The potential impacts of climate change and land transformation on biodiversity in Mediterranean climate south-west Western Australia – implications for threatened species conservation

Colin Yates[1], Jane Elith[2], Lesley Gibson[1], Asha McNeill[1], Guy Midgley[3], Paul de Tores[1], Adrian Wayne[1]

[1]Science Division, Western Australian Department of Environment and Conservation, Australia
[2]School of Botany, University of Melbourne, Australia
[3]Climate Change and Bio-adaptation Division, South African National Biodiversity Institute, South Africa

Widespread land transformation, associated habitat fragmentation, invasive species and introduced diseases continue to drive substantial declines in biodiversity in Mediterranean climate south-west Western Australia (SWWA). Projected climate change may interact with these factors to further threaten biodiversity. Mean annual temperatures have increased and since the 1970's there has been a significant decline in autumn and early winter rainfall and reduced stream flow. The consensus among Global Climate Models is that temperature will continue to increase and rainfall will continue to decline in the SWWA.

Patterns of biodiversity in SWWA are strongly influenced by climate. Unlike the other Mediterranean climate regions of the world SWWA is of low relief and with the exception of the Stirling Ranges which are just 1109 m a.s.l., there is limited scope for altitudinal migration into cooler and moister montane refuges. Under projected climate change, warmer and more arid conditions are expected to shift southwards and westwards, and there is a possibility that the coolest and wettest climate zones on the south coast, containing many relictual and mesothermic phylogenetic lineages may disappear. Where the latitudinal extent of the continent permits shifts in geographic range, extensive land transformation for agriculture and urbanization will limit the amount of habitat available for colonization, and habitat fragmentation will restrict dispersal.

As a first step in assessing the vulnerability of SWWA's biodiversity to climate change we have modeled the potential impacts of three climate change scenarios and their interaction with land transformation on the ecogeographic domains of regional biomes, endemic plant species (*Banksia* spp.) and the threatened

marsupial quokka (*Setonix brachycurus*). The models predict that the combined effects of climate change and land transformation may have significant adverse impacts on biodiversity, increasing the number of threatened species in the region with one regional biome the karri forest potentially losing all suitable climate range, 66% of *Banksia* spp. and quokka losing greater than 80% of their range by 2070 under the high emissions scenario. These results need cautious interpretation in light of the many assumptions and uncertainties in the climate and ecological models used. Nevertheless, the potential impacts identified provide insights into the relative sensitivities of regional biomes to projected climate change, indicate that increasing number of threatened species are likely, highlight the need for a better understanding of physiological and climate thresholds and ecological monitoring to detect change, and stress the importance of ecological restoration and identification and management of climate refuges as adaptation actions.

Threatened Species Research Forum

Western Australian Ecology Centre

9th July 2010

A Review of WA Government Research into Threatened Species