the unique mound spring environment is demonstrated by the comprehensive monitoring and research program on mound spring ecology and the work to help protect this environment. The ongoing implementation of water conserving practices to augment those already in place reinforces this commitment.

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Landscape design for water conservation

"Xeriscape" is a sleek new word that represents a sensible old idea: Let the outdoor environment created echo the natural world of regions. This approach has come into its own in recent years with the emphasis given to such ideas as low-maintenance landscaping, natural landscaping, and the like. With Xeriscape landscaping, however, there is a new and compelling twist - the designing or redesigning of a landscape to eliminate some of the estimated fifty percent of domestic or residential water usage that goes into maintaining landscapes in Australia. That is, nearly half of the water employed for domestic use ends up on lawns or gardens, and approximately half of that amount is considered to be applied unnecessarily or wasted. Coined from the Greek word *xeros,* meaning "dry", and *landscape,* Xeriscape landscaping has come to mean "quality, water-efficient landscaping". The creation of a Xeriscape landscape involves a series of specific and interconnected steps, from planning to maintenance, which can result in an estimated twenty to eighty percent savings in landscape water usage. Xeriscape landscaping takes its cue from the natural world by emphasising the use of plants for landscapes which require only the amount of rainfall available in a specific region. It may take up to three years to wean a new or changed landscape to a minimum of applied water, but with careful planning, it is possible to reduce or completely eliminate the need for added water above natural precipitation. Xeriscape landscaping can mean anything from simply paying closer attention to an existing plant-scape's site-specitc water needs to designing a whole new landscape based on Xeriscape guidelines. This paper sets out to elaborate seven basic principles which are the cornerstone of good Xeriscape design. Successful landscaping for water conservation incorporates all seven principles; changing turf areas without altering watering regimes is considered counter productive, as is planting lower water-demanding plants without understanding how they need to be maintained in order to become established.

VENUE	SYMPOSIUM 11
ARTS BUILDING MURDOCH LECTURE THEATRE	BIOMONITORING OF WETLANDS: THE IDEAL BIOMONITORS

STEVENSON, R.J., PAN, Y., SWEETS, P.R. & VANDERBORG, M. Department of Biology, University of Louisville, Louisville, KY 40292, USA.

Algal community patterns in wetlands and their use as indicators of ecological conditions

Algal and water chemistry characterizations have been collected in over 100 wetlands in two geographic regions of the United States. The objectives of the project are to develop hypotheses about the dominant determinants of algal community structure in wetlands. Plankton and periphyton on macrophytes and in surface sediments were collected in *Nuphar* and *Typha* marshes, *Brasenia* ponds, and swamps dominated by *Salix* or *Cephalanthus*. Great variability in conductivity and TP was observed in the 35 Kentucky wetlands. Diatom-based inference models were developed for use as quantitative indicators of both conductivity and TP in Kentucky wetlands. Plankton communities predicted conductivity better than epiphyton, but epiphyton predicted TP better than plankton (no sediments were collected in Kentucky). Great variability in pH, DOC, total P and total N occurred among the 70 Michigan wetlands. Preliminary analysis of these algal and environmental data indicate a strong response of algal community composition to pH, nutrient gradients and DOC. These results indicate that water chemistry has predictable effects on algal communities in wetlands, despite the high variability in plant community structure among wetlands. Ongoing wetland paleolimnological studies in Michigan, which are parts of this project, will be introduced.

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Diatom assemblages - ideal biomonitors of secondary salinisation of wetlands

Aquatic organisms monitor their environment continually as they respond to changes in water quality. They integrate the effect of all physical and chemical characteristics of the surrounding water. While chemical data provide only limited information on water quality at a given time, biota provide an overview of river health. The benefits of adopting a biomonitoring system along with chemical monitoring are discussed. The conceptual basis of biomonitoring of rivers is explained with several examples. The presentation specifically deals with the techniques of using diatom assemblages to assess the health of rivers. In the fast flowing rivers and streams, phytoplankton seldom develop. However, periphyton and micro benthos are abundant. Diatoms constitute the vast majority of the periphyton and benthic algae. When the flow of streams and rivers are modified by human activities such as dam-building and landscaping, stagnant pools develop and phytoplankton blooms may occur. Eutrophication and salinization affect the composition of phytoplankton Sampling techniques data analysis and interpretations for the use of diatoms as biomonitors are briefly presented. Pollution indices, diversity indices and a variety of biotic indices could be derived from diatom data. Case histories of biomonitoring using diatoms are presented.

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Kooragang Wetland Rehabilitation Project: Information content in benthic invertebrate samples

Biological monitoring programs are used to measure change in rehabilitated wetlands, but the design of biomonitoring programs is frequently subjective and may lead to poor allocation of resources. The community to be sampled, sampling intensity and level of taxonomic identification may affect the cost and outcome of biomonitoring programs. Ordination analysis provides a powerful means of finding patterns within complex data sets consisting of abundances of a number of species collected at a number of locations. However, the "usefulness" of ordination output, or its ability to represent a data set, is frequently judged subjectively. In the context of biomonitoring, subjective assessment of analyses is not appropriate. To increase the usefulness of ordination in biomonitoring, standard methods should be developed. As a preliminary step toward development of standard methods, an approach is presented that determines the effect of sampling design on ordination output. The approach relies on a Monte Carlo method that compares results from actual data to results from scrambled data. In addition, ordination biplots resulting from different sampling designs are compared. Cost effectiveness, or information return for the effort invested in monitoring, is considered. Results of an invertebrate monitoring program of estuarine wetlands on Kooragang Island, New South Wales, Australia are used as an example.

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Biomonitoring of a wetland to assess response to pesticides entering via agricultural irrigation drainage

As part of studies investigating the fates and effects of pesticides in irrigation waters, we used biosurveys to examine impacts of tailwater. This involved sampling macroinvertebrates and small fishes in a semi-natural wetland used as a conduit for agricultural drainage to the Murrumbidgee River. Different sample sites in the upper, middle and lower parts of Euwarderry Lagoon were expected to vary in their exposure to pesticides as concentrations dissipated via movement through the wetland. Replicate samples were taken on a monthly basis over the irrigation season using sweep nets, sediment cores, bait traps and composite samples in plankton nets within water autosamplers. The community composition of these was examined for seasonal changes at the three wetland sites and compared with a control billabong that did not receive agricultural drainage. These patterns of biotic assemblages were also compared to the concentrations of 33 pesticides measured in concomitant water samples and to acute and chronic toxicity of these waters tested with a local cladoceran water flea.

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After the inundation: long-term changes in the fauna of Lake Pedder, Tasmania

Lake Pedder, in south-west Tasmania, was exceptional for its setting, its unique quartzitic sand beach and its fauna. Its high biological values were not appreciated until the grand scheme for flooding had become firmly entrenched in governmental policy. In the early 1970's saving the lake was the major campaign of the emerging Australian conservation movement. From 1975 to 1989 twelve sites around the Serpentine Impoundment ("Lake Pedder") were regularly sampled. Four species of endemic animals have disappeared and five species peculiar to the original lakes of Pedder and Edgar have vanished. Faunal abundance, dominated by the cased trichopteran *Notalina parkeri*, peaked in 1977 and has since then steadily declined. Since 1986, the widespread amphipod *Austrochiltonia australis* has become the dominant littoral animal. Recently restoration of the lake was mounted but without any success. A further sampling trip in 1996 has revealed a low faunal abundance and diversity. This latter condition appears to be the long-term prospect for the lake.

VENUE	SYMPOSIUM 12
ARTS BUILDING FOX LECTURE THEATRE	BIODIVERSITY AND CONSERVATION OF WETLANDS

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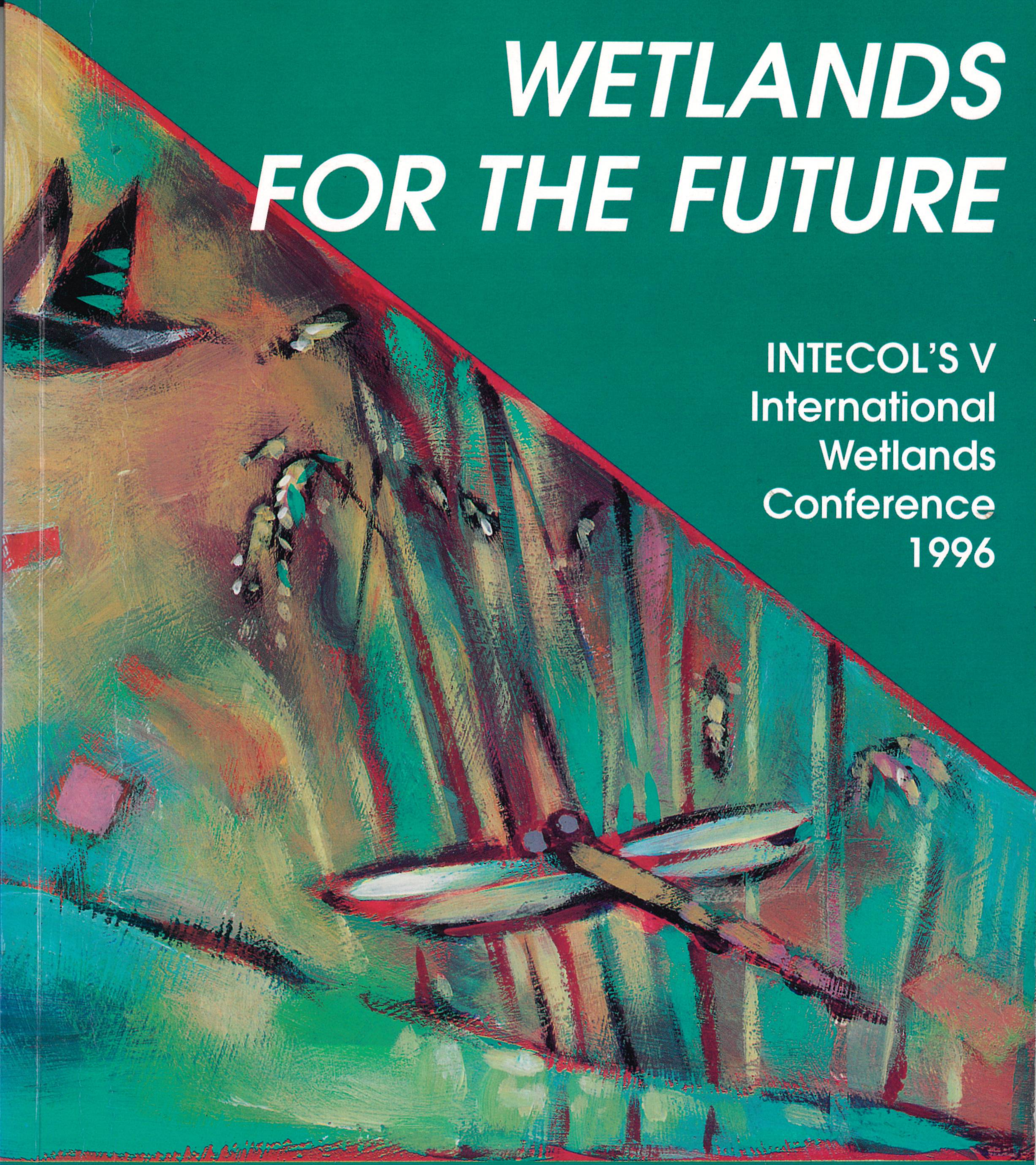
Biodiversity and wetlands conservation

Wetlands which include a wide spectrum of both freshwater and marine habitats, often transitional between upland and open water systems, cover only about 6% of the Earth's surface, but support directly or indirectly more than 20% of the total biodiversity. A large proportion of wetland biota is microscopic and among the most difficult to identify, and hence has remained poorly explored. Many wetlands such as the floodplain forests of the Amazon basin with more than 1000 species of trees alone or the peat swamps of Malaysia representing 25% of the flora are indeed "hot spots" of biodiversity. Wetlands together with the open water systems associated with them, are seriously threatened today by all kinds of anthropogenic activities, both in these systems and in their adjacent upland systems. The rapid

WETLANDS FOR THE FUTURE



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