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BIODIVERSITY OF AN ECONOMIC HOTSPOT THE PILBARA BIOLOGICAL SURVEY

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The Pilbara region in north-western Australia is unequivocally Australia's most important region with respect to the economic wealth and prosperity of the nation. In 2001 the Pilbara contributed over \$105 billion to the Australian economy or over 15% of GDP. The Pilbara is the leading resources sector region in WA, accounting for 63% of the value of mineral and energy production in the State in 2007. Despite the global financial crisis which has slowed the resources boom juggernaut somewhat, the importance of the region to the State's and nation's economic wellbeing cannot be understated. This economic hotspot is driven by the mineral and petroleum wealth of the Pilbara, particularly the region's endowment in iron ore, precious metals, natural gas and conditions suitable for solar salt production.

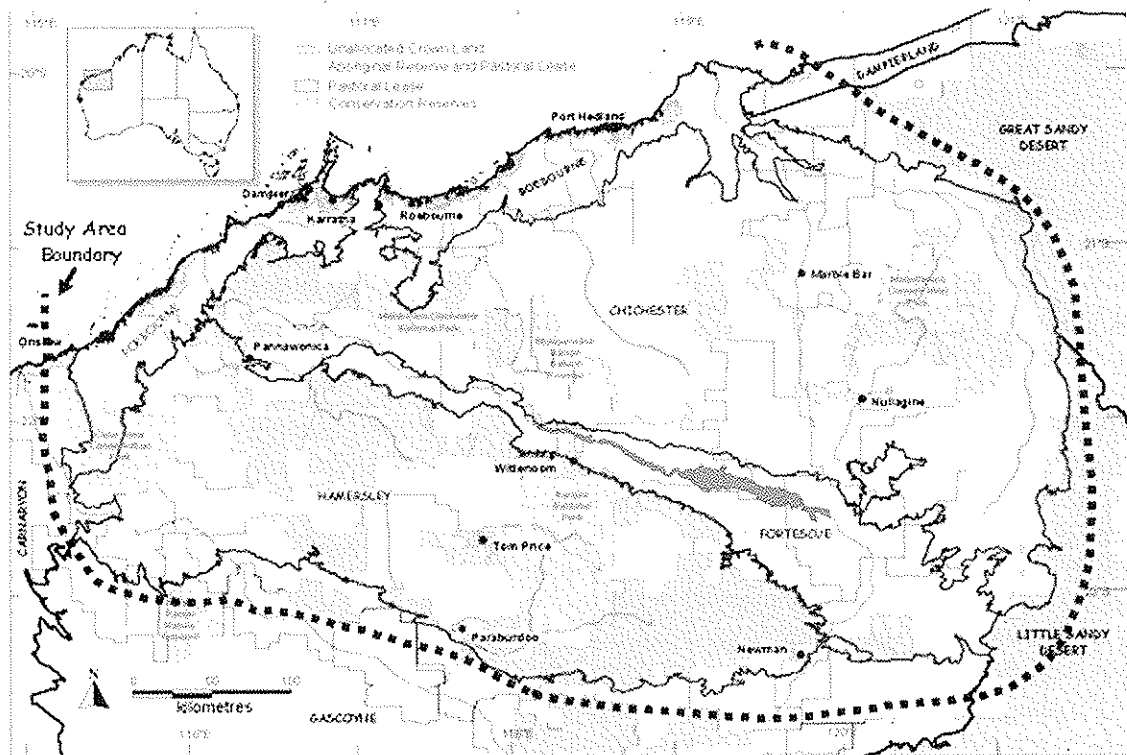
Commensurately, the Pilbara also has a wealth of biodiversity and has been recognised as one of the nation's 15 biodiversity hotspots. Documenting the Pilbara's biodiversity commenced when William Dampier collected several plants, including Sturt's desert pea, from the archipelago which now bears his name – Dampier

Archipelago - during his voyage along the coast of New Holland in 1699. Over the subsequent 300 odd years, research has continued to document the biodiversity of the Pilbara culminating in the region being recognised as one of the most extensively trapped and sampled parts of WA.

Nevertheless, despite a wealth of knowledge, no rigorous assessment has been undertaken of biodiversity across the entire 179,000 square kilometres of the Pilbara. Simple questions, critical for making informed nature conservation, sustainable land use and development decisions are hindered by a lack of regional perspective as to how biodiversity is distributed across the region, the condition of this biodiversity and the threats that impinge upon it. To address this shortcoming and

provide a framework on which to base future sustainable land use and biodiversity conservation decisions, the Department of Environment and Conservation (DEC) commissioned the Pilbara Biological Survey.

The Pilbara Biological Survey is a \$13.8 million project funded principally by DEC with contributions from the Federal Government (National Heritage Trust), WA Museum and several resource companies, in particular Rio Tinto, BHP-Billiton Iron Ore and Straits Resources. The survey, the largest of its kind to be undertaken in WA and arguably Australia, commenced in 2002 and is due for completion in 2009. It is a multidisciplinary project involving over 110 researchers who are documenting terrestrial and aquatic flora and fauna, including invertebrates, and the communities



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Botanists recording plants in a quadrat. (Bob Bromilow)

into which they are arranged across the region. All field work for the survey is now complete with voucher sorting, specimen identification, data compilation and analysis underway.

The effort required to comprehensively survey an area as large as the Pilbara has been substantial as demonstrated by survey effort statistics for the botanical component of the project. In total the botanical survey team comprised a core of four DEC scientists supported admirably by three technical officers. This DEC team was in turn assisted in the field by another 32 collaborators who included DEC volunteers, other DEC scientists, technical and operational staff, employees of Rio Tinto Iron

Ore and, perhaps most notably, botanists and taxonomists from all the mainland State herbaria in Australia. This survey team sampled 412 sites on two or three occasions and in so doing collected over 80,000 vouchers. The survey team travelled 128,000

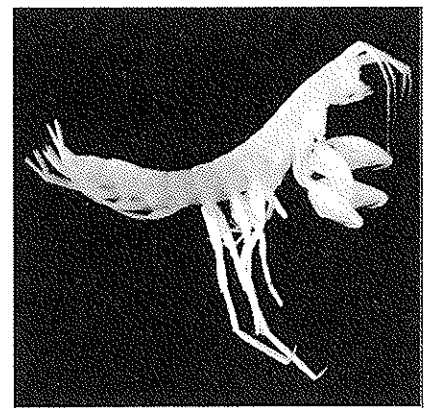
km throughout the region over a three-year period during 14 collecting trips which culminated in a total of 1,260 person days (3.5 years) in the field.

During the overall survey, a total of 304 terrestrial, an additional 108 botanical, 90 aquatic and 550 stygofaunal biodiversity sites were sampled on at least two occasions. The location of sample sites across the region was designed to capture the major geological and landsystem units that characterise the Pilbara while also taking into consideration patterns in climatic variation and fire history which strongly influence the patterning of biodiversity. It must be stressed that these types of regional surveys are designed to sample the characteristic widespread

community of a region and not the rarer and often charismatic special habitats which are very important biologically. However, these surveys do not provide insight into how the biodiversity of the region

is distributed, the sustainability of current land use practices or the effectiveness of the existing conservation reserve network.

Preliminary results for the survey indicate that the Pilbara is a very biodiverse natural region. This diversity was unexpected for many of the targeted groups sampled but in hindsight can be attributed to a number of factors associated with the heterogeneous climate, geology, landforms and soils of the region, and the impacts of important processes such as tropical cyclones and fire. It is now clear that the Pilbara is indeed one of Australia's biodiversity hotspots, as supported by the facts below.



An example of Pilbara stygofauna. (Stuart Halse)

- Over 350 stygofaunal invertebrates, the majority of which are tiny crustaceans (ostracods and copepods) that are new to science. Most of these aquatic groundwater invertebrates are short range endemics (very restricted distributions) and over 90% are endemic to the Pilbara. The Pilbara is now recognised as the international hotspot for stygofauna. (Stygofauna are aquatic invertebrates that live in groundwater aquifers and never see the light of day.)

- 1,035 species of aquatic invertebrate of which 10% are new to science and 20% are only known from the region. Significant



Allan Burbidge checking a pitfall trap. (Jim Rolfe)

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wetlands that support diverse invertebrate communities and restricted species include coastal claypans, some springs (Weeli Wolli, Millstream, Karijini gorges), deep permanent river pools, claypans on the Fortescue River and the nationally significant Fortescue Marsh.

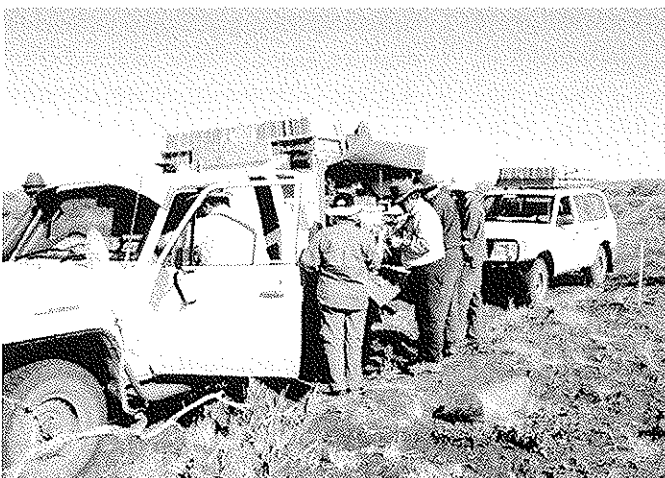
- Recognition of the Pilbara as a centre of diversity for charophytes (stoneworts) with 36 species and varieties being identified in wetlands of which about 30% are undescribed and 20% are restricted to the region. The aquatic flora is also rich in diatoms with 283 species being collected, 26 of which are new to science.

- A diverse community of ground spiders with about 320 species being collected of which 80-90% are new to science. Species richness approaches 40 species per 0.25 ha site.

- A similarly diverse community of ground beetles with 600+ species of which about 80% are also new to science. Species richness for ground beetles approaches 65 per 0.25 ha site and many appear to have very short geographical ranges.



DEC cadets installing pitfall traps. (Jim Rolfe)



Botanists preparing and processing plants in the field. (Stephen van Leeuwen)

- Up to 248 species of ground dwelling ants of which 10 % are new to science.

- Over 100 reptiles including several new gecko species and species range extensions which represent new records for the Pilbara.

- Approximately 250 species of non-oceanic birds including several rare species like the grey falcon but unfortunately no night parrots which were recently reported to occur on the Fortescue Marsh.

- Eighteen species of terrestrial mammal including the nationally threatened (vulnerable) mulgara. It appears that soil type and rockiness play a very important role in the distribution of ground mammals across the region. Basically those mammals that live in burrows occur on sandy substrates as they need to dig, while those that seek refuge in fissures live on cracking clays, whereas those that shelter under rocks live on rocky substrates.

- The identification from sub-fossil deposits obtained from caves, owl pellets and bat roosts of evidence (teeth, skulls) that the pre-European (5000-200 years before present day) mammal fauna comprised over 57 species, 11 of which are now extinct.

- Eighteen species of bat with one nationally threatened species, the Pilbara leaf-nosed bat, appearing to have an ubiquitous but cryptic distribution across the entire region.

- More than 20 new species of vascular plant including several *Acacia* and *Eremophila* species and many new records of both Kimberley and desert species for the region.

The survey is now drawing to a close with researchers busily analysing, writing and submitting manuscripts for publication. Unfortunately the botanists are still identifying many of their 80,000 vouchers and thus are a little behind! It is envisaged that the entire project will be completed by December 2009 when the survey results will be published as a volume in the Records of the Western Australian Museum. Online electronic versions of already completed papers (ground mammals, bats) should soon be available, via the WA Museum's website, for distribution.

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