Wheatbelt wonders under threat

Salinity is the greatest environmental threat facing Western Australia. As part of the State Salinity Strategy, which aims to find solutions to alleviate the problem, the Department of Conservation and Land Management (CALM) is undertaking the first ever comprehensive biological survey of the agricultural zone. Three years into the four-year survey, it is clear that the biodiversity of the agricultural zone is very high. Unfortunately, of about 4,000 flowering plant species found in the Wheatbelt, more than 850 are found only in fresh or naturally saline lowlands, which are directly threatened by rising groundwater and salinity.

by Greg Keighery

The Wheatbelt of Western Australia stretches from Kalbarri to east of Esperance. It contains all or significant parts of six (Geraldton sandplains, Swan Coastal Plain, Avon-Wheatbelt, jarrah forest, mallee and Esperance sandplains) of the eight biogeographic regions recognised in temperate south-western Australia. The south-west is an area of megadiversity for flowering plants on a world scale.

Rising saline groundwater—the result of clearing—threatens about 30 per cent of the agricultural area of Western Australia (see 'Halt the Salt', *LANDSCOPE*, Spring, 1997). This will have major impacts on the region's native plants and animals. To help plan to protect them, the Salinity Strategy needed detailed information. As a result, a four-year systematic survey of Wheatbelt plants and animals is being undertaken by CALMScience Biological Survey Group, together with scientists from a range of agencies and specialists.

WILDFLOWER WONDERLAND

The survey has established more than 660 survey sites (quadrats) throughout the Wheatbelt to record terrestrial flora. Another 200 sites have been established as part of a community survey on private and local government lands.

The agricultural zone has an estimated 4,000 species of flowering plants, and more than 60 per cent of these grow nowhere else. The region is the centre of diversity for many of the species-rich genera of trees and shrubs (such as *Acacia*, *Dryandra*, *Eucalyptus*, *Grevillea* and *Verticordia*) that characterise the south-west of Western Australia.

More than 850 flowering plant species are found only in fresh or naturally saline lowlands, which are directly threatened by rising groundwater and salinity. Several hundred other species found only in woodland sites will also be threatened in the longer term. One aim of the plant survey is to identify native species with potential for revegetation. A database of species that grow in naturally saline areas of the agricultural zone is being compiled, together with lists of all flowering plants in the area and their conservation status.

Previous page:
Main: Remnant bushland in the Wheatbelt region.
Photo – Marie Lochman
Inset: The largest population of yellow eyebright (*Euphrasia scabra*) is found in the Muir-Unicup recovery catchment.
Photo – Greg Keighery/CALM

Below: The biological diversity of the Wheatbelt has been shown to be much higher than was previously thought.
Photo – Jiri Lochman

It is already abundantly clear that the biodiversity of the agricultural zone is much higher than was previously thought. For example, detailed surveys of the Lake Muir-Unicup reserves have documented almost 1,000 species of flowering plants (considerably higher than the wildflower-rich Mount Lesueur area). The small Quairading Shire Reserve (surveyed by community volunteers) has more than 500 plant species, including two that are new to science and the largest populations of two critically endangered taxa.

Quadrats in the agricultural zone contain at least 20 and sometimes more than 90 species, the equal to most heathland areas, normally considered the most species-rich sites. This richness is often found in the small herbs of the low-lying woodlands, rather than in the shrubs, as seen in the northern and southern heathlands.

The biological survey has rediscovered one presumed extinct aquatic plant, and found four previously unknown species. Genetic studies of Wheatbelt species are showing high levels of variation between populations of widespread species.

PLANTS AT RISK

The survey has also established that naturally saline areas have very high biodiversity values. At least 64 threatened and priority taxa (species, subspecies or varieties) are restricted to these areas and several new taxa have been discovered during the survey. Priority taxa are those whose conservation status is of concern, and many are likely to be formally classified as threatened once there has been sufficient survey to determine their true status. These plants, and the communities in which they occur, are at major risk from rising water tables as

Right: Increasing salinity threatens the endangered long-leaved myrtle (*Hypocalymma longifolium*).
Photo – Greg Keighery/CALM

Below right: The largest known population of Chapman's acacia (*Acacia chapmanii* subsp. *australis*) is being destroyed by a spreading saline seep in a nature reserve near Bolgart.
Photo – Greg Keighery/CALM

they are adapted to fresh water flushing in winter and to summer drought, not to flooding with saline water. The survey is revealing major regional floristic differences in the salt lake chains occupying ancient drainage systems. Conserving these areas will be particularly challenging.

More than 1,500 of the 4,000 species in the agricultural zone grow low in the landscape, in riverine valleys, fresh water or primarily saline lands. Of these, 450 grow only in the Wheatbelt and are in grave danger of extinction as a result of the encroaching salt. Another 400 to 500 species, subspecies or varieties are centred in the agricultural zone, but not confined to it. These taxa are subject to major genetic erosion, as salinisation and hydrological changes may wipe out many of their populations.

Areas affected by secondary salinisation also show major declines in biodiversity. Rich and complex plant communities are replaced by a few succulents and weeds. Most lowland communities, including tall woodlands, mallee and melaleuca shrublands, freshwater and naturally saline wetlands, will be lost unless remedial action is taken. The Wheatbelt will lose much of its landscape character with the loss of these communities and paddock trees.

The subterranean cave communities, areas of species-rich heathland and temporary wetlands of the northern sandplains and Swan Coastal Plain are threatened by both rising fresh and saline groundwaters. Paradoxically, the increased fresh water is threatening these heathlands because they contain many plants susceptible to dieback (*Phytophthora* species).

Members of the WA Wildflower Society have surveyed about 200 sites on private and local government lands. More importantly, they have helped farmers (and scientists) see the incredible and often unique biodiversity in their own bush. Allowing city and country people to meet and share knowledge in these relaxed but wonderful settings provides some immensely satisfying networking. Detailed reports and field herbaria on the areas surveyed are provided to the landholders and major libraries.

WILDLIFE

To survey the wildlife, more than 300 biodiversity quadrats (where animals and plants are sampled) have been established across the Wheatbelt. Like the flora sites, they are placed in less disturbed examples of the main landscape types, as well as on a salt-affected example where this has occurred. Lines of pitfall traps are used to sample ground-dwelling invertebrates (spiders, scorpions and centipedes) and vertebrates (small mammals, reptiles and frogs). All these animals are relatively immobile and have to cope with salinity, rather than fly to a more hospitable home.

The central band of the agricultural zone was sampled in 1997–98, and all animals have been identified. The northern band was sampled in 1998–99 and the vertebrates and most of the invertebrates identified. The southern band was sampled during 1999–2000. The remaining areas around Dandaragan and Esperance are being sampled in 2000–01. During 2000–01, Birds Australia is also surveying birds on a selection of the biodiversity sites.

The study has already dramatically increased knowledge of the distribution, status and habitat of small Wheatbelt animals. For example, the survey of the central band identified 33 scorpion species (only 13 had been previously recorded for the entire Wheatbelt), 24 centipedes (23 previously recorded) and 329 spiders (128 previously recorded). Sixty to 70 per cent of spiders were undescribed.

In the northern and central bands, 113 species of small ground-dwelling reptiles, mammals and frogs were recorded, compared with Museum records of 130 species for the whole agricultural region.

ANIMALS AT RISK

The distributions of at least 40 per cent (210 of more than 500 species) of the region's spiders, centipedes and scorpions and 25 per cent (31 of 125 species) of its small ground-dwelling vertebrates are centred on the agricultural region or endemic to it. Different communities of species occur on different soil types within survey areas (sands, clays, loams and so on).

Secondarily saline quadrats (even partially affected) have around 30 per cent fewer species than their non-salinised counterparts. The fall is more dramatic when one realises that widespread 'weedy' spiders replace some of the localised specialists normally found in these habitats.

WETLANDS

The full range of wetland types within the study area will be sampled, ranging from rivers to fresh and

Top left: Andrew Storey sampling for aquatic invertebrates in the Lake Muir recovery catchment.
Photo – Greg Keighery/CALM

Above left: Members of the Wildflower Society of WA and local volunteers have surveyed about 200 sites on private and local government lands.
Photo – Greg Keighery/CALM

Far left: Small animals are sampled using pitfall traps.
Photo – Marie Lochman

Left: Animals such as the numbat are relatively immobile and have to cope with the effects of salinity.
Photo – Jiri Lochman

naturally saline wetlands to secondarily saline wetlands. The 225 wetlands sampled for aquatic invertebrates had about 650 quadrats established on them to document the flora of these wetlands. Another 30 wetlands and about 100 quadrats are being sampled this year.

Many new records, and major range extensions, of rare and priority flora have already been uncovered. Several new samphires (*Halosarcia* spp.) have been discovered.

Only 16 of the 61 more common waterbird species in the south-west prefer strongly saline or hypersaline conditions. A 1981–85 survey showed that an average of five waterbird species used hypersaline wetlands, compared with 20 in saline wetlands and 40 in fresh wetlands with live trees and shrubs. The death of shrubs and trees in many Wheatbelt wetlands due to salinity caused a 50 per cent decrease in the number of waterbird species using them. If salinity continues to increase, only 16 species, plus three or four species that use freshwater dams, will persist in the Wheatbelt out of an original waterbird fauna of more than 60 species.

AQUATIC LIFE

About 700 invertebrate species have so far been collected from Wheatbelt wetlands. About 50 per cent appear to be described and about 15 per cent (some 105 species) are only known from the Wheatbelt. Numerous species appear to be restricted to naturally saline wetlands, including fairy shrimps, snails, ostracods and copepods (tiny crustaceans). If all wetlands in the Wheatbelt became saline, up to 218 species (31 per cent of the aquatic fauna) would disappear from the Wheatbelt.

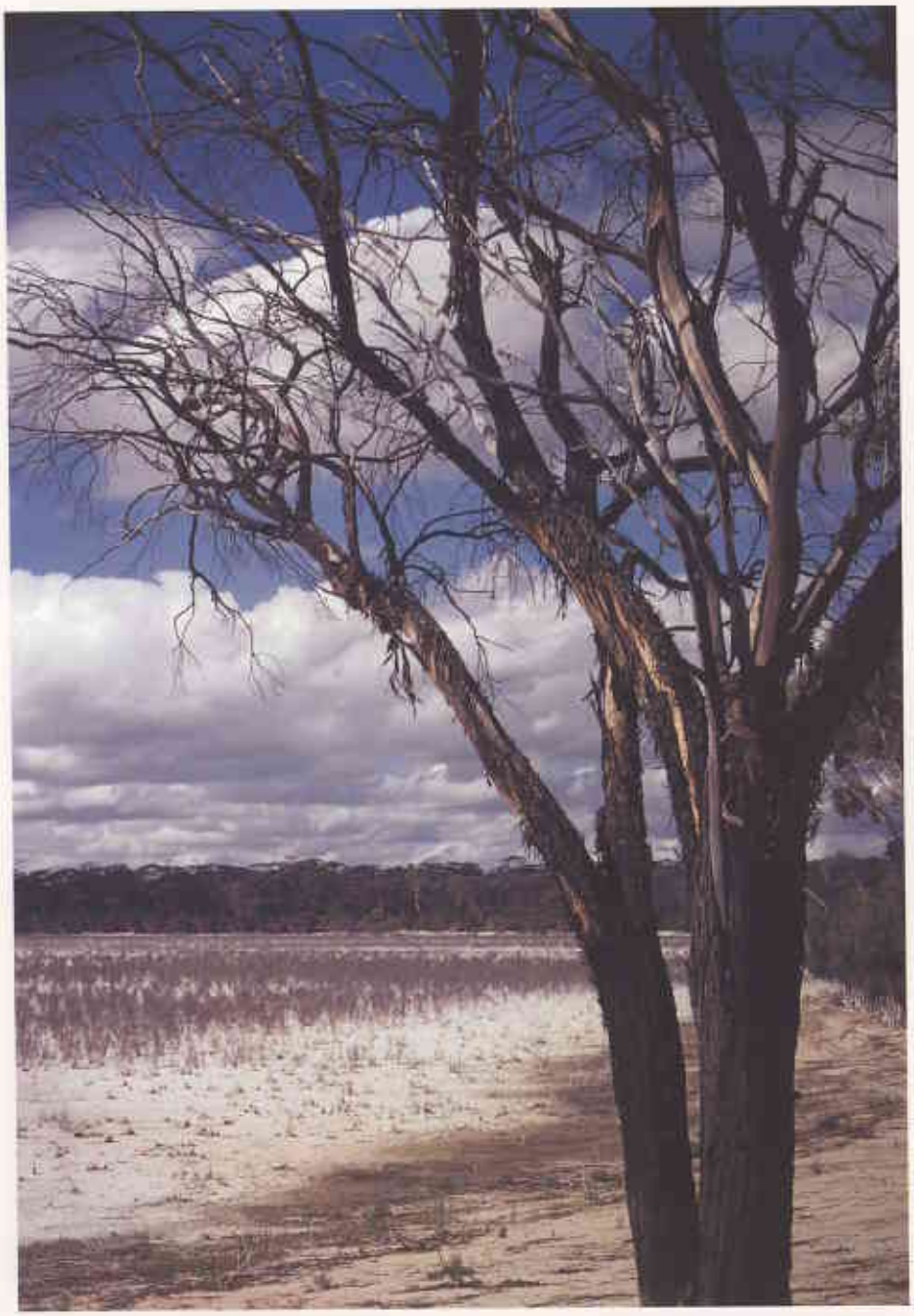
Species richness declines with salinity. Most fresh wetlands contain about 50 invertebrate species, compared with only four in the most hypersaline areas. As a rule of thumb, doubling salinity halves the number of aquatic invertebrate species.

ROAD TO RECOVERY

The biological survey will identify at least 10 potential natural diversity recovery catchments by 2001. Eight areas have so far been selected for their biodiversity and level of risk from salinity. These catchments are to be managed (through revegetation, remedial engineering work and so on) to protect their biodiversity from salinity, with dedicated staff and budgets. Work is already well advanced on the Esperance Lakes, Toolibin Lake and the Muir-Unicup wetlands. Action commenced in April 1999 to protect Lake Bryde, especially its lakebed community (already listed by CALM as a threatened ecological community) and surrounding vegetation. The values of the fifth recovery catchment, a series of naturally saline braided channels in the Watheroo area, have been documented and work is commencing. A report on biodiversity values has been prepared on a small-scale recovery catchment around Drummond Nature Reserve near Bolgart. Preliminary work has also been done on two other potential recovery catchments to protect wandoo woodlands and naturally saline areas.

Below: The crested grebe is one of many waterbird species that may disappear from the Wheatbelt if salinity continues to increase.
Photo – Babs & Bert Wells/CALM

Bottom: The survey recorded 33 species of scorpion in the central zone, 20 of which had not been found before in the Wheatbelt.
Photo – Jiri Lochman



Left: The lakebed community at Lake Bryde is listed as a threatened ecological community.
Photo – Greg Keighery/CALM

Below left: A temporary fresh water creek lined with sundews (*Drosera* species) in Wheatbelt wandoo (*Eucalyptus capillosa*) woodland at a reserve near Bruce Rock.
Photo – Greg Keighery/CALM

At the same time, CALM, in partnership with landowners across the Wheatbelt (see 'A Crop of Forests', *LANDSCOPE,* Spring 1999), has been planting areas of cleared and often unproductive farmland with maritime pine to lower the water table and help fight salinity. Such plantings provide returns for farmers while helping them care for their land and hence are a positive step in protecting catchments and ultimately threatened ecological communities.

The survey will provide an overview of the distribution and conservation needs of the terrestrial plants and animals of the Wheatbelt. Almost 1,000 sites will have been established that can be used for monitoring well into the future.

Longer-term studies of individual recovery catchments, and more detailed surveys of communities and regions identified, will be needed after the survey is completed in 2001. Monitoring of actions to recover catchments, and control and reverse salinity, will be needed to fine tune management actions, especially in regard to potential weeds, drainage, gypsum mining and other disturbances.

Hopefully, it is not too late to intervene and save the unique plants, animals and landscape of the remarkable Wheatbelt area.

Greg Keighery is a Principal Research Scientist with CALMScience, based at CALM's Wildlife Research Centre at Woodvale. He can be contacted on (08) 9405 5100 or by email (gregk@calm.wa.gov.au).

The complete results of the survey will be published in a wide variety of formats (both scientific and popular) to ensure that the information is available to anyone who needs it.

Winner of the 1998 Alex Harris Medal for excellence in science and environment reporting.

LANDSCOPE

VOLUME SIXTEEN, NUMBER 2, SUMMER 2000–2001

Botanists rediscover a presumed extinct grass perched on the mountain tops of the Stirling Range National Park. See page 43.

How can we preserve the Leeuwin-Naturaliste caves while catering for increasing visitation? See page 16.

Salinity Strategy surveys are revealing that salinity threatens more than 850 Wheatbelt plant species. How can managers intervene? See page 36.

Discover Perth's eight regional parks and their special features and attractions on page 28.

Learn about the spineless wonders of the marine world and their clever disguises on page 42.

FEATURES

BRIMMING WITH BIRDS
ALLAN BURBIDGE....10

CAVES OF THE CAPE
ANNE WOOD....16

NURSING THE FUTURE
STEPHEN WHITE AND MANDY CLEWS....23

PARKS FOR PEOPLE
CHRISTINE SILBERT AND TIM BOWRA....28

WHEATBELT WONDERS UNDER THREAT
GREG KEIGHERY....37

DRUMMOND'S GRASS
ANNE COCHRANE AND SARAH BARRETT....43

INVISIBLE INVERTEBRATES
ANN STORRIE....48

REGULARS

BUSH TELEGRAPH....4

ENDANGERED
GREAT DESERT SKINK....36

URBAN ANTICS
WHAT...NO BIRDS?....54

COVER

More than 160 different bird species use Cape Arid National Park, which lies on the South Coast about 120 kilometres east of Esperance. The red-eared firetail is one of them. This exotic-looking finch is confined to south-western Australia. It is found in areas of dense heath and undergrowth in thick forest, never too far inland. Cape Arid National Park is the eastern limit of its distribution.

Cover illustration by Philippa Nikulinsky

Executive Editor: Ron Kawalilak
Editors: David Gough and Carolyn Thomson-Dans
Bush Telegraph Editor: Verna Costello
Advertising copy and editorial assistance: Caris Bailey
Scientific/technical advice: Andrew Burbidge, Paul Jones and staff of CALMScience Division
Design and production: Tiffany Aberin, Maria Duthie, Gooitzen van der Meer
Illustration: Gooitzen van der Meer
Marketing: Estelle de San Miguel ☎ (08) 9334 0296 Fax: (08) 9334 0498
Subscription enquiries: ☎ (08) 9334 0481 or (08) 9334 0437
Colour Separation by Colourbox Digital
Printed in Western Australia by Lamb Print

Please do not send unsolicited material to *LANDSCOPE*, but feel free to telephone the Editor.

Visit *LANDSCOPE* online on our award-winning Internet site NatureBase at http://www.naturebase.net

Published by
Department of Conservation and Land Management,
Dick Perry Avenue, Kensington, Western Australia