



## Identifying important areas for conserving short-range endemic millipedes in south-west Western Australia

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### Background

The large and important contribution that terrestrial invertebrates make to biodiversity is well established, as is the vulnerability to extinction of those species that display short-range endemism. That is, species of insects, arachnids myriapods and crustaceans that have highly restricted distributions because of poor powers of dispersal, slow growth, low fecundity, specific habitat preferences or a combination of these factors. But we know very little about how many species there are or which areas within the south-west are most important for conservation.

### Aims

This research sought to identify areas of high species richness and endemism for millipedes within south-west Western Australia to assist with conservation planning. Additionally we wanted to understand which environmental factors may have influenced biogeographic patterns in millipedes. Such information is important in predicting whether some areas that were not sampled might also be important. It can also help us to gauge the level of threat posed by global climate change.

### Methods

This research project utilized the Western Australian Museum's extensive collection of preserved millipedes and database of localities where the millipedes were collected. These data were supplemented with field surveys during 2006-2007 of moist microhabitats likely to harbour millipedes such as creek lines, gullies and rocky outcrops. Millipedes were searched for by hand (turning rocks and logs as well as searching through the leaf litter) and extracted from the leaf litter with Tullgren funnels.



*Millipedes have two pairs of legs per body segment and are often found amongst leaf litter, under logs and stones, or buried within the soil. Photo: M.L. Moir*

### Findings

#### *Richness of millipedes*

South-western Australia has a rich millipede fauna with five orders, five families, 14 genera (seven genera undescribed) and 87 species (72 spp. undescribed) currently recognised. A large amount of taxonomic work is required, with 50 per cent of genera and 89 per cent of species undescribed. Additionally, the majority of species (85 species or 98 per cent of the fauna) display short-range endemism, as their geographic range is less than 10,000 km<sup>2</sup>. However, many species are known only from much smaller areas (e.g. < 100 km<sup>2</sup>). This means that south-western Australia has large numbers of millipede species that may be easily placed at risk of extinction through the loss or alteration of their habitats (such as by clearing, inappropriate fire regimes or *Phytophthora* dieback).

## Hotspots for millipedes

Five main areas were identified as having a particularly speciose millipede fauna or were areas where the millipede fauna was highly endemic (see Table 1). Nine other areas were also identified as being particularly important for millipedes.

## Environmental correlates of species richness and endemism

Differences in elevation and present day rainfall were found to be important variables of biogeographic patterns in millipedes. This means that many new species of millipedes could potentially be found in hilly/mountainous areas that have had minimal surveys to date. Additionally, the decline in rainfall predicted to occur for the south-west through global climate change may see a decline in the availability of moist refugia required by many species of millipedes.

Table 1. The five areas identified in the south-west displaying the greatest endemism and richness of millipede species

Hotspot no.	Area name
1	Stirling Range (east)
2	Cape Le Grand
3	Cape Arid
4	Walpole region
5	Porongurups



A new genus and species of sucking millipede (Polyzoniida: Siphonotidae). Photo: M.L. Moir



Two species of pill millipede (Sphaerotheriida: Sphaerotheriidae) currently listed as threatened on the Schedules of the Western Australian Government's Wildlife Conservation Act are *Epicyllosoma sarahae* (left) and *Cynotelopus notabilis* (right). Photo: M.L. Moir

## Congruence in millipede centers of endemism with other floral and faunal groups

Areas identified as important for the conservation of millipedes were not always those identified by other workers as important for vascular plants, mammals, frogs, freshwater crayfish and aquatic invertebrates. Centers of endemism for millipedes encompass all of these, plus other areas (e.g. Cape Le Grand and Cape Arid).

## Management Implications

Millipedes warrant considerable conservation attention as, although the fauna is poorly known taxonomically, most species have narrow geographic ranges and are often restricted to moist refugia indicating that they are likely to be highly susceptible to extinction. The fauna in south-western Australia is also very speciose. This means that the need for surveys of short-range endemic invertebrates including millipedes should always be identified in scoping documents for environmental impact assessments (EIAs). Furthermore, the need for taxonomic research should be highlighted, as most millipede species are undescribed. Moreover, regional fire management plans should identify moist refugia likely to harbour millipedes and actively protect these areas from wildfire. Finally, as vascular plants and vertebrate animals were poor surrogates for identifying all areas significant to millipede conservation, land managers will need to include invertebrates such as millipedes when attempting to determine the conservation values associated with particular patches of bushland or conservation reserves.

## Further Reading

Moir M.L., Brennan K.E.C. & Harvey M.S. 2009. Diversity, endemism and species turnover of millipedes within the south-western Australian global biodiversity hotspot. *Journal of Biogeography* 36(10).