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Should Hunter Valley Weeping Myall Woodland in the Sydney Basin Bioregion be listed as a Threatened Ecological Community?

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Abstract: In New South Wales, the *Threatened Species Conservation Act 1995* makes provision for the listing of Threatened Ecological Communities (assemblages of species occupying a particular area) as a means to conserving the variety of ecosystems present in the State. Hunter Valley Weeping Myall Woodland is listed as an Endangered Ecological Community under the New South Wales *Threatened Species Conservation (TSC) Act 1995* and as a Critically Endangered Ecological Community under the Commonwealth *Environment Protection and Biodiversity Conservation (EPBC) Act 1999*.

The provenance of populations of Weeping Myall (*Acacia pendula*, family Fabaceae) in the Hunter Valley has recently been questioned. In this paper we consider the implications of its hypothesized European introduction for listing Hunter Valley Weeping Myall Woodland under the *TSC* and *EPBS Acts*. The recognition of any community is contingent on the identification of both a particular assemblage of species and the critical environmental factors that determine their co-occurrence (the area the community occupies in environmental space). *Acacia pendula* is one of a range of semi-arid species which are primarily distributed west of the Great Dividing Range but also occur on Permian sediments in areas receiving the lowest rainfall of the Hunter Valley floor. On this basis we argue there is sufficient evidence to support the listing of Hunter Valley Weeping Myall Woodland under both *Acts*.

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Introduction

Weeping Myall (*Acacia pendula*, family Fabaceae) is widely distributed throughout the western slopes and plains of New South Wales (NSW) and parts of Queensland and Victoria. The eastern limit of its distribution in NSW is marked by an outlying population between the locations of Broke, Singleton, Muswellbrook and Sandy Hollow in the upper Hunter Valley. Both the provenance and taxonomic affinities of the Hunter population have been the subject of debate. Most recently, Bell and Driscoll (2014) made a persuasive argument that the Hunter population was not present at the time of European settlement but was introduced at some time in the second half of the twentieth century. As a consequence, they suggested that the status of *Acacia pendula* under the NSW Threatened Species Conservation Act (1995) (Endangered Population and Endangered Ecological Community) and Commonwealth *Environment Protection and Biodiversity Conservation Act (1999)* (Critically Endangered Ecological Community) should be reviewed.

Bell and Driscoll's (2014) case was based on several lines of evidence. First, they noted that while the journals of early Australian explorers made copious references to the presence of *Acacia pendula* in the western parts of its current range there were no mentions of its presence in the Hunter Valley. They argued that since the species is conspicuous and the exploration of the Hunter was no less thorough than elsewhere then it must have been absent at the time of colonisation. Second, no reliable herbarium records of *Acacia pendula* exist from the Hunter Valley prior to 1951, although collections have proliferated during the second half of the 20th century. Bell and Driscoll (2014) argued that such a pattern is again unlikely, given the extensive botanical exploration of the Hunter Valley, unless the species was introduced to the Hunter relatively recently.

Finally, with the exception of the Hunter Valley, *Acacia pendula* is restricted to the semi-arid slopes and plains west of the divide. Bell and Driscoll (2014) demonstrated that in addition to being remote from its western neighbours, the Hunter population occupies a different environmental niche characterised by higher rainfall (600 – 800 mm vs 300 – 600mm), higher elevation (200 – 299 m vs 100 – 199 m) and different soils (Sodosols/Kurosols vs Vertosols/Chromosols). The fact that this broader niche has only been realised in the Hunter Valley suggested, to Bell and Driscoll (2014), that the species must have been specifically introduced there.

Upgrade, defer, delist?

The publication of Bell and Driscoll's (2014) paper coincided with the exhibition of a preliminary determination made by the NSW Scientific Committee to list Hunter Valley Weeping Myall Woodland in the Sydney Basin Bioregion as a Critically Endangered Community under the *TSC Act 1995*. The determination upgrades the conservation status of the community from Endangered to a level equivalent to its listing under the Commonwealth *EPBS Act (1999)*. Doubts over the provenance of *Acacia pendula* in the Hunter Valley

raise the question of whether either listing is appropriate. Bell and Driscoll (2014) suggested that the conservation status and management of the community should be reviewed and that genetic studies are urgently required to resolve the matter of the provenance and genetic integrity of *Acacia pendula*. They further speculated that the species may even pose a threat to the conservation of floristic diversity through the competitive exclusion of understorey species.

A more general concern is whether there is quantitative support for the recognition of Hunter Valley Weeping Myall Woodland as a distinct assemblage of species. Limited sampling of the community has precluded a quantitative appraisal of its distinctiveness relative to other vegetation of the Hunter Valley (Peake 2006, Somerville 2009a&b, Sivertsen *et al.* 2011). Examining this question, Bell (2012) subsequently demonstrated (via ordination) a divergence of samples of the Hunter Myall Woodland assemblage from other grassy woodlands in the central and upper Hunter Valley (irrespective of the presence of *Acacia pendula* itself). However, he suggested that this divergence was a reflection of the depauperate understory characteristic of dense populations of *Acacia pendula*. In general, competent, experienced botanists remain unconvinced the Hunter Valley Myall Woodland constitutes an assemblage of species distinct from others occurring in the upper Hunter Valley.

Is there an ecological basis for CEC listing?

Whether populations of *Acacia pendula* were present, absent, incipient or dormant in the Hunter Valley at the time European settlement is not strictly relevant to the status of the Hunter Valley Weeping Myall Woodland. While its presence may be accepted as a *de facto* diagnostic feature of the community (Umwelt 2006), the *TSC Act 1995* defines a community as “an assemblage of species occupying a particular area” and the absence of any species in a particular sample is explicitly anticipated by the Determination. Nevertheless, the long history of disturbance in the Hunter Valley, combined with a paucity of systematic, quantitative survey data, increases the risk that biogeographic patterns are confounded with anthropogenic artefacts. What, then, is the ecological basis for recognising the community?

The assemblage of species listed in the Preliminary Determination to list Hunter Valley Myall Woodlands as a Critically Endangered Community includes a number of species that are primarily distributed on the western slopes and plains and reach their eastern distributional limit in the upper Hunter Valley. These species show a similar distributional pattern to *Acacia pendula* and hence, occupy a different environmental niche to their more western populations. They are generally restricted to the areas of weathered Permian Sedimentary bedrock or Quaternary Alluvium but vary in the range of elevation and rainfall over which they are distributed. Species with relatively broad distributions (*Acacia salicina*, *Notelaea microcarpa* var. *microcarpa*, *Maireana microphylla*, *Minuria leptophylla*, *Geijera parviflora* and *Ptilotus nobilis* subsp. *semilanatus*) are characteristic of a number of community types occurring

in the upper Hunter Valley (Peake 2006, Somerville 2009a&b, Sivertsen *et al.* 2011). The distribution of a second group of species (*Calocephalus citreus*, *Acacia melvillei*, *Enteropogon acicularis*, *Eragrostis alveiformis*) is more restricted. Records of these species are distributed over a similar area to those of *Acacia pendula* between Broke, Singleton, Muswellbrook and Sandy Hollow (Atlas of Living Australia, Accessed 13th August 2015). The distribution of *Enchylaena tomentosa*, *Lysiana exocarpi* subsp. *tenuis*, and *Chenopodium glaucum* follows a similar pattern although these species are also distributed on (or, in the case of *C. glaucum*, otherwise restricted to) the coast. Bell (2012) identified a number of these species as either statistically diagnostic or compositionally characteristic of a set of five plots sampling putative Hunter Weeping Myall Woodlands. Conversely, a subset of these species were either absent from, or rare in other communities described by Peake (2006), Somerville (2009a&b) and Sivertsen *et al.* (2011),

The patterns in the distribution of plant species described above are strongly correlated with annual rainfall, geology and topography. The eastern limits of species with western affinities are approximately demarcated by the 700 mm isohyet to the east of which rainfall rises steeply reaching 1000 mm over the 60 km between Singleton and Maitland. Rainfall also increases with elevation to both the north and south, rising to approximately 1000 mm on the Liverpool Range. The 700 mm isohyet defines the eastern limit of a rain-shadow extending some 200 km west up the Goulburn River Valley and beyond the Divide to Dunedoo. While rainfall is relatively invariant (625-675 mm) along this corridor the distribution of species characteristic of Hunter Valley Myall Woodlands is truncated to the west of Sandy Hollow at a location which corresponds approximately to the outcropping of Triassic Narrabeen sandstones in the Goulburn River Valley.

While the intersection of the western limit of the Hunter Permian sediments and the Goulburn River Valley rain shadow clearly constitutes a unique environmental niche, the Hunter Valley Myall Woodland is one of several candidate assemblages associated with this area. The closest alternative to Hunter Valley Myall Woodland, in terms of species composition and habitat, is Peake's (2006) Central Hunter Box-Ironbark Woodland (Map Unit 10). Peake (2006) identified six variants of this community occurring in habitats ranging from valleys to gently undulating hills, slopes and rocky knolls. In contrast, he described Hunter Valley Myall Woodlands as occurring on heavy clay soils associated with flood washouts. Sivertsen *et al.*'s (2011) Narrow-leaved Ironbark/ Grey Box grassy woodland of the central and upper Hunter (Map Unit 173) is an alternative interpretation of the same community, but is more extensively distributed at higher elevations in the upper Hunter Valley up to the 725 mm isohyet to the north, and in areas receiving up to 900 mm northeast of Ravensworth. Compared with either of the communities described above, the current distribution of *Acacia pendula*, whatever its origin, is a better approximation of the distribution of an interesting assemblage of semi-arid species in areas of lower rainfall along the valley floor.

One final factor for consideration concerns the location of the Hunter Valley Myall Woodlands with respect to the potential dispersal path of species moving from west to east. Beadle (1981) characterised the Goulburn River valley as one of the few places where the Great Diving Range posed a minimal barrier to the dispersal of species from west to east. The Goulburn River potentially facilitated this process and, as such, the junction of the Goulburn and Hunter Rivers with their associated floodplains potentially represents the first suitable habitat for species adapted to the heavier soils and floodplains west of the range. From this perspective, the remoteness of the Hunter *Acacia pendula* population from its western neighbours is potentially a function of discontinuities in the edaphic and climatic niche it is able to exploit.

Conclusion

While the origins of *Acacia pendula* in the Hunter Valley may be uncertain, its current distribution is indicative of important underlying patterns in the distribution of multiple species in relation to soil and climatic gradients. These patterns have been undoubtedly muted by disturbance over the past two centuries, just as the abundance of *Acacia pendula* (if it was present at the time of European settlement) has likely changed. Nevertheless, the co-occurrence of these multiple species in various combinations establishes the existence of an assemblage consistent with the definition of an ecological community under both the NSW *Threatened Species Act* 1995 and the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999. Whether the protection of Hunter Valley Myall Woodlands is conceived as conserving the last vestiges of Pleistocene Age semi-arid flora of the Hunter Valley (Tame 1992) or the eastern outpost of the contemporary semi-arid flora (Beadle 1981), the community is potentially the repository of important components of the genetic and ecological variability of its component species. Given the evidence supporting the distinctiveness of the assemblage and consistency with definitions of an ecological community, its restricted distribution and threats (Peake 2006, Department of Environment 2014, earlier *TSC Act* listing), continued protection of Hunter Valley Myall Woodlands as a Critically Endangered Community appears to be warranted.

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