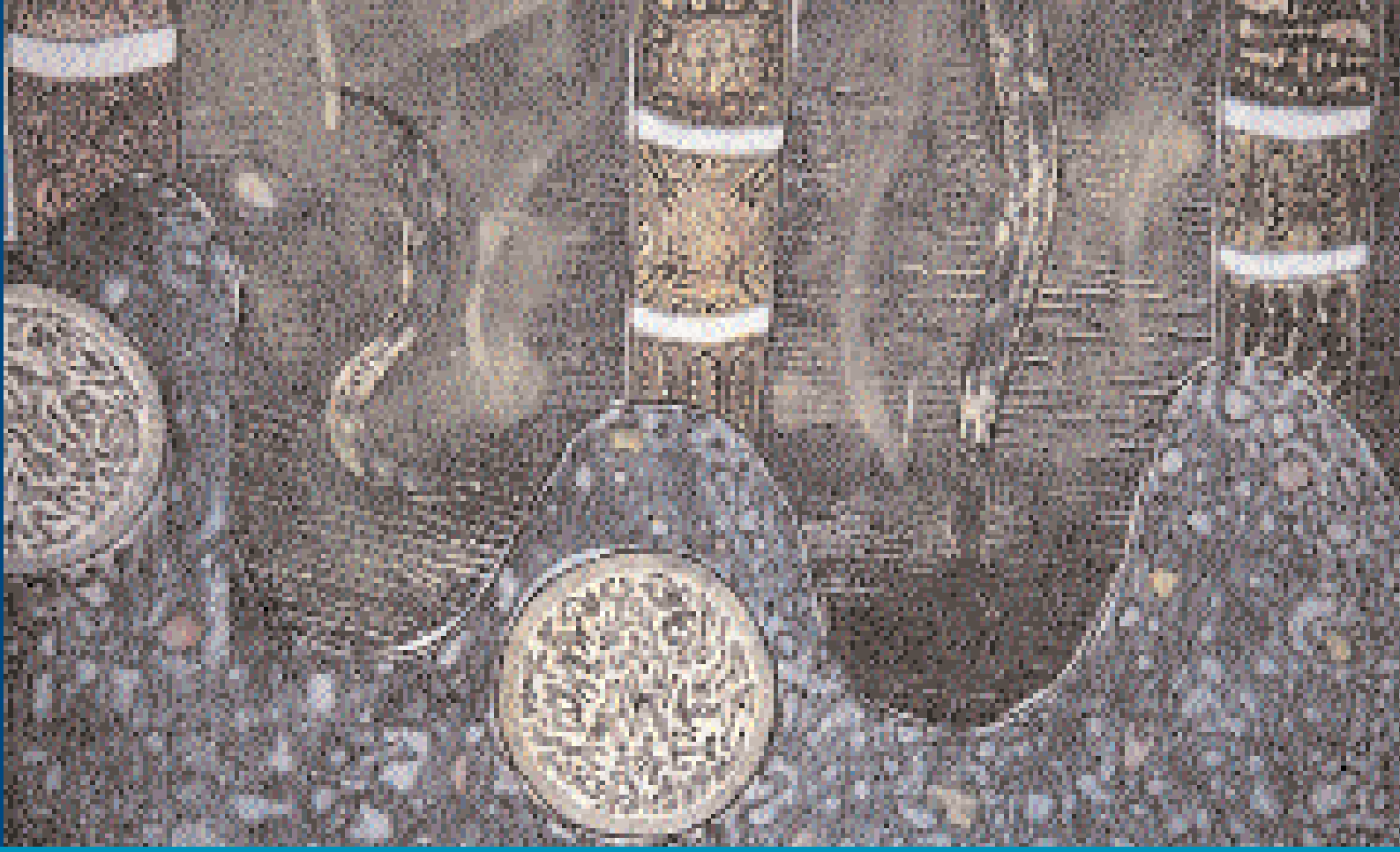
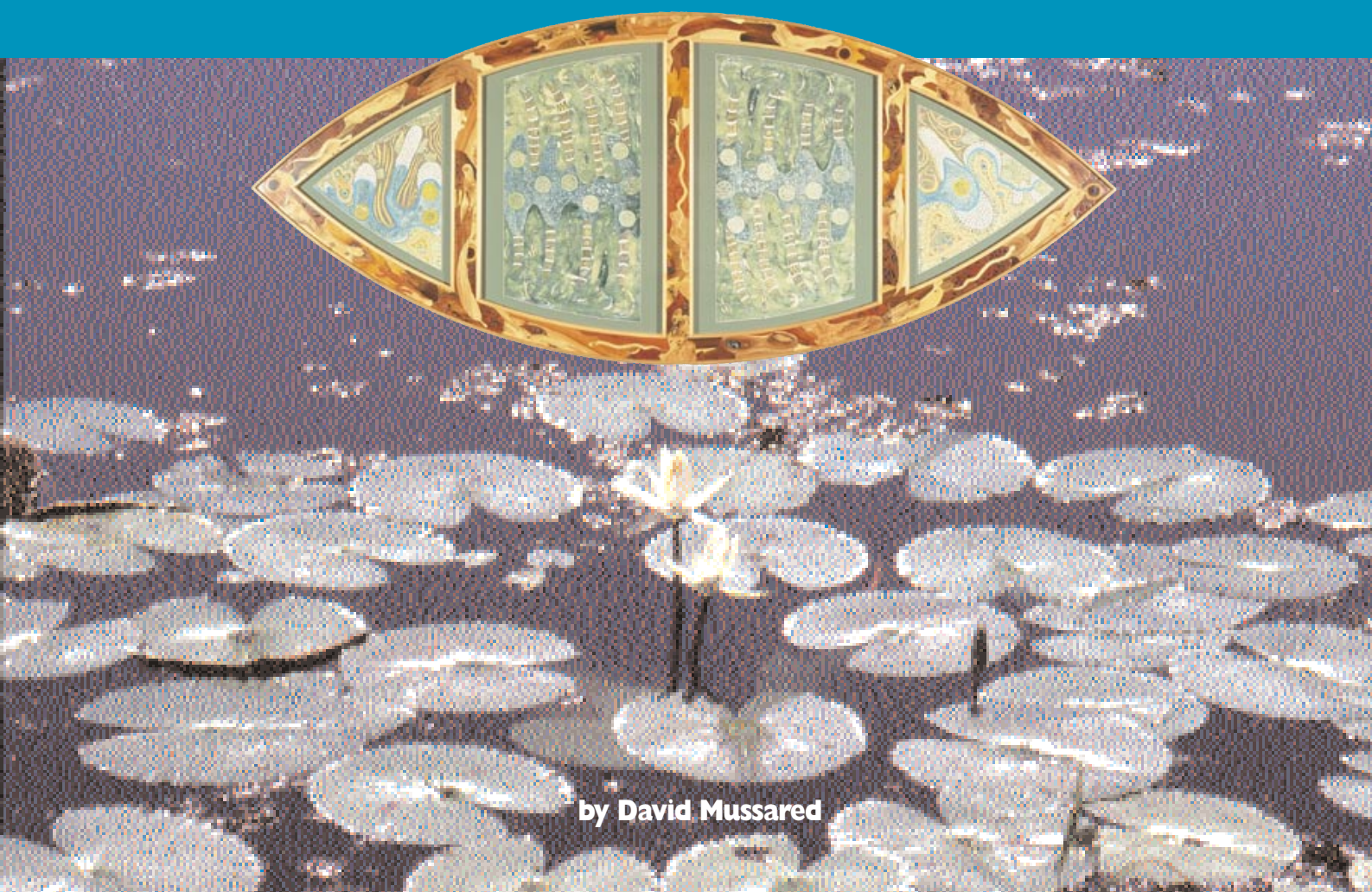


LIVING ON FLOODPLAINS



by David Mussared

COVER PICTURES

This close-up of the large middle section of *Remains to be Seen* represents the deep muted, swirling pools of the middle channel of the River Murray. Intentionally murky, eroded and decayed, this part of the work is also mystical and powerful – as it represents all the totems and indigenous life that was once abundant along the River.

***Remains to be Seen*, is the work of Wagga Wagga-based artist Treahna Hamm (Ginny Firebrace) who won the Australian Heritage Commission's Aboriginal and Torres Strait Islander Heritage Art Award in 1996 for this River Murray inspired work.**

Water Lillies, Arthur Mostead

Project Manager: Karen Markwort
Editors: Karen Markwort, Sandy Paine
Design Concept: Brett Russell, 4 Design
Layout and Design: Brett Russell, 4 Design

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The Murray-Darling Basin Commission

David Mussared, an Adelaide-based science writer, is the editor and publisher of *Land and Water News*.

Although best-known as the former science-and-environment reporter for *The Canberra Times*, David has also worked for Australian Associated Press, CSIRO Corporate Communications and the *The Advertiser* in Adelaide.

More recently he has worked as a freelance science writer for many different publications, and as a media consultant. In 1996 he was contracted by the Cooperative Research Centre for Freshwater Ecology to write *Living on Floodplains*.

Among several other major journalism awards, David's writing about the Murray-Darling Basin has won him Australia's prestigious National Landcare Media Award (1994), and the Environment Category of the international Commonwealth Media Awards (1994).

LIVING ON FLOODPLAINS

LIVING ON FLOODPLAINS IS AN IMPORTANT WORK.

It complements publications such as Tim Flannery's *Future Eaters* as a popular scientific account of the devastation that Europeans' anthropocentric approach to taming our great continent has inflicted on the landscape of Australia. It focuses on the highly productive Murray-Darling Basin, which produces 40% of the nation's agricultural produce, but is under extreme environmental stress.

The author, a journalist who was the 1994 winner of the National Landcare Media Award, "tells it as it really is", in a style that brings science to life for the everyday reader.

The landcare movement, a uniquely Australian community-action-oriented approach to solving environmental problems, is put forward as a cost-effective way of turning the problems around.

Countless small actions by millions of people who depend on the rivers might be enough to cobble together a river system in which the old and the new can somehow survive together.

The landcare movement provides a mechanism for "cobbling together countless small actions" that collectively slow down the degradation and start the repair process.

FOREWORD

Australia is classified as one of the world's mega-diverse regions, the only such region in a developed country. This diversity is well represented in the Murray-Darling River system and more importantly along its floodplains.

One of the strengths of the book is that it does not dwell on the negative, but puts forward a series of options to achieve change and move to a more sustainable future.

This publication comes at a time when the National Heritage Trust promises substantial increased funding to address key issues on a regional scale that can really make a difference.

Like Andrew Campbell's publication, *Landcare Communities Shaping the Land and the Future*, this book outlines options for redressing the damage and moving towards a more balanced ecocentric approach. It suggests innovative ways to find a better balance between productivity and nature conservation.

In highlighting the valuable role that the floodplains play in maintaining biodiversity and cleaning up the waterways, the book challenges the conventional wisdom of floodplain management. It puts a strong case for the provision of adequate environmental flows to improve biodiversity and move towards more natural water flow cycles.

The process of repair has begun with capped water allocations and community-based action, but it is clear that much more needs to be done to make substantial and measurable improvement.

David and his scientific advisory team have made a valuable contribution to popular scientific literature, helping to alert the nation to the problems and possible solutions to achieving sustainable productivity in the Murray-Darling Basin before it is too late.

Brian Scarsbrick
Chief Executive
Landcare Australia Ltd

ACKNOWLEDGEMENTS

Living on Floodplains was funded by the Cooperative Research Centre for Freshwater Ecology (CRCFE) and the Murray-Darling Basin Commission (MDBC). Its aim is to make public the growing scientific understanding about how floodplain rivers in the Murray-Darling Basin function, and to suggest practical ways for managers to apply this new knowledge.

The publication draws mostly, but not exclusively, on the work of CRCFE researchers, especially those based at the Murray-Darling Freshwater Research Centre (MDFRC) in Albury, New South Wales. Its main message is that a river and its floodplain need to be managed together; that together they make up a single ecosystem that is profoundly interlocked at all levels.

Although **Living on Floodplains** is a general rather than a scientific publication, it has been scrutinised by a committee of Australian freshwater researchers. Editorial workshops were held in Albury (July 9, 1996) and Canberra (August 5, 1996) to review the scientific content.

Much of the information in this publication comes from interviews with working scientists, although some is also drawn from previously published literature. The footnotes in the text refer only to this published material, not to the considerable personal contributions made by participating researchers.

Accordingly, the author wishes to acknowledge the invaluable assistance of those scientists who took part in interviews, telephone conversations, electronic mail exchanges and review workshops. This publication is an attempt to compile their work and their thoughts into a single, usable document. Unless otherwise indicated, all those mentioned below are part of the CRCFE.

Terry Hillman from Albury sketched in much of the 'big picture' information about how the different parts of an extremely diverse and confusing system fit together. He also provided much information about his own research interest, floodplain billabongs.

Sue Briggs (NSW National Parks and Wildlife Service based at CSIRO Wildlife and Ecology) from Canberra, commented at length, and most helpfully, on various drafts of this publication. Sue's contributions are scattered throughout the text, but she had particular input into the sections about planigales and dunnarts, lakebed cropping, waterbirds, floodplain management, and wetland degradation in the northern portion of the Murray-Darling Basin.

Russell Shiel, John Hawking and **Daryl Nielsen** from Albury all contributed some of their considerable knowledge about the natural history and ecological functions of invertebrate animals on floodplains. **Paul Bailey** and **Paul Boon** (Victoria University of Technology) from Melbourne supplied much of the background information about the role of bacteria in floodplain ecosystems.

Arthur Georges from Canberra, **Paul Humphries** from Albury, **Peter Gehrke** from Sydney and **Paul Brown** from Narrandera all helped detail the life histories, problems and the current level of understanding of floodplain vertebrates.

Rod Oliver and **Judy Frankenberg** from Albury provided much of the information about native and exotic vascular plants and algae.

Greg Raisin from Albury, **Ralph Ogden** (Australian National University) from Canberra and **Helen Glazebrook** (Charles Sturt University) from Albury all offered insights into the complex biological interactions between rivers & floodplains.

Anthony Scott (CSIRO Land and Water) from Canberra, **Tom Grant** (University of New South Wales) from Sydney and **David Goldney** (Charles Sturt University) from Bathurst all contributed information about platypuses.

Will Osborne from Canberra assisted with the section on frogs.

Darren Baldwin from Albury described the complex chemistry of floodplains and **Martin Thoms** from Canberra commented on the geomorphological processes at work in the Murray-Darling Basin. **Stuart Bunn** (Griffith University) from Brisbane offered helpful advice on many issues.

Tony Jakeman (Australian National University) from Canberra, **Garth Watson** and **Vladimir Matveev** from Albury, and **Tony Sharley** (Primary Industries South Australia) from Loxton all assisted in minor ways.

Karen Markwort from Canberra gave invaluable practical backup, especially overseeing the feedback process and organising the review workshops, while **Estelle Oliver** from Albury assisted with library research.

The author also wishes to thank the many others who helped by answering telephone queries, forwarding papers, suggesting avenues of research or generously offering snippets of useful information.

David Mussared
Author

Participants in scientific review workshops:

Albury, Tuesday, July 9

Professor Peter Cullen
Dr Sue Briggs
Dr Terry Hillman
Dr Russell Shiel
Greg Raisin
Mike Copland
Karen Markwort

Canberra, Monday, August 5

Dr Stuart Bunn
Dr Terry Hillman
Judy Frankenberg
Dr Russell Shiel
Ralph Ogden
Dr Martin Thoms
Karen Markwort

GREAT CRESTED GREBE

NOTES ON STYLE

In **Living on Floodplains** I have used common species names wherever possible, and have avoided the use of Linnaean ("Latin" or "scientific") names. An index of common and scientific names is included at the end of the publication.

Numbered references to endnotes are given in brackets throughout the text.

Throughout the text I have used the terms "pre-European" and "European" to describe Australia before and after English settlement at Sydney Cove in 1788. Of course Australia is not a European country, and the terms are intended only as convenient shorthand references.

CONTENTS

CONTENTS—CONTINUED

AUSTRALIA'S RING-BARKED RIVERS

This publication is based on a single scientific insight: that floodplains are as important to rivers as bark is to trees. Stripped of their floodplains, rivers will slowly die — just as ring-barked trees do. It seems a simple idea, but its implications for the way that we manage Australia's inland rivers are profound.

Most of the processes that drive life in Australia's inland rivers happen around their edges. Just as the sap flows through the outermost ring of a tree, not through its centre, the lifeblood of a river ebbs and flows on its floodplain. The vegetation growing there isn't mere decoration; it is a river's roots and leaves.

OVERVIEW

The billabongs, intermittent lakes and swamps that slowly shrink under the sun between floods aren't just convenient watering holes; they are a river's tubers and seedpods.

A floodplain is that area of relatively flat land covered by water during a major flood. It is built, layer upon layer, of nutrient-rich sediments deposited by the river during floods.

Floodplain waters contain at least 100 times more species than do river channels, and there is growing evidence that many, if not all, of the species that live in rivers depend in some way on floodplains. Floodplains are nature's water treatment works, removing vast quantities of pollutants from inland river waters. They also provide rivers with the building blocks of life, which are used by everything from bacteria to fish.

Yet for the past 150 or so years floodplains have been progressively alienated from their parent rivers, and have been developed for agriculture, recreation and industry. Floodplains have been extensively grazed, and frequently cleared for agriculture and other purposes. They have been invaded by feral animals and weeds, in many places affected by rising salinity, and subjected to vastly accelerated rates of erosion and sedimentation. The natural flow of water across them has been diverted for other purposes.

Most of the water which once flowed through the Murray-Darling system has now been co-opted for human use, and little is left to give floodplains the frequent wetting they need to thrive. The River Murray, whose natural flow is by far the lowest of all the world's great rivers, now disgorges to the sea less than 25 percent of the water it did a century ago. Floodplains that were once flooded three or four years out of five are often now only wetted once in 10 or 12 years. Some have not received a dousing in two decades. Equally problematic, large areas of floodplain which once dried out every year are now permanently flooded.

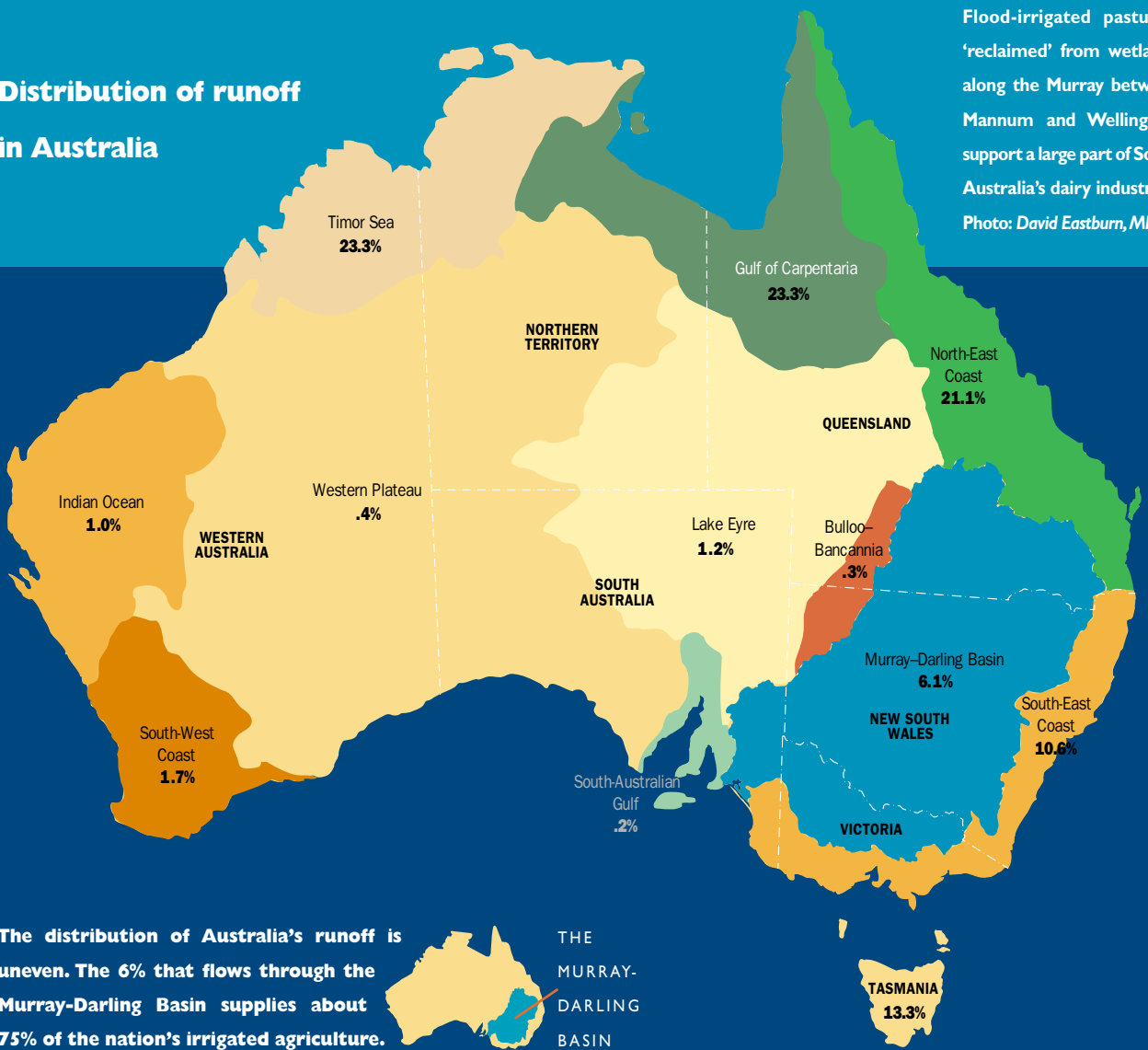
Inland floodplain ecology in Australia is a new field, and a concerted research effort has really only been under way for the past 10 or 15 years. Most research has so far concentrated on the Murray-Darling Basin, and that region is therefore the focus of this publication. However, the ecological processes described are probably common to most inland floodplain streams in southern Australia. The tropical floodplains of northern Australia also share some similarities, but are really a separate field of study. Coastal floodplain rivers, and their estuarine regions, are also beyond the scope of this work.

Although many aspects of the Darling River system are similar to the Murray and its southern tributaries, the Darling is a much more variable system. It has occasional summer floods instead of regular winter ones, and for most of its length it runs through deeply incised channels without the wide floodplains characteristic of southern rivers. Coolabahs grow along its banks instead of river red gums and black box trees. However, the Darling is linked to the Murray by much more than just the two rivers' confluence at Wentworth: they also share many of the same species, and many of the same problems. Therefore, in the chapters that follow, some aspects of the Darling system have been included to provide a more complete picture.

It is hard to overstate the importance of floodplain rivers to modern Australia. The Murray-Darling Basin alone, which makes up about a seventh of Australia's land area, is home to 1.8 million people, and to about 40 percent of the nation's agricultural production — including 75 percent of its irrigation. That 75 percent depends on the Basin's mere six percent share of Australia's total available surface water. Most of the rainfall that feeds Basin rivers falls on a very small area — some 40 percent of the River Murray's water comes from less than two percent of its catchment — and many Murray-Darling rivers flow for most of their length through arid and semi-arid plains.

Flood-irrigated pastures, 'reclaimed' from wetlands along the Murray between Mannum and Wellington, support a large part of South Australia's dairy industry.
Photo: *David Eastburn, MDBC*

Distribution of runoff in Australia



The distribution of Australia's runoff is uneven. The 6% that flows through the Murray-Darling Basin supplies about 75% of the nation's irrigated agriculture.

THE MURRAY-DARLING BASIN

The continental climate, which delivers water to their catchments, is perhaps the most variable and unpredictable in the world.

For all that, the Murray-Darling Basin is an unusually wet drainage system by Australian standards. Perhaps 95 percent of the time its catchment sheds enough water under natural conditions for some flow to reach the sea. In most of Australia's drainage basins, the sun evaporates more water each year than falls as rain. There are few of the great, permanent freshwater lakes that characterise other continents. Australia's lakes are dry clay or salt pans, filled occasionally by floods. Floodplain billabongs and waterways, for all their humble stature, are Australia's lakes. Their tannin-stained waters contain a significant share of the world's freshwater species. And those species, however small, are as peculiar to Australia — and arguably as important to the world — as are kangaroos and koalas.

Australia's river systems, and some of the species they harbour, are extremely ancient compared with rivers and their inhabitants elsewhere in the world. The Murray Basin's drainage pattern has remained almost unchanged for some 60 million years, and parts of the Darling Basin for even longer. Typically, south-eastern Australia's inland rivers rise as fast-flowing upland streams in the high rainfall watershed of the Great Dividing Range. As they come off the slopes and reach the flat landscape of the Basin they change. Water, which tumbles from the mountains in just a couple of days, can take many weeks, or even months, to cross the plains.

What happens along the way, as the rivers wind through a maze of anabranches and wetlands, is more important to river life than what is fed in upstream. In one sense floodplain rivers are more like very long shorelines than flowing streams. Their rising and falling floods wash over the freshwater equivalents of estuaries, seagrass beds, mangroves and all the other cleansing and life-supporting components of the seaside littoral zone. It is precisely this area of the river system which has been most changed by human activities.

The most recent human impact on floodplains is river regulation, which has compounded many existing problems and created some new ones. Throughout the 20th century, inland rivers have been dammed and diverted, initially to make them navigable but increasingly to supply water for irrigation. The waters of some rivers are now fully committed to irrigation, and floodplains have had to depend almost entirely on so-called 'surplus' flows for their water supply.

Under natural conditions in south-eastern Australia, floodwater fills river channels and spills out over the floodplains during winter and spring, and flow shrinks to a trickle in summer and autumn. Under regulated flow, upstream water storages fill during winter and spring, preventing flooding downstream. In summer and autumn the stored water is released as needed, converting naturally low-flowing summer rivers into bank-full conduits for supplying irrigation water.

Until now, irrigation has almost always been given top priority when allocating water, while the environment has been granted only what is left. However, scientists now say that to bring rivers back to health, water managers need to reverse the 'onus of proof': that rivers must first be given the water they need, and irrigators any that is surplus. Until that change is made Australians will be running down the capital of the river system, not living on its interest.

The chapters that follow can be roughly divided into four general sections. Chapters 2-7 describe the ecological processes at work on inland floodplains; Chapters 8-10 give a brief sketch of some of the native species which inhabit them; Chapters 11-15 describe how humans have altered floodplains over the past two centuries; and Chapters 16-19 suggest ways to better-manage floodplains.

Irrigating oranges using under-tree sprinklers. This is an efficient use of water as applications can be carefully controlled and evaporation and wind drift are greatly reduced. Photos: *David Eastburn, MDBC*

Irrigated vineyards and citrus blocks near Mildura in the Sunraysia region of Victoria.