RESEARCH

WHEATBELT BIOLOGICAL SURVEY

Greg Keighery

The survey has shown that the region is more diverse than documented, less well known than imagined but still under as many threats as believed.

Background

Dryland salinity was first recognised as a significant threat to agriculture in the Western Australian wheatbelt in the early twentieth century. However, it was not until the early 1970s that rising saline groundwaters were identified as a major threat to wetland biodiversity.

In 1996 the WA Government launched the Salinity Action Plan (SAP), a thirty-year plan to combat rising saline groundwater in the agricultural region of WA. Delivery of the plan was based on the property, catchment and State scales. The SAP recognised that the natural biodiversity of the south-west agricultural region was poorly documented and requested that CALM co-ordinate and undertake a biological survey in the region, with emphasis on low-lying areas that are vulnerable to salinity. This involved collaboration between scientists from CALM, WA Museum, University of WA and the University of Adelaide. Between 1997 and 2001 data was collected on the occurrence and status of a wide range of wetland and terrestrial organisms at over 1000 sites.

In order to have predictive value the survey needed to be site based, describing the physical and biological attributes of each sampling site. To support the SAP, there was a need for information that allowed predictive modeling of areas that have not been surveyed. This link between the physical and biological data is essential to provide a basis for predicting the presence of species, or species assemblages, beyond the actual sampling points. In addition, a site-based approach is essential to provide a basis for monitoring.

View north from Kokerbin Rock, Bruce Rock Shire. Photo: P. Hussey

The specified study area extended from the 600 mm annual rainfall isohyet inland to the eastern edge of land clearing, an area of approximately 25 million hectares. The study area is central to temperate south-western Australia, an area that is recognised internationally as a mega diverse area for flowering plants.

Overall, approximately 930 terrestrial quadrats were established and scored for vascular plants and ground-dwelling arachnids (spiders, scorpions, centipedes). Some other invertebrates (carabid beetles and millipedes) and small vertebrates (mammals, reptiles and frogs) were sampled at 304 sites. 232 wetlands were sampled for aquatic invertebrates, waterbirds and wetland associated plants. Diatoms were sampled in about a third of the wetlands, with a bias towards saline sites.

There has also been a high level of community involvement ranging from field days, seminars and structured surveys. For example approximately 200 sites have been established on private and shire lands by members of the Western Australian Wildflower Society, supported by CALM. As an outcome of the survey, Woodland Watch was established by WWF to help with the conservation of woodlands.

A principal output has been the publication of the data in print and CD (see ref). This is mostly highly technical and not for casual readers, but it ensures that the information gathered will be available for future comparison and research. Taxonomic outcomes of the survey are also being published for the vascular flora (six new species) and wetland invertebrates (25 new species). Many more await scientific description, including a new family of crustaceans.

Findings

The survey revealed so many interesting facts that it is difficult to highlight just a few. Despite extensive clearing and consequent fragmentation, the WA wheatbelt still retains most of its biological richness at the species level (except

continued on page 4

continued from page 3

RESEARCH

Salmon gum woodland, Depot Dam, Merredin
Photo: H. Adamson

for mammals), however, there has been extensive depletion of communities and of genetic variation within species. To continue to keep this, however, a major effort is required to combat the effects of fragmentation.

The best repositories of this biodiversity are the State reserve network of national parks and nature reserves, which are the largest and most intact remnants. However, many remaining freshwater wetlands are on private lands and most private remnants in good condition are of very high conservation value, often with unique combinations of biodiversity (communities, species or local variants). These areas are a vital component in the conservation of the biodiversity of the region.

Naturally saline areas are old and biodiverse in the wheatbelt, with numerous endemic plant and animal species, many previously unknown or undescribed. These areas require diverse hydrological cycles and are prone to increased flooding due to rising saline ground waters, leading to degradation.

Flora

The region has an estimated vascular plant flora of over 4000 species, of which at least 60% are restricted to the area. It is the centre of species diversity for many of the species-rich groups (*Acacia*, *Dryandra*, *Eucalyptus*, *Grevillea* and *Verticordia*) that characterise the south-west.

Of these 4000 species, over 1500 are found low in the landscape along valley floors. 850 are found only in fresh or naturally saline lowlands, which are directly threatened by rising ground water and salinity. Approximately half of these species (450 in total) are confined to the wheatbelt and are under threat of extinction by secondary salination. Several hundred other species found only in woodland sites in the wheatbelt, but not restricted to the wheatbelt, will be under threat of significant genetic erosion and population loss in the longer term.

Over 780 structural plant communities have been recognised across the wheatbelt, of which 200 are restricted to this area and 150 of these are threatened by salinity. Many of these are woodlands which, though now greatly fragmented, remain evocative of the area and are of considerable significance to our local and national heritage. The valley woodlands are under considerable threat from rising salinity and the wheatbelt will lose much of its local landscape character if they are not protected.

The survey discovered 16 previously unknown flowering plants and rediscovered three considered extinct.

It has long been established that Mt Lesueur (in the northern sandplains) and the Fitzgerald River / Stirling Range sandplains in the south are exceptionally species-rich. We have now demonstrated that wheatbelt woodlands are equally diverse, but in herbs, not shrubs. Species richness appears to be a common feature of the flora of south-west WA rather than a feature of only certain parts of it. As another example, the reserves of the Lake Muir–Unicup Recovery Catchment contain a vascular flora of almost 1000 species, considerably higher than that of Mount Lesueur.

Fauna

The survey has found much higher levels of biodiversity in ground dwelling invertebrates than previously suspected, eg previous estimates were of 200 spiders - we have now recorded over 750! Over 50% of these species are unnamed and many are restricted to the wheatbelt.

York gum woodland, grazed and ungrazed, Tammin
Photo: P. Hussey

continued on page 5

continued from page 4

RESEARCH

Approximately 25% of its small ground-dwelling vertebrates (mammals, reptiles and frogs) and at least 40% of the region's terrestrial invertebrates have distributions centred on the wheatbelt or are endemic to it.

A significant decline in the biodiversity of terrestrial invertebrates is apparent in secondarily saline areas (even partially affected), which have an average of 30% fewer species than their non-salinised counterparts. This loss is actually higher as localised specialists are replaced by 'weedy' generalist species.

Wetlands

The survey has recorded over 1,000 species of aquatic invertebrates, much higher than previously suspected. Again, over 50% of these species are unnamed. WA may be a world centre for biodiversity of these animals (especially micro-crustaceans) as well as for plants.

The species richness of aquatic invertebrates halves for each doubling of salinity levels in freshwater areas. About 250 invertebrate species present in the region are at risk of extinction from secondary salination. Nearly 70% of wetland birds could be lost from the wheatbelt if trends continue, mainly due to the loss of the fringing vegetation around wetlands that they need to breed.

Summary

While the Biological Survey Program has generated highly significant results, it is important to be realistic about what has been achieved. Following surveys and more specific studies carried out by the WA Museum, Universities, CSIRO and Fisheries and Wildlife in the 1960s and 1970s, there was a tendency to assume the wheatbelt was 'known'. However, we recorded over 1,000 species of wetland invertebrates and over 750 species of spiders, whereas, previous estimates suggested the region contained less than a quarter of this result. This project has shown how wrong the assumption was and despite vast gains under the current program, it has sampled only a small percentage of a highly variable landscape of mega-biodiversity.

At least 450 flowering plants and 400 invertebrate species are at risk of extinction as a direct result of salinity, compared to estimates before the survey that 11 species of flora were threatened and one was likely to disappear. In addition all remaining remnants of many valley floor wetland, shrubland and woodland communities could disappear because of salinisation.

Last but certainly not least, a major highlight of the survey was the unexpected discovery of the huge variety of wildflowers and the diverse, scenic, often beautiful landscapes that occur in the wheatbelt, yet which few West Australians seem to know about. This is another reason to keep publicising the values and threats to this special, world-class area.

Reference

Keighery, G.J., Halse, S.A., Harvey, M.S., McKenzie, N.L. (eds.) (2004). A biodiversity survey of the Western Australian agricultural zone. Records Western Australian Museum Supplement 67

Greg Keighery is Principal Research Scientist at CALM, Woodvale. He was Project Leader for the Wheatbelt Biological Survey.

How the wheatbelt has changed

This large ring-shaped mound with a depression in the centre on John and Dionna Pickford's property at Woodanilling was, within living memory, home to a colony of boodies.
Photo: Kathleen O'Brien