plant, where it filters into the soil. The roots of mallees and jarrah trees can extend down to 40 metres, allowing them to obtain moisture stored deep in the ground. Some native trees, shrubs and grasses can also limit their water-use by shedding leaves or becoming dormant.

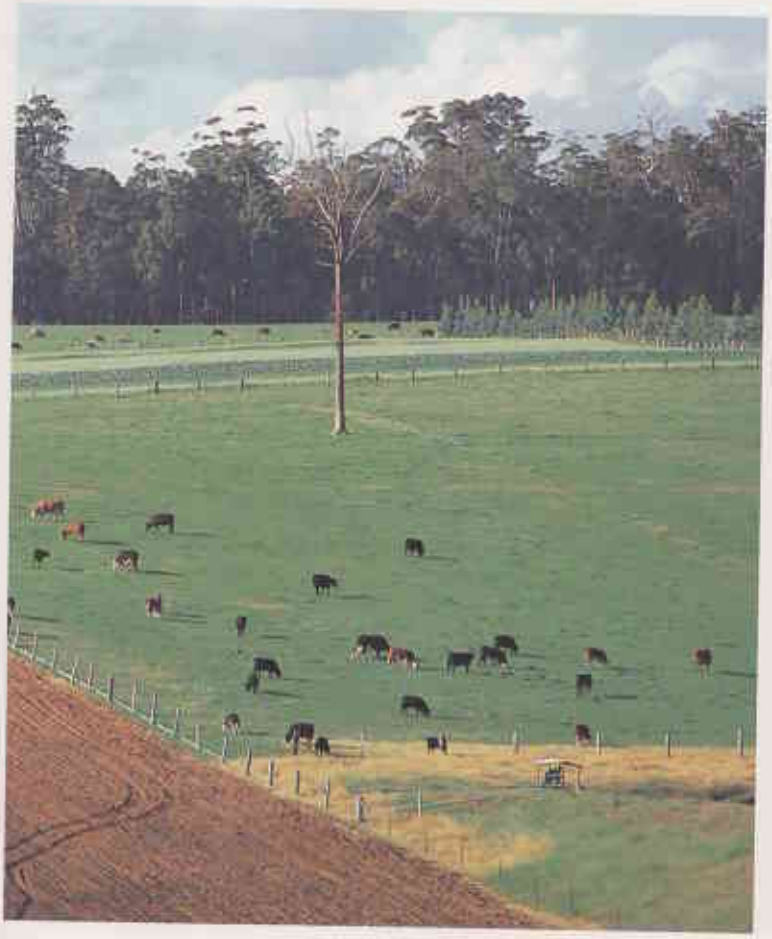
By contrast, crops and pastures grown on cleared land use less water than native plants because they have shallower roots and are either grown for a limited season or their leaves are grazed. As a result, more rainwater drains through the soil and reaches the water table, and these water tables are rising at rates between five centimetres and one metre per year. In some places, they have risen more than 25 metres since clearing occurred.

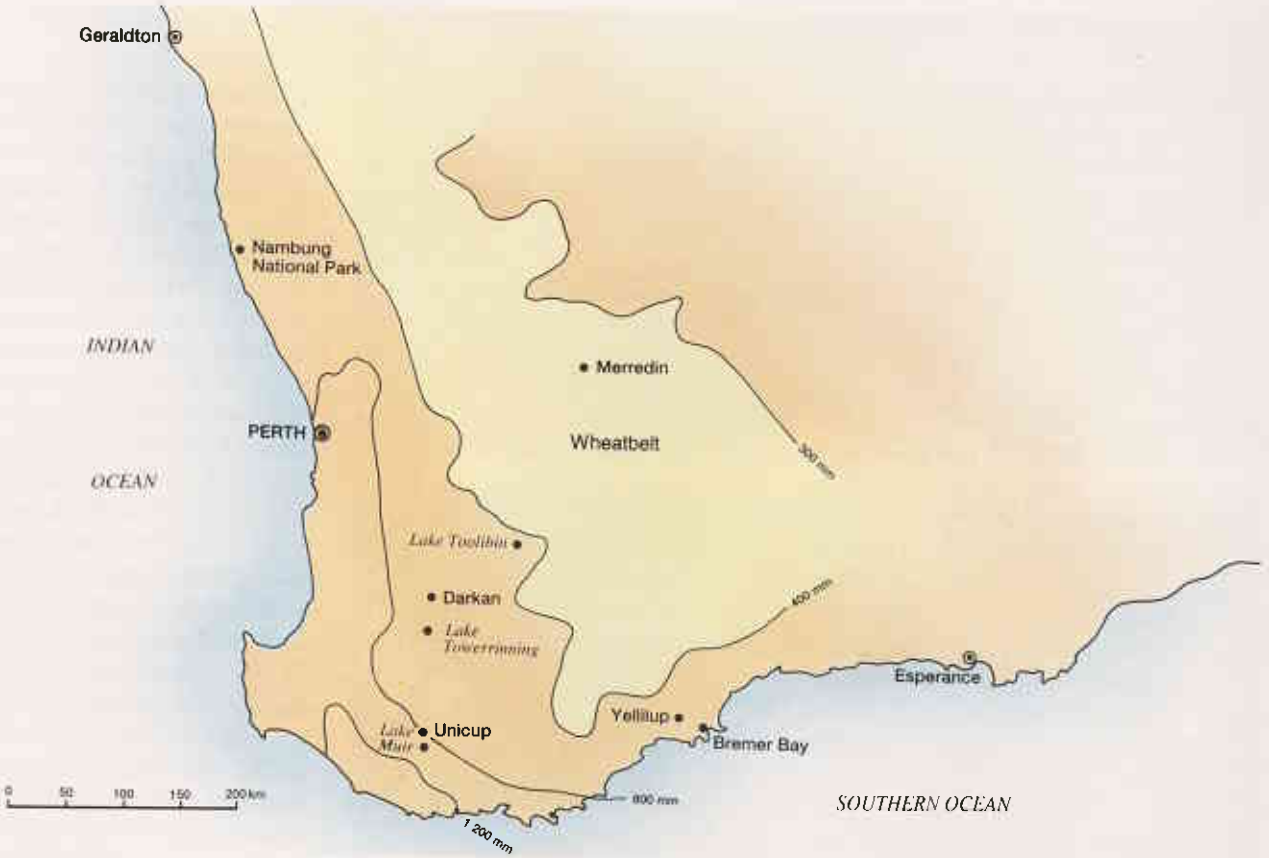
South-western landscapes contain large quantities of naturally occurring soil salts, which are stored deep below the surface. Rising groundwaters are dissolving these salts and bringing them to the surface. The end-result is waterlogged, saline soils, which few plants can tolerate. You do not have to drive far into country areas to notice the saltbush swamps that now occupy many low-lying valleys which were once covered by fertile soils and rich pastures. Agricultural land from Esperance to Geraldton, and as close to Perth as Gingin and Mundaring, is affected by salt. By 1993, farmers reported that more than half a million hectares were severely affected. A more recent assessment suggests that a further million hectares are moderately saline.

## THREAT TO REMNANTS

But it is not only cleared land that is affected; remnants of native vegetation suffer too. Vegetation remnants that occur downslope from large areas of

*Previous page*
The legacy of clearing; a tree graveyard at Nomans Lake near Narrogin. Like many freshwater lakes in the Wheatbelt, it has turned saline because of deforestation.
Photo – Marie Lochman






cleared land, or in areas next to major rivers, receive increased water, salt, nutrient and sediment loads. Surface water running from cleared farmland also provides a direct pathway for the spread of exotic (primarily weed) species. Significantly, the increased water movement into remnants also creates a more suitable environment for *Phytophthora cinnamomi*, the organism that causes dieback.

About 40 per cent of the remaining native vegetation in the South West consists of small and scattered remnants on private land. Pockets of remnant vegetation provide some protection for farmland if they occupy a significant proportion of the surface catchment and the groundwater system over which they lie. However, many remnants are too small to protect themselves, or prevent the widespread salination of their catchments.

Vegetation remnants in broad valleys, such as the widely dispersed remnants of salmon gum (*Eucalyptus salmonophloia*) and gimlet (*E. salubris*) woodland that occur throughout the Wheatbelt, are threatened by rising water tables. For example, in the Merredin catchment, recently fenced salmon gum and gimlet remnants face an uncertain future. Water table monitoring suggests the groundwaters beneath the entire valley, and the town itself, will be within two metres of the soil surface by the year 2020.

Throughout the lower south-west of WA, valleys, lakes and swamps containing wandoo (*E. wandoo*), flooded gum (*E. rudis*), flat-topped yate (*E. occidentalis*) and paperbarks (*Melaleuca* spp.) are becoming saline. Salt, phosphorus, nitrates and sediment from within the catchments collect in lakes and waterways, and are concentrated by evaporation over summer. Blooms of toxic cyanobacteria (also known as blue-green algae) are also now common. For example, wetlands in the Lake Muir complex, near Unicup, are at extreme risk. They support some unique plant communities, including three species of declared rare orchid. The few remaining freshwater wetlands in the South West are also important breeding sites for rare and threatened waterfowl, such as the Australasian bittern (*Botaurus poiciloptilus*) and the freckled duck (*Stictonetta naevosa*).

Another significant but threatened wetland is the Yellilup yate swamp system to the north-west of Bremer Bay. It contains some of the best remaining examples of flat-topped yate forest; many of the trees exceed 15 metres in height. Many yate forests elsewhere have been burnt too frequently by wildfires to achieve this size.

If water tables throughout the south-western part of the State continue to rise at the present rates, up to 25 per cent of most catchments (more than four million hectares), and as much as 40–50 per cent of some specific regions (most of the lower slopes and valley floors) could become salt-affected within the next century. All remnants occupying those areas, along with adjacent lakes and wetlands

*Far left:* Pockets of remnant vegetation, like this karri forest near Manjimup, may protect adjacent farmland from salination, if they are large enough.
Photo – Jiri Lochman

*Left:* Bare stumps are all that remain of the trees that once fringed Lake Ninan in the northern Wheatbelt. They could not tolerate the waterlogged, saline conditions caused by clearing of the area for agriculture.
Photo – Dennis Sarson/Lochman Transparencies

and most riverine or estuarine aquatic systems, will either decay or be permanently altered.

Native vegetation contained within State forest, national parks and nature reserves is also at risk. It is a common misconception that only small nature reserves in valleys are at risk from rising water tables, but hydrological research indicates that even large reserves can be modified by changing water balance.

Toolibin Lake is the last large 'freshwater' lake in the southern Wheatbelt. It is an important breeding ground for many species of waterbird and supports some rare communities of plants. The lake and its surrounding vegetation are sheltered by several nature reserves, but they sit within a catchment from which 92 per cent of the native vegetation has been cleared for agriculture. Rising groundwaters and saline run-off from the surrounding farmland have begun to kill the lake and its reserves, causing grave concerns among local landholders and government agencies.

The sandplains of the coastal zone between Perth and Geraldton are similarly at risk. As a result of clearing, the groundwaters are rising and areas of saline seepage are starting to appear on the surface throughout the region. A recent study north of Nambung National Park shows that hydrological degradation is set to escalate in the coastal zone, threatening a large part of Nambung (the lower Bibby Springs catchment) as well as extensive remnants of native vegetation on publicly-owned land. These special plant communities of the coastal sandplain face the double threat of salinity and dieback, which spreads more easily in waterlogged soils.

Simply fencing areas of high conservation value and declaring them as nature reserves or national parks will not be sufficient to protect them.

## URGENT ACTION

These examples of the decline or destruction of remnant vegetation on both private and public land highlight the need for urgent action. In most cases there is little time to act and, unfortunately, research into possible solutions is still limited. While we search for long-term solutions that are cost-effective and suited to farmers, we must try to lower the water tables as economically as possible.

Toolibin Lake is one of the first places where a recovery plan has been adopted to protect the lake and its associated reserves from salination. Importantly, the recovery plan represents a coordinated effort between local communities, landcare groups and government agencies such as the Department of Agriculture and the Department of Conservation and Land Management (CALM). The recovery plan includes short-term measures, such as surface drainage and groundwater pumping, to reduce the salinity and water levels of the lake, but it is recognised that the only long-term solution to the problem is to restore the water balance of the whole catchment.

To this end, CALM is providing technical advice and funding to help

*Below:* Seasonal algal blooms can cause saline lakes to turn a distinctive pink colour.
Photo – Bill Bachman

local farmers to adopt agricultural practices that should both conserve Toolibin and help rehabilitate salt-affected farmland—improving the productivity of the entire catchment (see 'Recovering Lake Toolibin', *LANDSCOPE*, Spring 1994).

Another example shows how rapid and well-planned action can limit the severity of the effects of clearing for agriculture. Lake Towerrinning, a nature reserve near Darkan, is one of the many wetlands in the South West that have become saline. By the end of the 1980s, Towerrinning had lost its fringing vegetation, had become eutrophic (ie. high in nutrient levels) and contained little aquatic life, although it was still visited by local and migratory birds.

The Lake Towerrinning Catchment Landcare Group was formed to restore the lake and to encourage profitable and conservation-based farming practices in the catchment. In 1991, the group developed a management plan to lower salinity in the lake. The plan involved building a dam 12 kilometres upstream of the lake, to capture water that had been inadvertently diverted to an adjacent catchment. The water would be re-diverted into Towerrinning, and it was proposed that the improved water flow through the lake would help flush away the salt and nutrients stored there.

By the end of the 1992–93 summer, the re-diversion dam and a 12-kilometre waterway were built, using local labour and machinery. Only six months later, the salinity within Lake Towerrinning had been reduced by more than 50 per cent. In the process, government agencies and the local farmers blended expertise and local knowledge to develop a strong working relationship. They proved that a committed community armed with sound scientific advice can achieve rapid results.

The experience from Toolibin and Towerrinning suggests that active intervention and cooperation between agencies and the community are essential for the survival of about 600 nature reserves in south-western Australia. These reserves range in size from less than one hectare to more than 1 000 hectares, and many are threatened with annihilation.

There are also about 300 000 remnants of native vegetation on private land in south-western Australia, and there is an urgent need to develop a system to assess and classify these remnants. Those considered to be at risk will require careful monitoring and management if they are to survive. For those remnants already beyond repair, we can at least preserve their genetic inheritance by documenting the flora and fauna, collecting seeds and attempting to conserve some of the wildlife.

*Top:* Native vegetation planted along creeks helps to lower the water table and protect the catchment from the effects of rising groundwaters and salination.
Photo – Jiri Lochman

*Above:* The eastern side of Toolibin Lake is one of the last places in the Wheatbelt where freshwater lake vegetation survives, though it is threatened by increasing salinity.
Photo – Kim Howe

## INNOVATIVE METHODS

Remnants of native vegetation, whether on public or private land, are not ecological islands; it is not possible to manage remnants in isolation from their surrounding catchments. This means that ecologists and farmers will have to work together if the nature conservation values of remnants are to be retained.

Innovative methods need to be developed that maintain the nature conservation values of remnants and wetlands at the same time as conserving farmland and increasing agricultural production, for the benefit of all Australians.

The real challenge for ecologists and agriculturalists is to develop new farming systems that result in less land degradation. These could include farming perennial native trees and shrubs that lower the water table as well as providing a commercial return. For example, oil mallees, such as species from the

*Eucalyptus oleosa* group and the smooth-barked York gum (*E. loxophleba* subsp. *lissophloia*), are being developed for the large-scale production of eucalyptus oil (see 'Oil in the Leaves', *LANDSCOPE*, Winter 1993). In addition, many of our native mallees produce attractive foliage and flowers, which are finding a place in the lucrative international cut-flower market (see 'Turning a New Leaf', page 35). Deep-rooted native trees, such as brown mallet (*E. astringens*) and rock sheoak (*Allocasuarina huegeliana*), which can be grown in easily managed thickets, provide useful timber, and speciality timbers, such as sandalwood (*Santalum spicatum*), command a high price. The CALM share-farming schemes for hard and softwood trees are now well-established (see 'Tree Crops for Farms' in *LANDSCOPE*, Summer 1992–93); and CALM's newly released Western Blue Gum is set to reinvigorate farmland, decrease salinity, and provide quality hardwood too. (See 'The Western Blue Gum is Here!' in *LANDSCOPE*, Summer 1994–95.) Our native plants also have the potential to produce high-value extracts for the pharmaceutical and herbicide industries (see 'Nature's Medicine', *LANDSCOPE*, Winter 1994).

Understanding how native plants manage water may also help in developing such agricultural systems. Creating a water balance in the agricultural matrix that mimics the water balance existing under native vegetation will save both valued farmland and remnant vegetation.

A fundamental change in attitudes is occurring, with more owners of commercial farms now acting as caretakers of the land and its flora and fauna. If ecologists can discover indigenous species in our remnant stands of native vegetation around which new sustainable agricultural systems can be developed, nature conservation will truly become an integral part of agriculture.

A salmon gum is the sole survivor of woodland around Taarblin Lake, which has fallen victim to salination.
Photo – Jiri Lochman

Kate Hooper is a contributing editor to *LANDSCOPE* and can be contacted on (09) 384 5711.

Richard George is a regional hydrologist with the Department of Agriculture, responsible for land and water research in the south-western river catchments. He can be contacted on (097) 25 5255.

This article is based on research by Richard George, Don McFarlane and Russell Speed from the Western Australian Department of Agriculture, in *Nature Conservation IV: The Role of Networks*, edited by D.A. Saunders, J.L. Craig & E.M. Mattiske (Surrey Beatty & Sons, Chipping Norton), in press.

# LANDSCOPE

VOLUME TEN NO.3 AUTUMN ISSUE 1995

*Flower arrangements featuring eucalyptus foliage are becoming popular with florists. Find out why on page 35.*

*Unseen for more than 100 years and believed to have been extinct, Gilbert's potoroo turned up quite unexpectedly. See page 28.*

*Salinity is a problem in the State's south-west, but farmers, communities and government agencies are working to find solutions. See page 39.*

*A giant dragonfly lives in the south-west of Western Australia. You can find out more about this ancient relict of the jarrah forest in 'Western Petalura' on page 52.*

*The thick-billed grasswren is one of several animals that may be reintroduced to Shark Bay as part of an ambitious project. See 'Return to Eden' on page 22.*

## FEATURES



## REGULARS



## COVER

*The stunning royal robe* (Scaevola striata) *is one of a host of fabulous fanflowers found in Western Australia. Suzanne Curry discusses this and other species in the family Goodeniaceae on page 10.*

*The illustration is by Philippa Nikulinsky.*


**Managing Editor:** Ron Kawalilak
**Editor:** David Gough
**Contributing Editors:** Mandy Clews, Verna Costello, Kate Hooper, Carolyn Thomson
**Scientific and technical advice:** Andrew Burbidge, Ian Abbott, Paul Jones
**Design and production:** Maria Duthie, Sue Marais
**Finished art:** Karen Addison
**Illustration:** Ray Andress, Ian Dickinson, Gooitzen van der Meer
**Cartography:** Promaco Geodraft
**Marketing:** Estelle de San Miguel ☎ (09) 334 0296 Fax: 334 0498
**Subscription enquiries:** ☎ (09) 334 0481 Fax: 334 0498
Colour Separation by Prepress Services
Printed in Western Australia by Lamb Print




Published by Dr S Shea, Executive Director
Department of Conservation and Land Management,
50 Hayman Road, Como, Western Australia 6152.