Regional Review of
Wetland Management Issues

Western Australia (except Kimberley) and Central Australia

Occasional Paper 02/97

National Wetlands R&D Program

Land & Water Resources Research & Development Corporation

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Regional review of wetland management issues

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J. A. Davis and R. H. Froend

Environment Australia
Biodiversity Group

Land & Water Resources Research & Development Corporation

Authors:

J. A. Davis—Biological and Environmental Sciences, Murdoch University, Murdoch, WA 6150;
and R. H. Froend—Department of Environmental Management, Edith Cowan University,
Joondalup Campus, Joondalup Drive, Joondalup, WA 6027

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Land and Water Resources Research and Development Corporation
GPO Box 2182
Canberra ACT 2601
Telephone (02) 6257 3379 Facsimile (02) 6257 3420
E-mail public@lwrrdc.gov.au
HomePage www.lwrrdc.gov.au

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Introduction

This review, as part of the scoping review (see LWRRDC Occasional Paper 01/97) for a National Wetlands R&D Program, covers regional issues for most of Western Australia (except the Kimberley, see Finlayson *et al.* in LWRRDC Occasional Paper 03/97) and Central Australia. Priority areas in WA are the high-rainfall zone wetlands, the southern coast wetlands, the Wheatbelt, the Swan Coastal Plain and the Pilbara.

This publication outlines the current knowledge of wetland resources within the specified WA region and then identifies key current issues in wetland management. Information on the current knowledge of the region's wetland resources has been sourced from a significant number of recent publications published by State government agencies and academic institutions. Substantial advancements have been made in the areas of wetland mapping and evaluation, ecological research, environmental water requirements, wetland classification, and wetland hydrology research.

Identification of the key issues in management of wetlands within the region was completed by reviewing issues outlined in the draft State Wetland Conservation Policy and by canvassing the opinions of 30 wetland researchers and managers.

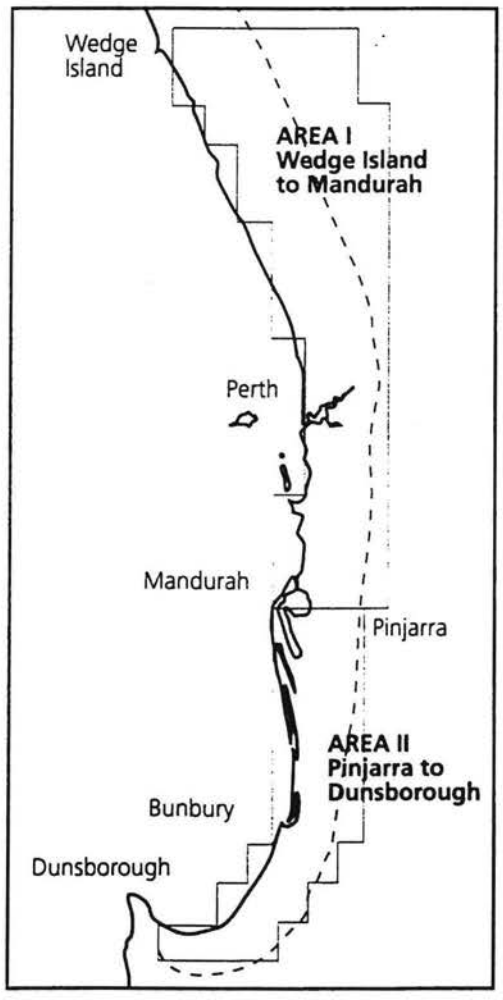
The wetland types included in this study are predominantly lentic but consideration has also be given to key estuarine and riverine systems where particular issues have not been addressed by other wetland policy and management initiatives.

Current knowledge of wetland resources within the region

Western Australia

Western Australia stretches over 21 degrees of latitude, from regions in the south, where heavy rainfall occurs mainly in the winter months, to tropical regions dominated by summer rainfall. The diversity of the State's wetlands is correspondingly large. Nevertheless, much of the State (40%) is arid, with erratic and low rainfall (less than 250mm annually). These factors strongly influence the occurrence and diversity of the State's wetlands.

Significant concentrations of wetlands occur on the Swan Coastal Plain between Wedge Island (160km north of Perth) and Dunsborough, near-coastal areas along the south-west and southern coastline of WA, and the Kimberley (covered in LWRRDC Occasional Paper 03/97 'National Wetlands R&D Program: Regional Review of Wetland Management Issues: Wet-Dry Tropics of Northern Australia').



The Swan Coastal Plain is the only area in WA in which comprehensive wetland mapping and evaluations have been completed. Since European settlement 70–80% of wetlands on the Swan Coastal Plain have been lost through urban, industrial and agricultural development. More than a quarter of the Swan Coastal Plain land area between Wedge Island and Dunsborough is wetland. More than three quarters of the resource is seasonally waterlogged flats or basins. In almost all cases, these wetlands are interconnected with other wetlands, particularly rivers, creeks and artificial channels, providing an extensive network and a great variety of habitats. Only 17% of all the basin and flat wetlands in the Wedge Island to Mandurah area remain fully vegetated with mainly native species. An additional 45% of the resource is more than 50% vegetated. Only 48% of rivers and 33% of creeks support more than half their original vegetation. Recent geomorphic wetland mapping and classification at a scale of 1:25,000 provides the most accurate and comprehensive description of wetland extent and types available for the Swan Coastal Plain. A simple geographic information system has been built to incorporate the accurate boundaries of the Swan Coastal Plain's 10,000 basin and flat wetlands, 6,400km of rivers and creeks, and 4,700km of artificial channels

Natural wetlands have been classified as one of seven basic types based on water regime and cross-sectional shape, and additionally two artificial wetlands types have been categorised.

Basin wetlands

- dampland = seasonally waterlogged basin
- sumpland = seasonally inundated basin
- lake = permanently inundated basin
- artificial basins (eg. dams, reservoirs)

Flat wetlands

- floodplain = seasonally inundated flat
- palusplain = seasonally waterlogged flat

Channel wetlands

- river = permanently inundated channel
- creek = seasonally inundated channel
- artificial channels (eg. open drains)

Wetlands of the Wedge Island to Dunsborough Area1

	Wetlands Type	Wetlands Areas		Number of Basin Wetlands		Length of Channel Wetlands	
		ha	%	No	%	km	%
Basins	Lake	14,100	4	200	2	—	—
	Sumpland	34,339	10	4,879	50	—	—
	Dampland	31,370	9	3,924	41	—	—
	Art. Basin[2]	606	<1	689	7	—	—
Flats	Floodplain	9,543	3	—	—	—	—
	Palusplain	241,595	66	—	—	—	—
	Paluslope	377	<1	—	—	—	—
	River[3]	1,074	<1	—	—	837	
Channels	Creek	—	—	—	—	5,796	
	Art. Channel	—	—	—	—	4,742	
Estuary	Waterbody	19,382	5	—	—	—	—
	Peripheral	9,867	2	—	—	—	—
TOTAL		362,253	100	9,692	100	11,375	

1. Statistics for basin, flat and channel wetlands of the Wedge Island to Dunsborough area.
2. Artificial basins of the Pinjarra to Dunsborough area excluded.
3. River areas exclude river segments less than 50 metres.

Almost all basin and flat wetlands of the Wedge Island to Mandurah area have been evaluated for condition, wetlands benefits and values. Almost all basin and flat wetlands of the Wedge Island to Mandurah area have had at least some of their values described. Major regional studies have identified some of the outstanding values that many of the Swan Coastal Plain wetlands have for recreational use, educational use, or environmental, historical or Aboriginal significance. These studies include the *Conservation Reserves for the Darling System* by the then Department of Conservation and Environment in 1983 and more recent wetlands studies contributing to '*Safeguarding Our Water Resources: Perth–Bunbury Draft Regional Allocation Plan*' by the Water Authority of Western Australia and the Western Australian Water Resources Council in 1991.

A further 1,630 wetlands in the Moore River to Mandurah area have been evaluated based on (i) a survey of wetland naturalness of discrete basins and flats (percentage of wetlands undisturbed) and (ii) mapping of the extent of vegetation on extensive basins and flats.

Assessments of more than 60% of the channel wetlands between Gingin and Mandurah have also been completed and the extent of clearing and modification to the area's rivers and creeks quantified. Artificial channels support very little native vegetation, with only 4% of these wetlands having a riparian zone which is more than 50% vegetated. Rivers, creeks and artificial channels are almost always enveloped by palusplain or floodplain, the vast majority of which have been cleared. Only 6% of palusplain and 22% of floodplain in the Gingin to Mandurah area remains vegetated.

No systematic study of wetlands has been undertaken in WA other than in the Swan Coastal Plain and the Pilbara, but inference and anecdotal information indicate significant levels of wetland loss and degradation elsewhere. In agricultural areas, wetlands have been drained, cleared and cultivated for summer pasture or cropping, with many being affected by rising saline groundwater, an almost complete loss of wetland function, or invading plant species. Within the Wheatbelt of WA, very few near-pristine freshwater and naturally-saline wetlands remain, with most being affected by rising water levels, secondary salinity and physical disturbance. Research on wetland ecology and impacts of land use has been completed for very few Wheatbelt wetlands.

Wetlands in the Murchison, Pilbara and Southern Kimberley have adapted to irregular inflows of water

from cyclonic rainfall. They are, however, sensitive to continuing environmental changes. Many wetlands in these regions have been degraded by pastoral activities, mining and recreation and, combined with their inherent fragility, there are likely to be only a few pristine wetlands remaining in these regions. In isolated areas of the north and north-west Kimberley, and other areas that are sparsely populated, many virtually pristine wetlands still exist.

Mapping and evaluation of all south-west and southern coast wetlands has now commenced, following similar methods used for the Swan Coastal Plain studies. Research on aspects of wetlands ecology, biodiversity, hydrology and management is increasing in the lower south west region and southern coast, however significant progress is yet to be made.

Much of the published comprehensive research on wetlands in WA has been on features of Swan Coastal Plain and Darling Range wetlands. This is expected due to the significant number and diversity of wetlands, and the extensive nature of land development and diversity of land uses on the Coastal Plain. A comprehensive research program has been undertaken over the last decade to evaluate and classify wetlands on the Coastal Plain, and to understand the interdependency between wetland environmental values and the water resources that support them. On the basis of this and other research, Environmental Protection Regulations have been implemented to protect specified lakes on the Coastal Plain from effluent, mining, groundwater drawdown, drainage and filling.

Wetland inventory data is included in a Wetland Atlas and more detailed information is included in Wetland and Natural Resources Map Folios which contain wetland boundary information with preliminary wetland evaluations for over 90 map sheets of the Moore River to Mandurah area. The Folio Maps have been produced at a scale of 1:25,000 for use with other available maps and have been distributed to Local Government Authorities and wetland education centres.

Central Australia

The central ranges of central Australia, including the MacDonnell, James, Krichauff, and George Gill Ranges, are dominant landscape features and contain a diverse range of waterbodies including permanent groundwater-fed seeps ('relict streams'), deep river gorges, shallow semi-permanent river wetlands, and temporary and ephemeral rock-pools and claypans. Many of the wetlands and river pools are associated with the Finke River and its tributaries. The region is arid, the climate is characterised by extreme diel and seasonal temperature differences, the average rainfall is 250mm per annum and annual total evaporation is in the order of 3,200mm. The extreme aridity of the region has resulted in the common perception that it contains few water-bodies. Certainly, permanently flowing rivers and large bodies of standing waters do not occur here, but the aquatic ecosystems that are present are an important focus for both nature conservation and tourism within the region.

Current issues in wetland management

Water regime

Wetland water requirements

Establishment of wetland water regime criteria for management and protection of wetland values is of critical importance in areas of the region where land use conflicts with wetland conservation. Areas of particular importance are the Swan Coastal Plain, Lake Muir Wetlands Complex, Millstream in the Pilbara and the south coast wetlands. Conflict between abstraction of groundwater and wetlands water requirements is an issue of increasing importance in Central Australia. The advent of ecotourism is placing increasing pressure on arid zone water supplies.

Development of water requirement criteria for different plant community types is needed. Substantial information exists for emergent macrophytes, however, there is a critical lack of information on tree and shrub dominated wetland plant communities and vegetated damplands. Emphasis should be placed on understanding the water requirements of long-lived species with episodic recruitment patterns and communities associated with damplands. There is an urgent need to use quantitative data of this kind for developing criteria for the management of groundwater use, drainage and floodplains, catchment land use, and protection of threatened plant communities.

Engineering solutions to rehabilitation or protection of wetlands

Hydrological conditions adverse to the conservation values of wetlands can be controlled by employing various 'hard' techniques in manipulating water regime and water quality. Guidelines are required for use of artificial maintenance of wetland water regimes to cater for environmental water requirements under changing conditions.

Wetland hydrology

There is an increasing need to relate hydrology to the ecology of wetlands. There is an urgent need for quantitative information on the hydrology of damplands (perched versus connected systems), Wheatbelt ephemeral wetland hydrology and impacts of agricultural drainage.

Decomposition and nutrient cycling in wetlands

There is a lack of knowledge on the impact of changing water regime on decomposition and nutrient cycling in wetlands. The importance of seasonal drying of wetlands in sediment nutrient retention needs to be assessed.

Water quality

Nutrient enrichment

Many wetlands on the Swan Coastal Plain, and in the Blackwood and Avon River catchments and wetlands near the southern coast, are excessively nutrient enriched because they receive nutrients in groundwater and surface water inflows arising from various human activities including agriculture, horticulture and urban development. The rapidly leaching sands of the coastal region result in the nutrients applied to catchments being rapidly transferred to wetlands.

The consequences of nutrient enrichment are well documented and include the development of nuisance blooms of blue-green algae, odours and anoxic conditions. Waterfowl, fish and large invertebrates may suffer direct lethal effects due to both algal toxicity and periods of reduced oxygen availability. Waterfowl deaths may also occur as a result of outbreaks of botulism, caused by the bacterium, *Clostridium botulinum*, and promoted by anoxic conditions. Outbreaks of nuisance midges at Perth wetlands are also a direct consequence of the development, and subsequent decay, of large algal blooms. The sources of nutrient enrichment and reasons for the occurrence of nuisance algal blooms are fairly well understood with respect to wetlands on the Swan Coastal Plain. Management issues include approaches to controlling excessive nutrient inputs and preventing development of nuisance algal blooms. The management of eutrophic wetlands and the protection of oligotrophic and mesotrophic wetlands are ongoing issues of management concern. The identification of natural trophic levels will assist with the formulation of policy regarding unacceptable levels of enrichment.

The wetlands of central Australia, in particular the wetlands of the Finke river and the gorges and river

pools within the West MacDonnell Ranges display varying degrees of nutrient enrichment due to pastoral activities within their catchments and their use by feral animals (eg. horses, camels). Fish kills are believed to be the result of both low winter temperatures and the release of anoxic water into the epilimnion during overturn in deeper waterbodies. Excessive growth of macrophytes such as *Myriophyllum* (possibly an introduced species) and *Typha*, is believed to be a consequence of nutrient enrichment arising from pastoral activities.

Salinisation

Many wetlands within the wheatbelt region of WA have been adversely affected by salinisation arising from the wide-scale clearing of native vegetation and the planting of shallow rooted annual crops within their catchments. The consequences of salinisation with respect to conservation are profound and have resulted in the loss of much of the flora and fauna intolerant of elevated salinities, although little documentation exists of the aquatic species present prior to the onset of salinisation. Management issues include the prevention of secondary salinisation of rural wetlands and reversal of the process of salinisation.

Little is known about the changes in fauna and flora community composition and structure in response to increasing water and soil salinity. The impact of decreasing salinity and changes in water regime due to remedial measures needs to be assessed for wetlands with a long history of salinisation.

Acidification

Increasing acidification is not currently a problem in wetlands within WA or central Australia; however the potential for acidification of waterbodies within a region of acid sulphate soils in south-west WA needs further determination and surveillance.

Colour

Many wetlands in south-western Australia are moderately to highly coloured by tannins (fulvic and humic acids). Concern is expressed that the clearing of vegetation from catchments may result in a decrease in colour. This may occur over time-scales of 50 years or more and so be a problem unrecognised by current wetlands managers. The origin, transport and fate of dissolved organic material in coloured wetlands needs elucidation and the impact of clearing on coloured wetlands must be determined.

Pesticides

Wetlands within the urban region of Perth, WA, are contaminated with both pesticides and heavy metals (Davis et al., 1993). Organochlorine residues have been detected within wetlands sediments and are mainly the result of programs for the control of Argentine ants (undertaken from the mid 1950s to 1986) and ongoing treatments for termite control within urban areas. Midge control programs result in the regular application of an organophosphate pesticide (Abate-temephos) to eutrophic wetlands within urban areas. Abate is also applied to wetlands for mosquito control. Mosquitoes are currently more of a problem within the coastal salt-marshes rather than the large, open wetlands of the Perth region. However increasing concerns regarding Ross River virus and expanding urbanisation has meant that some wetlands are now also treated with Abate for mosquito control.

Heavy metals

Heavy metals, in particular, cadmium, arsenic and zinc have been detected in the sediments of some Perth wetlands and appear to be the result of the discharge of industrial wastes. A Perth electroplating company was fined $15,000, and the company director gaoled, in February 1995, for the discharge of toxic waste into an adjacent wetland. Lund *et al.* (1989) found that an urban wetland, Lake Monger, was contaminated with lead from freeway run-off, but contamination of a rural wetland, Lake Wannamal, from duck-shooting was minimal, probably because alkaline, rather than acidic conditions existed at the lake. Heavy metal contamination in some Perth wetlands has also been attributed to leaching of contaminants from adjacent (and now disused) land-fill sites.

The fate of heavy metals and pesticides within wetland ecosystems and the extent of biomagnification and bioaccumulation within wetlands food chains must be more clearly elucidated.

Biodiversity and conservation

Loss of wetlands

Halse (1988) estimated that 70% of the original wetlands of the Swan Coastal Plain have been drained, filled-in or otherwise lost as a consequence of land clearing for agriculture and urban development during the last 100 years. Although it is more difficult to estimate the number of wetlands lost elsewhere in

the south-west of Western Australia as a result of land use activities, the total figure may be as high as 50% for coastal regions. Estimates of loss of wetlands in the arid and semi-arid regions of WA and central Australia are very difficult to provide but may be low because of less intensive urban development or agricultural activity within these regions. There may be a net gain as the result of the presence of created waterbodies, for example the sewerage ponds in Alice Springs which are now considered to be valuable waterfowl habitats.

Conservation of wetland plant and animal communities

Emphasis must be placed on the maintenance of species diversity with respect to both plants and animals. The links between plant diversity and animal diversity need to be clearly established. Inventories of plant and animal communities and recognition of threatened, vulnerable and rare communities are urgently needed for many wetland systems, particularly those remote to population centres. Changes in water regimes, water quality and frequency of disturbance have resulted in the loss or degradation of wetland vegetation, changing significantly the trophic and structural foundation of wetland habitats. The littoral vegetation of rural wetlands has received little attention compared with their urban equivalents. Emphasis should be placed on maintenance of species diversity, weed invasion, recruitment requirements, inventories of plant communities and endangered flora.

Grazing

The impact of livestock grazing and usage of wetland systems and approaches to wetland conservation within rangelands are both important management issues in rural WA and central Australia. The impact of cattle and feral animals on central Australian waterbodies is an issue of major concern. Monitoring of improvement after the removal of cattle and feral animals is an important management issue.

Fire

Peat swamps in the extreme south-west of WA are subjected to burning as part of a fire management regime conducted by CALM. The effect of fire on aquatic processes and flora and fauna is not known, although some disturbance of nutrient regimes obviously occurs. The effects of prescribed burning regimes must be determined and the importance of episodic disturbance on wetland plant community dynamics further investigated.

Exotic plants and animals

Introduced fauna in the wetlands of the Swan Coastal Plain include the mosquito fish, carp and goldfish. Mosquito fish are widespread and abundant in a large number of wetlands and may indirectly result in poorer water quality through predation of herbivorous zooplankton such as *Daphnia*. The impact of introduced fish on water quality and the displacement of native species are both important management issues. Introduced invertebrates in the wetlands of south-western WA include the gastropods, *Pseudocinnea columella* (a host of the sheep liver fluke), *Helisoma* sp. and *Physa acuta*. The yabby, *Cherax destructor*, is widespread in many waterbodies in south-western Australia, as a result of active stocking programs. The displacement of native species, particularly the marron, is of concern.

Comparison of recent records of fish and invertebrates in central Australian waterbodies with those of the Horn Expedition, undertaken more than 100 years earlier in 1894, reveal no apparent extinctions or introductions. Exotic fish are not present in central Australian waterbodies and ongoing efforts to ensure that they do not become established are of major importance. *Cherax destructor*, is believed to occur naturally in central Australia but has been actively translocated to waterbodies without yabbies within the region. Degradation and erosion of banks, caused by introduced yabbies, in waterbodies of special conservation significance, eg. Stokes Creek in the George Gill Range, is an issue of concern.

Weed invasions are a major problem at many wetlands within both urban and rural regions. The spread of exotic plants at the Millstream wetlands in the Pilbara region of WA is of particular concern. Invasive exotic species at Millstream include the Indian water fern (*Ceratopteris thalictroides*), the giant water lily (*Nymphaea gigantea*), the Date palm (*Phoenix dactylifera*) and the Cotton palm (*Washingtonia robusta*). Ecologically sensitive approaches to the control of wetland weed invasions are required.

Wetland and Waterbird Conventions/Agreements

At present the conservation and wise use of wetlands and waterbirds in Australia and the region is facilitated by a number of international conventions and bilateral agreements including the:

- Ramsar Convention;

- Japan–Australia Migratory Bird Agreement (JAMBA);
- China–Australia Migratory Bird Agreement (CAMBA); and
- Bonn Convention.

The aim of the JAMBA and CAMBA is to ensure that the governments involved recognise the value of migratory birds by protecting those birds that migrate between Australia, Japan and China. The East-Asian-Australasian Shorebirds Reserve Network is an international cooperative effort supported by both government agencies and non-government organisations. The aim of the Network is to provide a framework for regional shorebird conservation by building a network of both sites and people. Further investigation must be undertaken to resolve possible conflicts with the requirements and obligations of these agreements.

Buffer zones

General guidelines for the width of wetland buffer zones have been developed by Davies and Lane (1995) but the effectiveness of buffer zones at specific wetlands types within WA still requires determination. This is an issue of particular management concern where the rapid encroachment of urban areas on wetland ecosystems (eg. the outer Perth metropolitan region) is currently occurring. The issue of the criteria for effective buffers between agricultural and horticultural activities and wetlands must also be addressed. Development of guidelines based on ecological grounds for provision of 'buffers' between proposed developments, agriculture and wetlands, is needed.

Landuse impacts on wheatbelt wetlands

The status of WA Wheatbelt and south coast wetlands is poorly documented. The emphasis in the past has been on salinity impacts with little consideration of the role of nutrient enrichment. There is a need to document the processes of rural wetland decline to assist in the development of rehabilitation guidelines.

Social and Sectoral Issues

Government policy

The role and effectiveness of government policy (State and Commonwealth) in wetland protection requires further determination and examination.

Roles of conservation groups, community groups and local government

The roles of conservation groups, community groups and Local Government in wetland management and restoration are important and require consideration and guidance. The development of a cooperative approach to wetland management and R&D, involving State, Commonwealth and Local Governments, landholders, the private sector, conservation organisations and other interest groups is long overdue. Means by which ecological considerations can be incorporated into land use planning need investigation. Community education programs in wetland ecology and management are needed.

Tourism

The potential impacts of tourism on wetlands, particularly since the advent of ecotourism, need determination and appropriate management and monitoring protocols are required.

Aboriginal concerns

Although Aboriginal usage of wetland ecosystems has been documented in some areas, there is currently little aboriginal input into wetland management. Aboriginal concerns regarding wetlands, and mechanisms for Aboriginal input into wetland management, need to be addressed.

Nuisance and health issues—midges and mosquitoes

Environmentally sensitive approaches to both midge and mosquito control at wetlands are urgently needed. A particular need is to develop alternatives to the use of the organophosphate pesticide 'Abate'.

Monitoring and modelling

Wetlands of international significance

Identification of wetlands of international significance, not only on the basis of migratory waterbirds, but also habitat type, vegetation and heritage value is needed.

Documentation and mapping

Documentation and mapping of existing wetlands is required, in particular their distribution, attributes,

functions and uses. Priority areas include the lower south-west, southern coast and the Wheatbelt. Consideration should also be made for the northern half of the state. This information is required for land and water use planning procedures, recognition of wetlands and promotion of conservation on a catchment or regional basis. In central Australia, the waterbodies of the George Gill Range and the West Macdonnell Ranges are relatively well studied, while other areas, including the waterholes of the Finke River, the Krichauff Range (Palm Valley) and the Dulcie and Davenport Ranges, are less well known.

Monitoring programs

The need for long-term monitoring of key wetland ecosystems is overwhelming. Baseline physico-chemical and biological monitoring (macro-invertebrate) programs have been undertaken for wetlands on the Swan Coastal Plain but, with some exceptions, no ongoing programs exist. Baseline physico-chemical and biological data now exist for a number of central Australian water-bodies but a long term program is required. The need for community and volunteer monitoring programs similar to Ribbons of Blue and Waterwatch programs for streams and rivers is evident.

Similarly, a nationwide program, such as the National River Health Program (which is jointly supported by Environment Australia and LWRRDC, with the involvement of many water agencies) would be of benefit in guiding state and local agencies in wetland monitoring program development and techniques. The determination of key indicator species and family level indices are both approaches that warrant further investigation with respect to the use of macro-invertebrates for wetlands monitoring.

Approaches to determining change in ecological character and distinguishing natural ecological changes from human impacts are both areas of investigation that are vital to the better monitoring and management of wetland ecosystems.

Mapping, inventory and classification

Western Australia currently has a wetland classification system based on geomorphic characteristics which was developed for wetlands on the Swan Coastal Plain. There is a need however, to modify the system to emphasise the biological, and particularly the habitat differences and similarities between wetlands. Development and promotion of a single classification system incorporating these features is required. The mapping and documentation of existing wetlands, particularly their distribution, attributes, functions and uses, is a major priority for wetlands in the lower south-west, southern coast and Wheatbelt regions of WA. This information is required for land and water-use planning procedures, recognition of wetlands, and promotion of conservation on a catchment or regional basis.

Restoration and creation

Techniques for wetland creation

Development of practical guidelines for wetland creation and establishment of aquatic habitat are needed, including techniques for creating wetlands for different purposes eg. landscaping, replacement, industrial effluent, etc. Techniques and ecologically appropriate guidelines for the restoration of wetland ecosystems are urgently needed. The dynamic and resilient nature of many wetland systems must be better recognised as an attribute facilitating restoration.

Restoration of degraded urban and rural wetlands

Practical guidelines for the restoration of wetland habitat are needed. For example, wetland vegetation restoration, promotion of natural plant recruitment and the control of exotic plant species are factors which have received little attention. Restoring aquatic fauna and macrophyte diversity in degraded wetland are also important considerations.

Use of natural and artificial wetlands for nutrient stripping

There needs to be a holistic approach to developing efficient wetland design for stormwater drainage and incorporating artificial wetlands for nutrient removal. This can be achieved by testing the efficiency of different suites of design characteristics. The ability of natural wetlands to incorporate nutrients requires further determination.

Biomanipulation

The role of biomanipulation in the restoration of wetlands water quality needs further elucidation. In WA the most productive areas of research may lie in the investigation of the control of the mosquito fish as a means of increasing zooplankton herbivore biomass.

Regional priorities

Environmental water requirements

There is an urgent need for quantitative information on the environmental water requirements of dampland communities. This community type occurs throughout the Swan Coastal Plain and the remainder of the south-west of the state and is rapidly becoming the most threatened wetland habitat type in the state. Developing criteria for the management of groundwater use, surface water drainage, catchment development, and protection of threatened plant communities requires a greater understanding of the interrelationship between dampland habitat and hydrology. There is a critical lack of information on the water requirements of tree and shrub dominated perched aquifer damplands. Emphasis should be placed on understanding the dependence of long-lived species, with episodic recruitment patterns, on perched aquifers, and the spatial and temporal dynamics of these fragile systems. With increasing development of semi-rural catchments along the southern coast, the lower south-west and on the Swan Coastal Plain, there is an increasing need to relate changes in hydrology to the ecology of damplands. Similarly in Central Australia, there is a need for a better understanding of the role of groundwater in supporting wetland systems.

Control of nuisance insects

Development of environmentally sensitive approaches to the control of nuisance insects, in particular midges and mosquitoes, is needed to reduce the amount of pesticides currently being applied to wetlands systems. Current conflicts between health issues (ie. control of mosquitoes) and environmental objectives should be recognised and addressed.

Exotic flora and fauna

Better understanding is required of the roles and extent of invasion of exotic flora and fauna in wetland systems and environmentally sensitive approaches to eradication. Improved knowledge of the process of exotic species invasion is required in order to improve current management practices and develop appropriate and transferable guidelines.

Protocols for monitoring

Development of protocols for wetlands monitoring programs (including establishment of long term sites) and volunteer and community involvement is needed. The evaluation of the use of family-based indices in macroinvertebrate monitoring and use of indicator species with respect to eutrophication (using both algal and macroinvertebrate indicators) should be considered. Special consideration must be given to monitoring spatially and temporally dynamic systems, for example, wetlands in arid and semi-arid regions.

Animal and plant interactions

Greater understanding of the interactions between wetlands animals and plants is required for the protection and conservation of wetlands biodiversity. This knowledge would enable the identification of key ecosystem components which are essential to the maintenance of biodiversity. These elements can then be given priority for management and conservation.

Managing impacted wetlands

Development of methods for managing impacted wetlands, in particular eutrophic and saline systems and procedures for restoring water quality are needed.

Wetland resources

Better knowledge of wetlands resources within remote regions of WA and Central Australia are needed, particularly given the popularity of these systems with ecotourism.

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