Biodiversity impacts of Chilean needle grass *Nassella neesiana* on Australia's indigenous grasslands

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STA THESIS

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Abstract

The exotic invasive Chilean needle grass *Nassella. neesiana* (Trin. & Rupr.) Barkworth has been recognised as a major threat to biodiversity in the endangered natural grasslands of south-eastern Australia. Research was undertaken in Canberra and Melbourne grasslands to examine mechanisms by which *N. neesiana* invades native grasslands, the impacts of invasion on vascular plant and invertebrate biodiversity and mechanisms of impact. Time series analysis of historical aerial photographs demonstrated that invasion was absent or very slow when infestations abutted healthy grassland, but grasslands in poor condition experienced linear infestation expansion rates >5 m per year. A field experiment demonstrated that major disturbance (death of the native grasses) was required for *N. neesiana* recruitment from panicle seeds and that intact grassland was not invaded, even with high propagule pressure. Gaps of c. 1 m (as opposed to 10-30 cm) were required for establishment. Pin transect sampling demonstrated that increased senescence of *Themeda triandra* swards correlated with greater invasion. *Nassella neesiana* was found to deplete soil water in spring compared to *T. triandra*, a likely mechanism of biodiversity impact. Areas occupied by *N. neesiana* in three disparate grasslands were found to have significantly reduced native vascular plant diversity (species m^{-2}). Diversity decreased with increasing size of the *N. neesiana* patch. Forbs were the most affected group but one or more dominant grasses were absent at the smallest patch sizes. Exotic plant diversity was similar inside and outside patches. Analysis of sweep net samples determined that invertebrate populations and species richness were significantly reduced in *N. neesiana* grassland, although numerous native insect species consume the plant. Much of the loss of diversity in invaded areas probably precedes invasion and is caused by anthropogenic disturbances including *T. triandra* senescence dieback, mowing and major soil disturbance. Native grasslands in good condition are resistant to invasion.

Declaration

I, Ian Guthrie Faithfull, declare that the PhD thesis entitled *Biodiversity impacts of Chilean needle grass* Nassella neesiana *on Australia's indigenous grasslands* is no more than 100,000 words in length including quotes and exclusive of tables, figures, appendices, bibliography, references and footnotes. This thesis contains no material that has been submitted previously, in whole or in part, for the award of any other academic degree or diploma. Except where otherwise indicated, this thesis is my own work.

Signature

16 April 2012

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Contents

List of abbreviations and foreign words and phrases

ACT	Australian Capital Territory
bp	before present
C	carbon
c.	*circa*, approximately
cf.	*confer*, compare
Ed. Eds.	editor(s)
Edn.	edition
et al.	*et alia* or *et alii*, and others
et. sub.	and subsequently
gen.	genus
ha	hectare
ibid.	*ibidem*, in the same place as above cited reference
in litt.	in correspondence
K	potassium
loc. cit.	*locus citatus*, in the place cited
N	nitrogen
No., no.	number
nov.	new (as in *nov. gen*.)
NSW	New South Wales
op. cit.	in the work previously cited
p., pp.	pages
P	phosphorus
P	probability
pers. comm.	in personal communication
rev.	revised
sed	standard error of differences (between the means of two samples)
sensu	in the sense of, according to
sens..lat..	*sensu lato*, in a broad sense
s.s.	*sensu stricta*, in a strict sense
sp.	species
spp.	more than one species
subsp., ssp.	subspecies
t	tonne
vide	see
vs	versus
ybp	years before present

Convention

Dates recorded in numerical format are in the form dd/mm/yy

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