A preliminary assessment of the composition and cover of vascular plants associated with patches of *Nassella neesiana* (Trin. & Rupr.) Barkworth (Poaceae) in an Australian native grassland

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Summary Chilean needle grass (*Nassella neesiana*) is highly invasive in temperate native grasslands of south-eastern Australia. Its impact on plant biodiversity was quantified by assessing foliar cover and species diversity of other vascular plants inside, on the margins of, and outside *N. neesiana* patches in a degraded *Themeda triandra* grassland at Yarramundi Reach, Australian Capital Territory. Early results indicate that the presence of *N. neesiana* correlates with reduced native plant diversity and increased exotic plant diversity**.**

Keywords *Nassella neesiana*, Chilean needle grass, temperate grassland, biodiversity, impact.

INTRODUCTION

Weeds are a major threat to biodiversity in Australia, but there is little quantitative information on specific biodiversity impacts, even for Weeds of National Significance (WONS) (Grice *et al.* 2004, Coutts-Smith and Downey 2006). Chilean needle grass, *Nassella neesiana* (Trin. & Rupr.) Barkworth (Poaceae: Stipeae), a WONS species, is a long-lived, C_3 tussock grass of South American origin, with high reproductive and survival rates, found in areas of >500 mm annual rainfall in south-eastern Australia. It has an estimated potential Australian distribution of over 41 million ha (McLaren *et al.* 1998). *N. neesiana* is a highly invasive weed, undergoing a rapid range expansion, and is apparently able to out-compete smaller species which grow in inter-tussock spaces. It is reportedly able to actively invade grasslands, is rated as a highly significant threat to grassland biodiversity and is considered to be currently causing rapid degradation of threatened native grassland remnants (Hocking 1998, Morgan 1998, Grice 2004, McLaren *et al.* 2004, McDougall and Morgan 2005).

Lowland temperate grasslands are one of the most threatened ecosystems of south-eastern Australia, with <1% of their original area remaining and poor representation in reserves (Kirkpatrick *et al.* 1995, Groves and Whalley 2002). *N. neesiana* is one of the more recent of the many threats to the integrity of remaining grassland remnants; however, the nature and extent of its impacts on biodiversity have been poorly quantified.

Yarramundi Reach, Australian Capital Territory (35°17.5'S, 149°05'E) is a degraded, 15 ha *Themeda triandra* Forrsk. grassland at the western end of Lake Burley Griffin, that is becoming heavily invaded by *N. neesiana*. Frawley *et al.* (1995) provided a brief history of the site and considered it to be 'one of the more important ACT grasslands'. Their list of important weeds at the site did not include *N. neesiana*. However, one of the earliest references to the species in the ACT (Berry and Mulvaney 1995 Volume 2 Appendices p. 261) noted it to be 'common along the bicycle path'. A survey by Bruce (2001) found *N. neesiana* to be spreading, scattered to subdominant, with some very dense infestations. In autumn 2007 the floristic diversity of patches of *N. neesiana* and the areas around them in this grassland were investigated in an attempt to determine the weed's impact.

MATERIALS AND METHODS

Three patches of *N. neesiana* were investigated on 25–26 May 2007. They were precisely located by measuring distances and compass bearings to prominent landmarks and with a GPS device. The foliar cover for each vascular plant species (represented by live above-ground vegetation) was estimated using a 1 m^2 quadrat with a 10 cm × 10 cm grid. Four quadrats were assessed within each of three areas: *N. neesiana* patch, native grassland outside the patch, and the transitional zone at the edge of the patch (Figure 1).

Species present were classified as native, exotic (introduced), or, if they could not be identified, as undetermined. The number of species, including *N. neesiana*, in each category in each quadrat and sampling zone was calculated.

RESULTS

Areas within *N. neesiana* patches had lower total vascular plant diversity than those outside of patches (Figures 2 and 4) and lower native plant diversity

(Figures 3 and 4). More weed species were present in the patches than outside them (Figure 4). Transitional zones (patch edges) had similar diversity to areas outside the patches. Only a small proportion of species present could not be reliably identified as native or exotic (Figure 4).

DISCUSSION

Presence of *N. neesiana* correlated with reduced native plant diversity and increased exotic diversity. Loss of native diversity may be the consequence of the dense cover and high litter levels of *N. neesiana* stands (Gardener and Sindel 1998), but these factors could be expected to impact similarly on exotic plants, also reducing their diversity. Reduced plant diversity is also recorded in unmanaged stands of *T. triandra*, which become increasingly dense as the time since fire or thinning increases (Kirkpatrick *et al.* 1995). Much of the native vegetation outside of *N. neesiana* patches at Yarramundi Reach consisted of such dense *T. triandra*, so the reduced native plant diversity in *N. neesiana* patches occurred despite probably reduced 'background' diversity in the uninvaded areas.

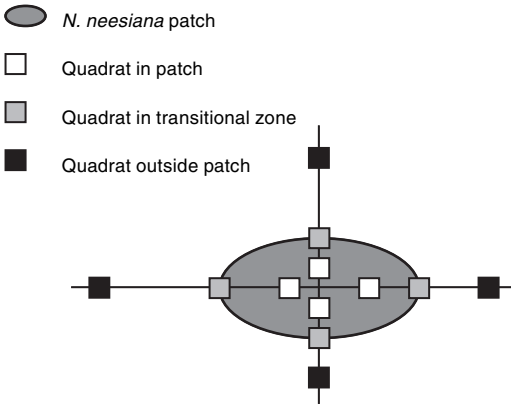

Figure 1. Schematic representation of patch sampling methodology.

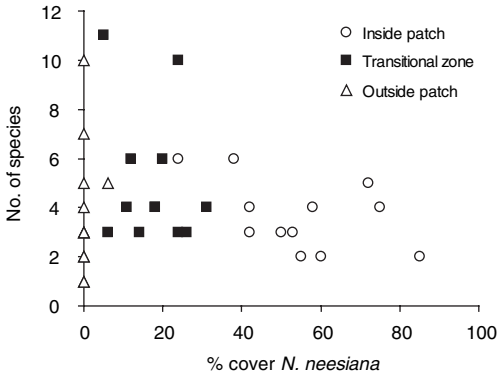

Figure 2. Number of vascular plant species in quadrats associated with *N. neesiana* patches at Yarramundi Reach. Note that two quadrats in the transitional zone each had 18% *N. neesiana* cover and three other species present.

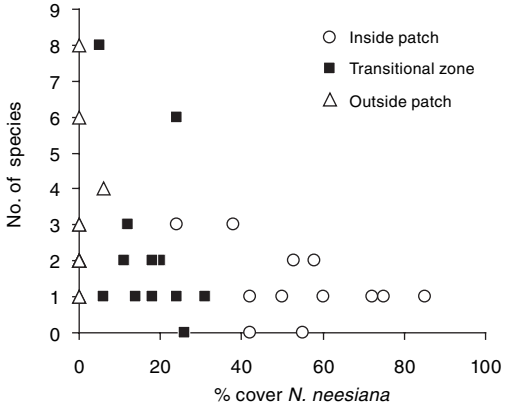

Figure 3. Number of native plant species in quadrats associated with *N. neesiana* patches at Yarramundi Reach.

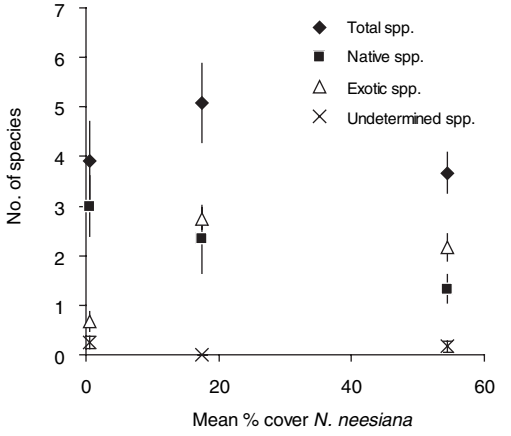

Figure 4. Mean number of exotic, native, undetermined and total vascular plant species associated with three *N. neesiana* patches at Yarramundi Reach. Error bars show standard errors.

Data not presented here indicate that in quadrats outside of patches and on patch margins, increasing cover of major perennial grasses (all species combined) resulted in markedly reduced total plant diversity, whereas inside patches (where almost all such cover consisted of *N. neesiana*) it had little effect on diversity. This suggests that altered diversity inside patches is not due to the presence of *N. neesiana*, but to some other prior cause. Other preliminary evidence, to be investigated in more detail and reported at a later time, suggests that *N. neesiana* invasion may be a consequence of previous degradation, and may follow, rather than precede, reduced native biodiversity.

The sampling methodology did not enable assessment of the most floristically diverse vegetation present in the study area, in part because of the high level of degradation and the abundance of other exotic perennial grasses. The study was undertaken in late autumn when the diversity of green, above-ground plants is not at its maximum in temperate native grasslands. A variety of spring-growing annuals and perennials that die back to the root stock are generally not apparent at that time of year. Similar studies are to be undertaken in spring, when higher diversity is expected, and with a modified sampling regime to enable comparison of the most intact native vegetation. Further work will attempt to assess the effects of *N. neesiana* patch size, age and location, and grassland management regimes on species change at this and a range of other native grasslands.

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