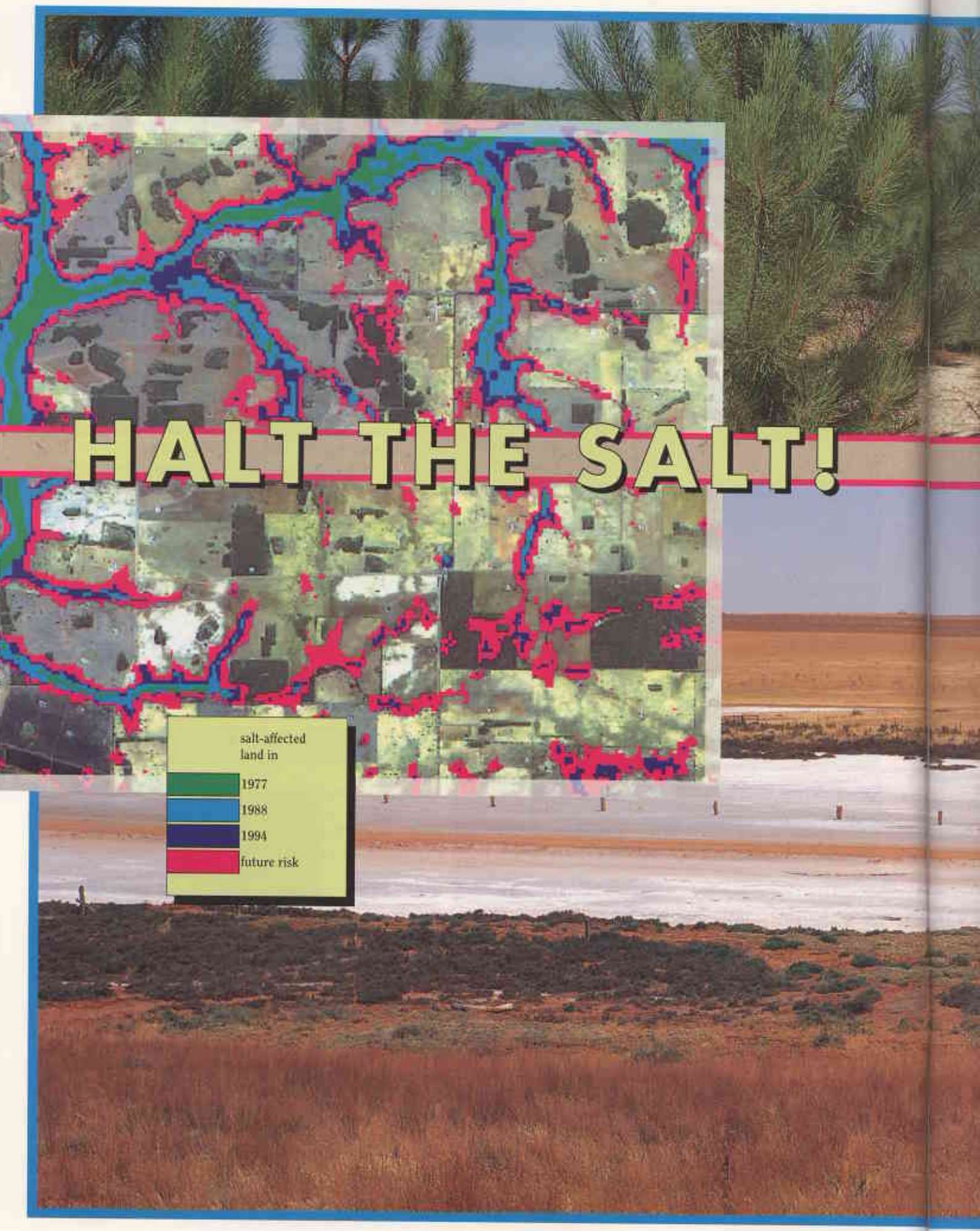
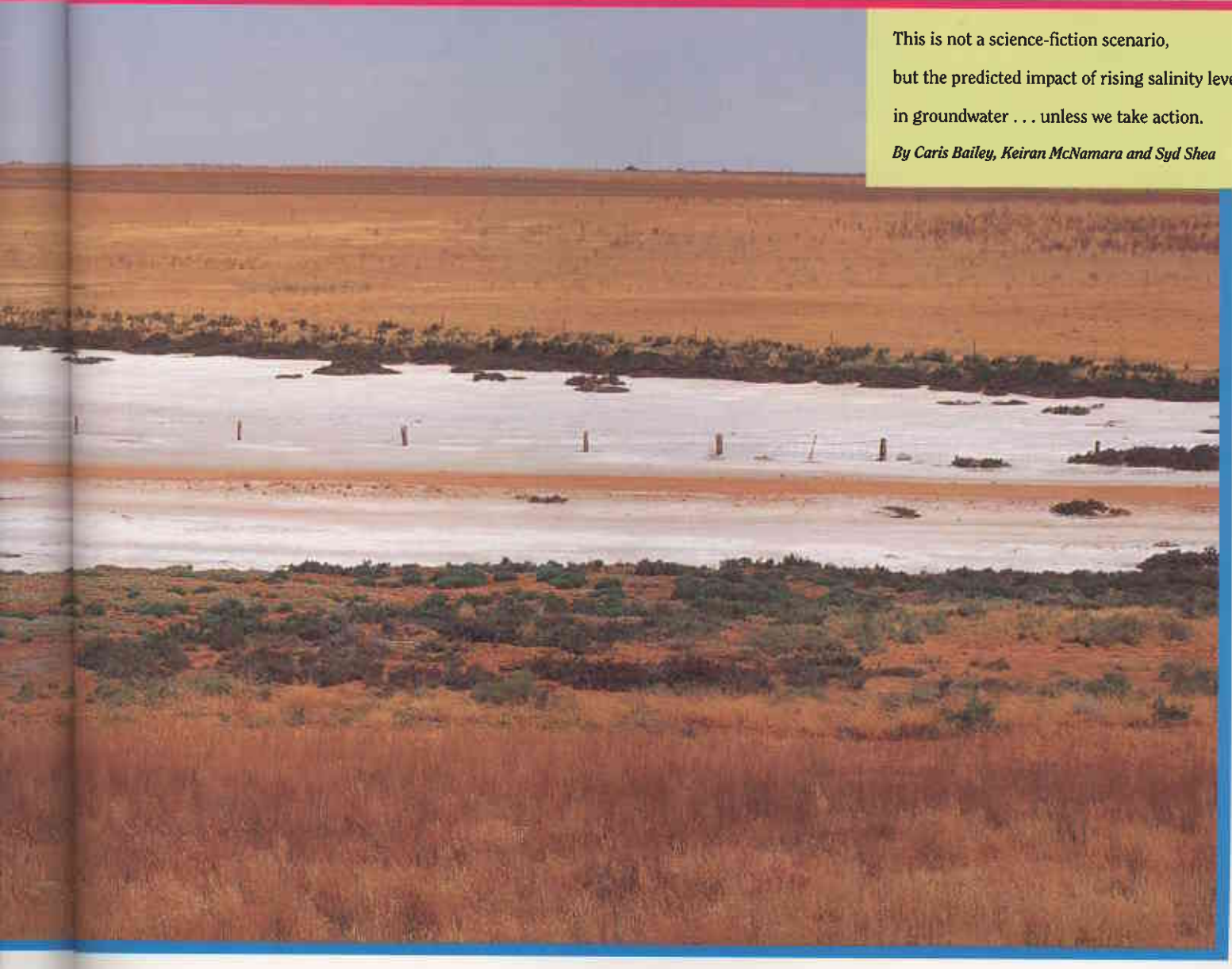

HALT THE SALT!
salt-affected land in
1977
1988
1994
future risk

Subterranean forces are threatening to wipe out half the nature conservation reserves in Western Australia's south-west agricultural area. A massive 80 per cent of the remnant native vegetation on farms could also disappear.

WESTERN AUSTRALIA'S SALINITY ACTION PLAN

This is not a science-fiction scenario, but the predicted impact of rising salinity levels in groundwater . . . unless we take action.

By Caris Bailey, Keiran McNamara and Syd Shea



The problems caused by rising salinity levels need long-term, coordinated solutions. Long-term, because these problems have been created over a century and can't be solved quickly; in fact salinity will worsen in some areas before it improves. Coordinated, because salinity is a widespread problem that can't be solved with isolated projects.

Nature conservation, water quality, agriculture and rural infrastructure are all at risk from salinity in Western Australia. To combat these threats, a 30-year Salinity Action Plan has been prepared jointly by the Department of Conservation and Land Management (CALM), Agriculture Western Australia, the Water and Rivers Commission and the Department of Environmental Protection. It requires action from rural landowners, the Government and the broader community and builds on the salinity management practices already implemented by many farmers and catchment groups. This article discusses the threat to biodiversity in particular and the way that farm forestry is already helping to turn the tide.

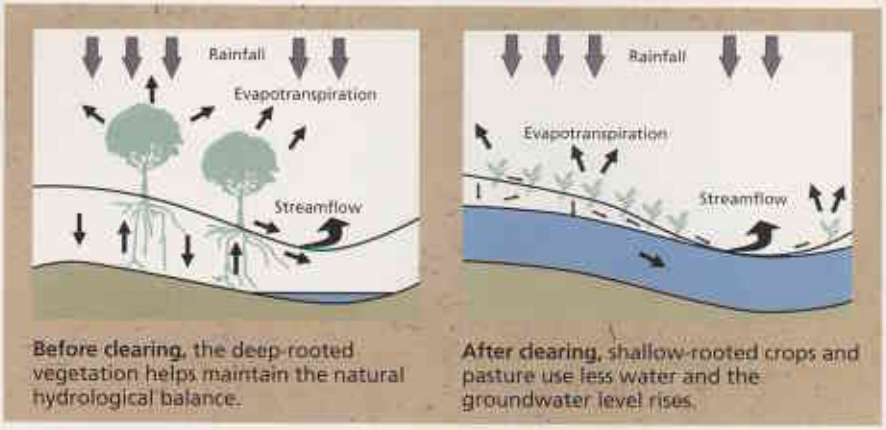
FAR-REACHING

A crust of salt in a farm paddock is the image most people associate with salinity problems—they're not sure where the salt came from, but it seems just one more uncertainty farmers face working with the elements.

In fact, salinity has enormous implications for the whole community. It is not an entirely natural event, but another environmental change caused by European settlement. A change that threatens native vegetation and the wildlife it supports, our drinking water, and even roads and buildings, as well as farmland. The cost of developing new water supplies, repairing damaged roads and lost agricultural production has already run into millions of dollars. The cost of losing biodiversity in an area where so much native vegetation has been cleared is immeasurable.

Clearing is central to the salinity problem. With the benefit of hindsight, we now know that clearing deep-rooted,

Previous page
Top: Maritime pine (*Pinus pinaster*).
Photo – Michael James
Below: Salt-affected farmland near Katanning.
Photo – Bill Bachman/Lochman Transparencies
Inset: Portion of upper Kent River catchment.
Map courtesy of CSIRO



Before clearing, the deep-rooted vegetation helps maintain the natural hydrological balance.

After clearing, shallow-rooted crops and pasture use less water and the groundwater level rises.

Below: Dead trees in Lake Murapin show the effect of rising salinity levels.
Photo – Babs & Bert Wells/CALM

perennial native vegetation and replacing it with shallow-rooted, annual crops and pastures has thrown groundwater levels completely out of balance.

Widespread clearing was the accepted land practice of the day when new settlers converted the bush into farms and towns, and over the years generated enormous wealth for the State. Today, the south-west agricultural region produces agricultural goods worth more than $4.5 billion every year.

However, unlike native trees and perennial shrubs, the roots of crops and pastures can't reach the rainfall that infiltrates deep into the subsoil. This means extra water is being stored as groundwater. It's estimated that every year, more than five billion kilolitres are being added to existing stores of groundwater beneath the south-west agricultural area—three or four times the amount of water that flows through all the streams and rivers in the region. The groundwater level has to rise because impermeable granite basement rock (at an average depth of 20 metres) prevents deep vertical drainage and the flat landscape and subsoil clays prevent rapid sideways drainage.

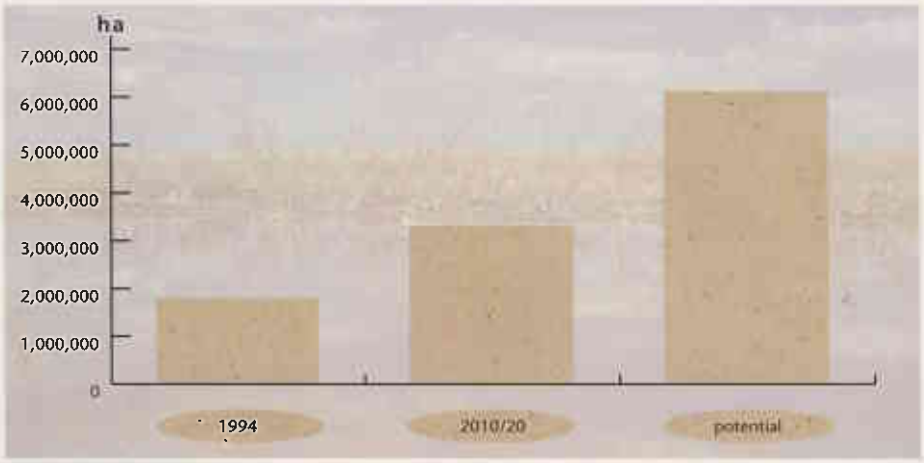
Rising groundwater degrades the biological and physical environment. Saline groundwater affects vegetation and soil fauna, eventually destroying habitats. There are also problems such as waterlogging, bare and saline soils, erosion, sedimentation, salinity of rivers and wetlands and increased runoff.

WHERE DOES THE SALT COME FROM?

The salt in soils across the south-west originally came from the ocean. Prevailing winds carry tiny amounts of salt (20–200 kg/ha/annum) inland where it is deposited in rainfall and dust.

Today there are up to 10 000 tonnes of salt stored under every hectare of the State's south-west. The amount of salt in the subsoil depends on location and soil type—less salt is stored in high rainfall areas and the highest concentration is found in low rainfall areas, generally those that are flat with poor surface drainage.

As groundwaters rise, they mobilise the salt, bringing it closer to the surface. Eventually, plants that are not salt-tolerant die and the loss of cover leads to erosion. When the saline groundwater reaches the surface, salt is concentrated by evaporation and damages the soil—and foundations—and drains into waterways.



Above: The area of land affected by salinity was estimated at 1.8 million hectares in 1994, but this could more than treble without remedial action.

Right: The slender tree frog (*Litoria adelaidensis*). Photo – Jiri Lochman

BIODIVERSITY THREATENED

Salinity is one of the most serious environmental threats facing Western Australia. This threat occurs across a huge area where biodiversity has already been profoundly affected by land clearing and the arrival of exotic plants and animals and diseases.

Rising groundwater affects whole catchments. That means salinity will affect not just the farmland that has been cleared, but the areas of native bush on farms and conservation reserves. Hydrologists from Agriculture Western Australia estimate that up to 80 per cent of susceptible remnant vegetation on farms and 50 per cent on public lands, including nature reserves, could be degraded by salinity in the south-west.

Salinity affects biodiversity across the landscape, but is most serious in wetlands, rivers and whole valley floors. While some species tolerate and even thrive in saline habitats, salinity adversely affects many species of wetland plants and animals, and may result in the loss of particular wetland types.

In the late 1970s, one of CALM's predecessors began monitoring water and salinity levels in 52 wetlands between Eneabba and Esperance. Several wetlands in low rainfall areas, with largely cleared catchments, have since shown marked increases in salinity levels. By contrast, fresh and brackish wetlands with intact native vegetation throughout their catchments had no significant increases in salinity.

Many other monitored wetlands were already saline when the study began. While these have shown limited increases in salinity, the gradual decay of dead trees and shrubs from their floors and shores has continued. This woody material provides habitats for aquatic invertebrates and micro-algae, which in turn form part of the food supply for waterbirds. No species is known to have become extinct as a result of salinity, but this may reflect the poor documentation of our wetland flora and fauna. Certainly, most aquatic freshwater plants have disappeared from the Wheatbelt.

Eleven species of threatened flora found in the agricultural region have at least one population considered to be at threat from salinity. At least one species,

the hinged dragon orchid (*Drakonorchis drakeioides*) is likely to disappear unless rising groundwater is halted.

As low-lying areas degrade, plants that specialise in growing in these areas, such as flat-topped yate (*Eucalyptus occidentalis*), salt salmon gum (*Eucalyptus salicola*) and many paperbarks (*Melaleuca* species) will disappear at local and regional levels.

The impact on native fauna is most obvious with waterbirds and freshwater invertebrates. Of the 61 more common waterbirds in south-western Australia, only 16 prefer saline or hypersaline conditions. Salinity has already caused a 50 per cent decline in the number of species occurring in the better, freshwater wetlands in the south-west.

Frog habitats have been markedly reduced. Some, such as the slender tree frog (*Litoria adelaidensis*), either have, or are likely to, become extinct in inland agricultural areas. Even widespread species, such as the spotted burrowing frog (*Heleioporus albopunctatus*), are thought to be far from secure.

The decline and loss of habitats has had various effects on reptiles and mammals. The long-necked swamp tortoise (*Chelodina oblonga*) can tolerate quite high salinity levels, but needs fresh water to breed and has declined markedly as a result. The disappearance of riparian thickets and grasslands in some areas has been a major cause of the disappearance of tammar wallabies (*Macropus eugenii*). In other cases, such as the water rat (*Hydromys chrysogaster*) it was probably the loss of their prey of freshwater molluscs and shellfish to salinity that has largely caused their demise in agricultural areas.

THE SOLUTION

Research has shown that clearing too much of the deep-rooted vegetation for agriculture caused salinity, and that

Above left: Flat-topped yate (*Eucalyptus occidentalis*) prefer low-lying areas – these are among the first to be affected by salinity.
Photo – Marie Lochman

Left: Freshwater paperbarks (*Melaleuca rhaphiophylla*) are also at risk.
Photo – Marie Lochman

planting trees and shrubs can prevent and even reverse the problem. It's a straightforward solution, but what impact will it have on agriculture and how will we pay for the millions of trees and shrubs required?

Many field studies have shown that replanting certain trees can lower water tables rapidly. Current research aims to determine the optimum proportion and distribution of trees to capture the full range of benefits as well as retain a practical system for conventional cropping and grazing. Stands of vigorously growing trees in the Wellington catchment, for example, lowered the water table by eight metres in 10 years, and groundwater levels can be reduced significantly by strategically planting trees on only 20 per cent of a farm. These plantings can be integrated with traditional farm practices and can even improve productivity by providing shade and shelter for crops and stock.

The cost of planting trees on the scale required is still more than landholders and the community can afford. It is clear that the scale and cost of planting will be large. For example, the Commonwealth Government's new $1.25 billion Natural Heritage Trust would only just begin the job even if it was all spent on revegetation. However, if significant numbers of trees can be planted as a commercial crop, landcare becomes not only affordable, but profitable. CALM estimates that more than one million hectares of already cleared agricultural land in the south-west could support commercial tree crops. The wood fibre produced would help meet the increasing worldwide demand for forest products, and of course, the economic value of a tree crop doesn't change its capacity to lower groundwater levels and deliver other landcare benefits, such as helping to control wind erosion.

CALM's largest farm forestry operation to date has been planting

Above right: The tadpole of the spotted burrowing frog – another species facing changing habitats.
Photo – Jiri Lochman

Right: Long-necked swamp tortoises will tolerate saline water, but need fresh water to breed.
Photo – Babs & Bert Wells/CALM

bluegums (*Eucalyptus globulus*) in the high rainfall south-west (see 'Restoring Nature's Balance', *LANDSCOPE*, Autumn 1998 and 'Tree Crops for Farms', *LANDSCOPE*, Summer 1992–93). CALM currently has contracts to establish at least 60 000 hectares of bluegums for overseas investors. The Department has also begun planting oil-yielding mallee eucalypts in the low-rainfall Wheatbelt. Several oil mallee species are being used, most of them native to the Wheatbelt. Eucalyptus oil has potential as an industrial solvent—a product with a huge market commensurate with the scale of planting necessary to bring Wheatbelt salinity under control. However, there is still a great deal of development work to be done to reduce production costs to a competitive level for these new markets.

Now, the medium rainfall zone and west coastal sand plain have been targeted for CALM's newest farm forestry program, the Maritime Pine Project, which is a key component of the Salinity Action Plan.

MARITIME PINE PROJECT

This project is based on *Pinus pinaster*, which is thinned at least twice throughout the 30-year life of the planting to yield a range of products from pulpwood to medium-density fibre board and sawlogs. The species originates on the coasts of France, Spain and Portugal—giving the pine its common name—and has been grown in State-owned plantations in Western Australia since the 1920s.

The State Government will spend $18 million per annum (to be phased in) to establish up to 150 000 hectares of maritime pines in sharefarm agreements with landowners over the next decade. At an average planting rate of 1650 seedlings per hectare, this is a target of nearly 250 million trees. As happened with the bluegum project, CALM expects to be able to attract private investment for the project to allow an even greater area to be planted.

The Maritime Pine Project is only feasible because of the enormous improvements in Western Australia's *Pinus pinaster* stock as the result of decades of tree breeding, and also by the development of new markets for pine thinnings, particularly for reconstituted panel products.

Dr Eric Hopkins, a scientist working for the Forests Department and then CALM, began a maritime pine breeding program in 1957. Dr Trevor Butcher, who has worked on the project since 1968, heads the breeding program today. Many others have contributed to this program, which has produced seedlings that are 70 per cent more productive than the original unimproved seed imported to Western Australia from Portugal (see 'In Search of the Perfect Pine', *LANDSCOPE*, Autumn 1992). CALM is now working to make these superior trees available for future plantation establishment, and new studies of site productivity and establishment techniques are under way.

Water Authority research has shown that maritime pine plantings reduce water table levels by up to 3.5 metres more when compared with native woodland. An even greater difference is likely between pine and cleared farmland.

PINES PLUS BIODIVERSITY

Native species are also important in revegetating farmland, to increase biodiversity as well as reducing saline water tables. Pines, of course, will contribute to biodiversity by protecting remnant vegetation, but as well as this, dozens of native tree species will be

Above left: **Decades of tree breeding in Western Australia have produced superior stock which will be the basis of the Maritime Pine Project.**
Photo – Jiri Lochman

Left: **CALM's target is to plant nearly 250 million maritime pine seedlings over the next decade.**
Photo – Marie Lochman

planted as part of the project. These species include four acacias which will be excellent host trees for the parasitic sandalwood, *Santalum spicatum*, which produces a valuable aromatic timber.

Up to 10 per cent of the land planted under the Maritime Pine Project is expected to be commercial and non-commercial native trees, usually in areas too rocky or too saline for pines, or where landowners prefer native trees for landscaping reasons. Extending the area of trees planted beyond those sites suitable for pines will increase the landcare benefits. It will also increase biodiversity and help create corridors of native vegetation, which in turn will benefit native wildlife. This project will complement Western Shield, CALM's project to control feral predators so the native animals that remain can increase in number and other species can be returned to their former habitats. Over time, the combined efforts of government agencies and community groups could reconstruct much of the ecology of the agricultural region in target areas.

SALINITY ACTION PLAN

Western Australia's Salinity Action Plan is a long-term, coordinated response to the most severe salinity problems in Australia.

It is estimated that three million hectares of trees and perennial, deep-rooted shrubs will have to be planted over the next 30 years, in combination with other water management practices. These practices can be grouped in the following categories:

- improving water use of annual crops and pastures;
- collection, re-use and/or disposal of surface water;
- drainage or pumping, re-use and/or disposal of groundwater; and
- protection and management of remnant native vegetation.

A major part of the Action Plan will be implemented by establishing priority areas for on-the-ground action. Focus catchments are being selected to concentrate action and Government advice, including fully coordinated support teams. Key 'recovery' catchments are also being established where priority will be given to restoring and protecting water resources, natural diversity, wetland values and rural infrastructure.

The effectiveness of these and other measures will be monitored during the life of the Action Plan. Regular evaluation will be a key responsibility of the State Salinity Council, appointed earlier this year. Council members represent the relevant land management and environmental statutory bodies, the Farm Forestry Development Group, business and environmental interests and agricultural landholders.

We know salinity is preventable and, with time, reversible in many areas. We also know that turning back the tide will require long-term, coordinated action from farmers, the Government and the wider community. The Salinity Action Plan sets out a blueprint for long-term success.

Top: One of the native species (*Santalum spicatum*) to be planted as part of the Maritime Pine Project.
Photo – Jiri Lochman

Above: Many landowners are already working in catchment groups to control rising watertables.
Photo – Courtesy Agriculture Western Australia

Caris Bailey is a special projects officer with CALM. Keiran McNamara is CALM's Director of Nature Conservation and Syd Shea is CALM's Executive Director.

All can be contacted on (08) 9442 0300.

The threat from below . . . How can we defeat our greatest environmental enemy? Read about salinity and what we can do about it on p. 10.

One of the best aids to plant conservation is completely invisible. See our plant DNA story on p. 18.

LANDSCOPE

VOLUME THIRTEEN NUMBER 1, SPRING 1997

Dryandra, one of the last refuges of the native wildlife. Now you can experience this woodland wonderland for yourself. Find out how on p. 36.

Europeans brought alien plants and animals to WA's rangelands, which have since become degraded. What can be done? See p. 42.

How old is the Stirling Range? Read about this stunning area in our story on p. 48.

FEATURES

REGULARS

COVER

The Fitzgerald River National Park boasts a startling array of habitats, mammals, birds and other species. Its wildflowers in spring are often spectacular. Our story on p. 28 is a fascinating tale of variety, beauty, and threat in this aged land.

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