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LIFE ON THE ROCKS – A CRACKING GOOD PLACE TO LIVE

Colin Yates, Phil Ladd and Dave Coates

In 1970 a young English school teacher came to visit a friend in Western Australia. Being interested in plants she spent some time in the 'bush', and when walking on a granite rock in the State's wheatbelt noticed an unusual small shrub which caught the imagination. Keen to know more, she took a sample to the Western Australian Herbarium, where the then Duty Botanist Alex George exclaimed "This hasn't been seen for 50 years". This is the story of how one of Western Australia's rarest plants *Verticordia staminosa* subsp. *staminosa* was re-discovered, and the beginning of Penny Hussey's remarkable career in bringing attention to, and enabling conservation of, Western Australia's extraordinary flora.

Some 30 years later, scientists Colin Yates and Dave Coates from the Department of Environment and Conservation (DEC), and Phillip Ladd from Murdoch University, investigated the evolutionary history and ecology of *Verticordia staminosa* and discovered much more about this shrub. Their studies revealed a remarkable and enduring natural history, and highlighted the importance of protecting remnant native vegetation from livestock grazing and other threatening processes.

The population of *Verticordia staminosa* subsp. *staminosa* which Penny re-discovered in 1970 is still the only known population of the shrub. A comprehensive census of the population undertaken by the research team estimated that there were about 1,200 plants distributed among 49 sub-populations, varying in size from one to 160 plants. The number of plants in each sub-population increased with the availability of rock cracks in the massive granite pavements. A second sub-species, *Verticordia staminosa* subsp. *cylindracea*, which is also rare, is known from a cluster of granite rocks some 400 km away (see map). There are numerous granite rocks in between the two subspecies but extensive searching has failed to reveal new populations.

Genetic studies undertaken by the research team revealed exceptionally high levels of genetic divergence between the two subspecies. Because neither has any obvious mechanism for long-distance dispersal there must have been a very long period of historical separation, with the subspecies originating from a common progenitor sometime in the early Pleistocene (1–1.5 million years ago). The period of Earth's history since has been marked by the Great Ice Age when glaciers advanced and retreated numerous times across much of the Earth's surface. In south-west WA there was no ice, but climate oscillated between cooler arid phases and warmer wetter phases.

The insight from the genetic studies is that the present populations of *V. staminosa* have survived *in situ* on the same granite outcrops through multiple cycles of previous climate change. How might this have happened? What are the implications of this for managing the shrub in the face of anthropogenic climate change and the warming and drying projected for the south-west? The research team's investigations of *V. staminosa's* ecology, physiology, population dynamics and pollination biology provide some answers.

The rock fissures where *V. staminosa* plants grow, concentrate water run-off from the surrounding massive granite surfaces, so that even the smallest amount of rainfall or heavy dew can result in moisture reaching plant roots. These water gaining sites may provide refuges for plants in a drying climate. The shrub is also very drought tolerant with plants becoming dormant over extended dry periods and re-hydrating rapidly when rain falls. Plants are long-lived and because they are drought tolerant, rates of mortality are low. Some seedling recruitment occurs in most years but rates are highest in the very wettest years. Plants are self-compatible which means they do not require pollen from other plants to produce seeds. This

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Verticordia staminosa

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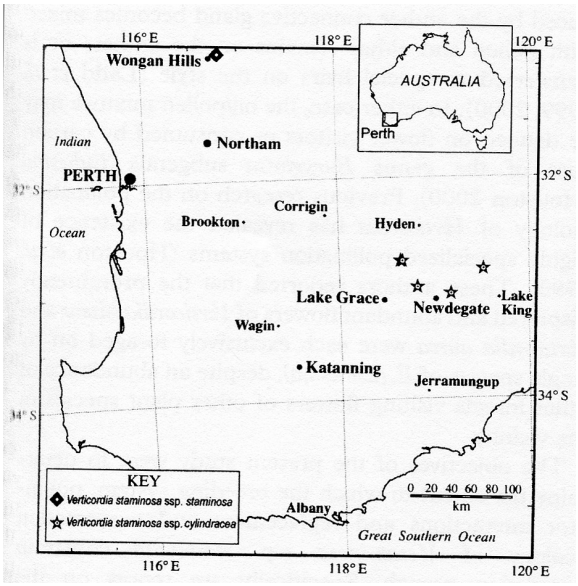

may be an especially important trait if, under drier and warmer climatic conditions, the population declines to a small number of plants. Indeed low levels of genetic variation within the subsp. *staminosa* and subsp. *cylindracea* indicate populations may have declined to a smaller number of plants and genotypes in the past subsequently expanding but with a restricted gene-pool.

Integration of the research findings into a model enabled the research team to investigate the potential impact of different climate scenarios on the *V. staminosa* population. Under more arid conditions the population was remarkably stable and extinction risk marginally increased compared to a simulation using historical climate conditions. A key finding of the model was the importance of protecting adult plants from any disturbances that could result in high rates of mortality. On a granite outcrop in the wheatbelt this would include livestock grazing and inappropriate fire regimes.

Verticordia staminosa subsp. *staminosa* faces an uncertain future. What the shrub's actual climate tolerances are, and the role of granite outcrops as climate change refuges is the subject of ongoing research. Nevertheless, the story of its rediscovery and remarkable natural history provide some hope and highlights the importance of conserving and sympathetically managing the remnants of native vegetation in the south-west of Western Australia.

Dave Coates is Programme Leader and Colin Yates Principal Research Scientist in DEC's Science Division. Phil Ladd is Senior Lecturer in Ecology at Murdoch University.

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2008 Year Book Australia (p 477)

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