

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

Ian Guthrie Faithfull, B.Sc. (Hons.)

**School of Engineering and Science
Faculty of Health, Engineering and Science
Victoria University, St Albans, Victoria, Australia**

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STA THESIS

Faithfull, Ian Guthrie

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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

Title	i
Abstract	iii
Student declaration	iv
Acknowledgements	v
Contents	viii
List of abbreviations and foreign words and phrases	1
List of figures	2
List of tables	6
Chapter 1. Introduction	11
Chapter 2. Temporal changes in patch and infestation dimensions	38
Chapter 3. Historically quantified infestations revisited	66
Chapter 4. Disturbance and seed inundation field experiment	85
Chapter 5. Relationship between senescence of <i>Themeda triandra</i> and invasion by <i>N. neesiana</i>	132
Chapter 6. Soil moisture depletion in spring – a possible mechanism for <i>N.</i> <i>neesiana</i> impact	157
Chapter 7. Diversity of vascular plants associated with <i>N. neesiana</i> patches	170
Chapter 8. Invertebrate diversity	208
Chapter 9. Conclusions	251
References	263

List of abbreviations and foreign words and phrases

ACT	Australian Capital Territory
bp	before present
C	carbon
c.	<i>circa</i> , approximately
cf.	<i>confer</i> , compare
Ed. Eds.	editor(s)
Edn.	edition
<i>et al.</i>	<i>et alia</i> or <i>et alii</i> , and others
<i>et. sub.</i>	and subsequently
gen.	genus
ha	hectare
ibid.	<i>ibidem</i> , in the same place as above cited reference
in litt.	in correspondence
K	potassium
<i>loc. cit.</i>	<i>locus citatus</i> , in the place cited
N	nitrogen
No., no.	number
<i>nov.</i>	new (as in <i>nov. gen.</i>)
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)
<i>sensu</i>	in the sense of, according to
<i>sens..lat..</i>	<i>sensu lato</i> , in a broad sense
s.s.	<i>sensu stricta</i> , in a strict sense
sp.	species
spp.	more than one species
subsp., ssp.	subspecies
t	tonne
<i>vide</i>	see
vs	versus
ybp	years before present

Convention

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

List of figures

1.1	The McIntyre and Lavorel (2007) ‘state and transition model’ for temperate grassy woodlands of south-eastern Australia.	18
2.1	Dudley Street grassland, ACT, 21 January 2005, showing the broad area of grassland assessed for <i>N. neesiana</i> areal cover, the <i>N. neesiana</i> intrusion upon which estimates of rates of change of area and linear boundary changes were made, and the roadside infestations assessed for linear expansion rates.	44
2.2	<i>Nassella neesiana</i> patch at Dudley Street, ACT. 19 April 2005 and 31 March 2008.	46
2.3	Yarramundi Reach <i>N. neesiana</i> Patch R.	50
2.4	Western side of Crace Grassland Reserve, 8 May 2007, showing a dense monoculture of <i>N. neesiana</i> within the fence of the building compound and a belt of green <i>N. neesiana</i> in a drainage line leading downhill from the compound, grazed very short by rabbits.	53
2.5	Elevated area in the north-west section of Crace Grassland Reserve, 8 May 2007, highly disturbed by cattle and kangaroo grazing and densely infested with <i>N. neesiana</i> .	53
2.6	Mowing the road verge along the south-west edge of the Dudley Street grassland.	58
2.7	<i>Nassella neesiana</i> patch G, Crace Grassland, ACT, with kangaroo trail.	59
2.8	Yarramundi Reach grassland, ACT, 7 May 2007, showing <i>N. neesiana</i> infestations in a wide mown zone along the bicycle path.	62
3.1	Location of the north-south section of the oxygen pipeline across the Laverton North Grassland, 13 April 2007.	69
3.2	Location of the oxygen pipeline at Laverton North in relation to the quadrats applied in this study and the historical quadrats investigated by other workers, based on their cited latitudes and longitudes.	71
3.3	The ‘reserve’ zone at the western end of Laverton North Grassland Reserve, 28 January 2008.	74
3.4	The ‘unmanaged’ zone on private land immediately west of the Laverton North Grassland Reserve, 28 January 2008.	74
3.5	The ‘pipeline’ zone, immediately west of Laverton North Grassland Reserve, 28 January 2008.	74
3.6	Variation in the cover of <i>N. neesiana</i> in quadrats along permanent transects at Yarramundi Reach grassland, 1993-2007.	76
3.7	Percent foliar cover of major species contributing to ground cover along transect B, Yarramundi Reach grassland, 23 May 2007.	77

3.8	Percent foliar cover of major species contributing to ground cover along transect D, Yarramundi Reach grassland, 23 May 2007.	77
3.9	Sequential cover/abundance ratings of major species and bare ground in quadrats along the oxygen pipeline at Laverton North grassland, 1990, 1991, 1994 and 2007.	78
4.1	Iramoo Wildlife Reserve, Cairnlea, Victoria, showing the land management units and the location of the field experiment.	90
4.2	Site of the disturbance experiment at Iramoo Grassland Reserve, Cairnlea, Victoria, 25 June 2007.	90
4.3	Plot layout and treatment regime in the disturbance experiment.	92
4.4	Monthly rainfall and number of rain days from January 2007 to November 2008, over the period of the disturbance experiment and the preceding six months.	96
4.5	Time trend of the mean number of <i>N. neesiana</i> plants per plot for each treatment over the course of the disturbance experiment.	101
4.6	Recruitment pattern of <i>N. neesiana</i> in the disturbance experiment in a 'full kill' plot with substantial establishment, 27 and 69 weeks after seed application.	102
4.7	Effects of 'full kill', 'half kill' and 'no kill' treatments in the disturbance experiment 15 weeks after herbicide treatment.	103
4.8	Mean projective foliar cover (%) of <i>N. neesiana</i> and all other plants combined, by kill treatment in seeded plots in the disturbance experiment c. 69 weeks after seed application.	104
4.9	Mean number of juvenile <i>N. neesiana</i> per plot by treatment in the disturbance experiment 27 weeks after seed application.	107
4.10	One of the largest plants in the disturbance experiment, fruiting for the first time, just prior to biomass harvest, 69 weeks after seed application.	110
5.1	Sampling 'pin' used in the study.	141
5.2	Distribution of <i>N. neesiana</i> , dead <i>T. triandra</i> , total <i>T. triandra</i> and other plant species along a pin transect at Yarramundi Reach, Patch G, 13 October 2007.	143
5.3	Relationship between the number of <i>N. neesiana</i> pin intersects at a transect point and the ratio of dead to living <i>T. triandra</i> pin intersects at that point, where the number of <i>T. triandra</i> pin intersects at the point was >9, at Yarramundi Reach patch G, 13 October 2007.	144
5.4	Distribution of <i>N. neesiana</i> , dead <i>T. triandra</i> , total <i>T. triandra</i> and other plant species along a pin transect at Yarramundi Reach peg 0884, 25 April 2008.	144
5.5	Relationship between the number of <i>N. neesiana</i> pin intersects at a transect point and the ratio of dead to living <i>T. triandra</i> pin intersects at that point, where the number of <i>T. triandra</i> pin intersects at the point was >9, at Yarramundi Reach peg	145

	0084, 25 April 2008.	
5.6	Distribution of <i>N. neesiana</i> , dead <i>T. triandra</i> , total <i>T. triandra</i> and other plant species along a pin transect at Yarramundi Reach peg 0885, 25 April 2008.	145
5.7	Relationship between the number of <i>N. neesiana</i> pin intersects at a transect point and the ratio of dead to living <i>T. triandra</i> pin intersects at that point, where the number of <i>T. triandra</i> pin intersects at the point was >9, at Yarramundi Reach peg 0085, 25 April 2008.	146
5.8	Distribution of <i>N. neesiana</i> , dead <i>T. triandra</i> , total <i>T. triandra</i> and other plant species along a pin transect at Dudley Street grassland peg 0886, 26-27 April 2008.	146
5.9	Relationship between the number of <i>N. neesiana</i> pin intersects at a transect point and the ratio of dead to living <i>T. triandra</i> pin intersects at that point, where the number of <i>T. triandra</i> pin intersects at the point was >9, at Dudley Street peg 0086, 26-27 April 2008.	147
5.10	Distribution of <i>N. neesiana</i> , dead <i>T. triandra</i> , total <i>T. triandra</i> and other plant species along a pin transect at Dudley Street grassland peg 0887, 27-28 April 2008.	147
5.11	Relationship between the number of <i>N. neesiana</i> pin intersects at a transect point and the ratio of dead to living <i>T. triandra</i> pin intersects at that point, where the number of <i>T. triandra</i> pin intersects at the point was >9, at Dudley Street peg 0087, 27-28 April 2008.	148
5.12	Distribution of <i>N. neesiana</i> , dead <i>T. triandra</i> and total <i>T. triandra</i> along a pin transect at Laverton North Grassland peg 0220, transect 11 March 2008.	148
5.13	Senescent <i>T. triandra</i> surrounded by <i>N. neesiana</i> at Yarramundi Reach grassland, ACT, 21 October 2008.	150
5.14	<i>Nassella neesiana</i> intrusion into senescent <i>T. triandra</i> , Yarramundi Reach grassland, ACT, 24 October 2008.	151
5.15	<i>Nassella neesiana</i> invasion front in the north-west section of Dudley Street grassland, 8 May 2007.	152
5.16	Remains of <i>T. triandra</i> tussocks after senescence dieback with seedlings of <i>N. neesiana</i> establishing, Dudley Street grassland, ACT, 13 October 2007.	153
5.17	<i>Nassella neesiana</i> invasion zone in an area previously occupied by senescent <i>T. triandra</i> at Dudley Street grassland, ACT, 8 May 2007.	153
6.1	Near-surface soil moisture transect from <i>N. neesiana</i> into senescent <i>T. triandra</i> , Yarramundi Reach, ACT, 17 and 22 October 2008, Transect D.	164
6.2	Near-surface soil moisture transect in a mown zone from <i>T. triandra</i> grassland into an <i>N. neesiana</i> patch at Yarramundi Reach, ACT, 19 and 22 October 2008.	165
7.1	Overlap between <i>N. neesiana</i> and <i>T. triandra</i> at the margins of <i>N. neesiana</i> patches	174

- at Yarramundi Reach and Laverton North grasslands.
- 7.2 Relationship between the area (m²) of *N. neesiana* patches and the mean number of native and exotic vascular plant species m⁻² inside the patches for all patches assessed at the three grasslands. 187
- 7.3 Relationship between the area (m²) of *N. neesiana* patches and the mean number of native vascular plant species m⁻² inside the patches for the three grasslands. 187
- 7.4 Chosen linear regressions of plant composition parameters inside *N. neesiana* patches: (a) relationship between the mean number of native grasses inside *N. neesiana* patches and patch area; (b) relationship between the mean number of native forb species inside *N. neesiana* patches and the mean number of native dicot species outside the patches; (c) relationship between the mean number of native dicots inside and outside *N. neesiana* patches; (d) relationship between the mean number of exotic grasses (excluding *N. neesiana*) inside and outside *N. neesiana* patches; (e) relationship between the mean number of exotic forbs inside and outside *N. neesiana* patches; (f) relationship between the mean number of exotic dicot species inside and outside *N. neesiana* patches. 190
- 7.5 Native *Bulbine bulbosa* in flower with rosettes of the exotic daisy *Hypochoeris radicata* in an *N. neesiana* patch at Yarramundi Reach Grassland, 22 October 2008. 191
- 8.1 A living individual of the exotic Small Pointed Snail *Cochlicella barbara* cemented to a dead leaf of *N. neesiana* at Laverton North Grassland, 12 February 2008. 224
- 8.2 Larval case of a grass case moth, Psychidae sp. on *N. neesiana* at Iramoo, Vic. 5 November 2008. 231
- 8.3 *Pterolocera* sp.; a. larva on *Austrostipa*, Crace, 17 October 2008; b. adult female and eggs, from Crace 12 October 2006 larva, collected and reared on *N. neesiana*. 232
- 8.4 Larva of *Anthela denticulata* eating *N. neesiana*, Iramoo grassland, Cairnlea, Victoria, 13 August 2008. 233
- 8.5 *Anthela ocellata* collected at Laverton North Grassland, 24 March 2007. a. larva after 14 weeks of rearing on *N. neesiana*; b. cocoon with *N. neesiana* leaves loosely attached. 234
- 8.6 *Persectania ewingii*; a. adult, pupal case and final instar larval exuvium; b. larva; collected as a final instar larva in the base of an *N. neesiana* tussock at Iramoo on 10 August 2007 and reared on *N. neesiana*. 234
- 8.7 *Pheidole* sp. minors working on excavations of awnless *N. neesiana* seeds solidly stuck upright in the ground at Iramoo, 21 January 2008. a. cooperative effort by three workers; b. single worker, previously removing soil has moved to the top of the seed in an attempt to lever it free from the ground. 235

- 8.8 *Pheidole* minor workers moving *Nassella trichotoma*, *Themeda triandra* and *Romulea rosea* seeds along a foraging trail towards the nest at Iramoo, 19 January 2008. 236
- 8.9 *Iridomyrmex* sp. removing artificially de-awned *N. neesiana* seeds dropped near a foraging trail at Laverton North Grassland, 29 November 2007. a. one method of carriage by an individual worker. b. workers cooperating to dislodge a seed wedged under plant debris. 236

List of tables

- 2.1 Measured and inferred rates of *N. neesiana* spread in New Zealand. 40
- 2.2 Areal extent of *N. neesiana* infestation, proportion of total area infested and calculated rates of expansion of infestations at Dudley Street grassland 1995-2005, based on air photo interpretation. 45
- 2.3 Areas of *N. neesiana* patch at Dudley Street compared by field measurement on 14 October 2007 and from interpretation of aerial photographs of 31 March 2001 and 21 January 2005. 45
- 2.4 Progressive change in area of *N. neesiana* patch at Dudley Street 2002-2008 by interpretation of Google Earth images. 47
- 2.5 Linear expansion of *N. neesiana* infestations at Dudley Street grassland 2001-2005 based on aerial photography and field measurements. 48
- 2.6 East-west diameter and distance north from road of the Dudley Street *N. neesiana* patch from Google Earth imagery 2002-2008. 48
- 2.7 Comparison of the size of *N. neesiana* patches at Yarramundi Reach grassland assessed by ground measurement and interpretation of 21 January 2005 aerial photograph. 51
- 2.8 Area of *N. neesiana* infestation and incorporated Patch A at Crace Grassland, assessed by on ground measurement and interpretation of Google Earth imagery. 52
- 2.9 Progressive change in area of *N. neesiana* infestation around patch A at Crace Grassland Reserve 2002-2008 by interpretation of Google Earth images. 52
- 2.10 Comparison of the size of *N. neesiana* patches at Laverton North Grassland assessed by ground measurements and interpretation of 24 January 2006 aerial photograph. 54
- 2.11 Selected estimates of changes in the area of *N. neesiana* infestations at four grasslands, derived from ground measurement and interpretation of aerial photographs. 58

3.1	Locations of permanent transects at Yarramundi Reach re-assessed for <i>N. neesiana</i> cover on 23 May 2007.	70
3.2	Location and date of assessment of quadrats at Laverton North Grassland in the April 2007 study.	72
3.3	Location and date of assessment of quadrats in the January 2008 zone survey at Laverton North.	73
3.4	Percent foliar cover of <i>N. neesiana</i> in quadrats along permanent transects at Yarramundi Reach.	76
3.5	Mean projective foliar cover of plant species and categories, litter cover and proportion of bare ground (%) in five 10 m ² quadrats in each of three management zones (Reserve, Unmanaged, Pipeline) at Laverton North, January 2008.	81
3.6	Mean numbers of native, exotic and total vascular plant species per 10 m ² in three management zones at Laverton North, January 2008.	81
4.1	Analysis of variance used for all treatment effects.	98
4.2	Soil analysis for the disturbance experiment site.	99
4.3	Median number of <i>N. neesiana</i> panicles m ⁻² , glume pairs m ⁻² , emerged awns m ⁻² , detached seeds m ⁻² and leaves/plant in the disturbance experiment.	102
4.4	Effects of kill treatments and <i>N. neesiana</i> seed application on biomass of vascular plant species and groups in the disturbance experiment 69 weeks after <i>N. neesiana</i> seed application.	105
4.5	Effects of kill and sugar treatments on the mean number of <i>N. neesiana</i> plants in the disturbance experiment 22 weeks after seed application.	106
4.6	Proportion of plots in which <i>N. neesiana</i> was present, 69 weeks after seed application, by seed and kill treatments.	107
4.7	Effect of kill and sugar treatment on <i>N. neesiana</i> mean above-ground biomass m ⁻² within seeded plots in the disturbance experiment 69 weeks after seed application.	108
4.8	Median <i>N. neesiana</i> biomass for those plots in the disturbance experiment with <i>N. neesiana</i> present, 69 weeks after seed application.	108
4.9	Effects of nutrient treatments on the mean biomass per <i>N. neesiana</i> plant in the disturbance experiment 69 weeks after seed application.	108
4.10	Effects of sugar, and nitrogen and phosphorus fertilisation on <i>N. neesiana</i> biomass 69 weeks after seed application within ‘full kill’ and seeded plots in the disturbance experiment.	109
4.11	Effects of nitrogen and phosphorus treatments on the mean number of <i>N. neesiana</i> plants m ⁻² in the disturbance experiment 22 weeks after seed application.	109
4.12	Effects of nitrogen and phosphorus fertilisation on mean biomass m ⁻² of <i>N. neesiana</i>	109

	within ‘full kill’ plots in the disturbance experiment 69 weeks after seed application.	
4.13	Effect of nitrogen on the median number of <i>N. neesiana</i> panicles m ⁻² , glume pairs m ⁻² , emerged awns m ⁻² , detached seeds m ⁻² and leaves m ⁻² within ‘full kill’ and seeded plots in the disturbance experiment.	111
4.14	Effect of phosphorus on the median number of <i>N. neesiana</i> panicles m ⁻² , glume pairs m ⁻² , emerged awns m ⁻² , detached seeds m ⁻² and leaves m ⁻² within ‘full kill’ and seeded plots in the disturbance experiment.	111
4.15	Effect of sugar on the median number of <i>N. neesiana</i> panicles m ⁻² , glume pairs m ⁻² , emerged awns m ⁻² , detached seeds m ⁻² and leaves m ⁻² within ‘full kill’ and seeded plots in the disturbance experiment.	111
4.16	Effect of sugar treatments on above-ground biomass of vascular plant species and groups in the disturbance experiment 69 weeks after <i>N. neesiana</i> seed application.	114
4.17	Effect of nitrogen fertilisation on above-ground biomass of vascular plant species and groups in the disturbance experiment 69 weeks after <i>N. neesiana</i> seed application.	115
4.18	Effect of phosphorus fertilisation on above-ground biomass of vascular plant species and groups in the disturbance experiment 69 weeks after <i>N. neesiana</i> seed application.	116
5.1	Locations, designations, dates and lengths of pin transect samples in areas of senescent <i>Themeda triandra</i> .	142
5.2	Slopes of fitted lines relating the ratio of dead/total <i>T. triandra</i> pin intersects at a transect pin point to the number of <i>N. neesiana</i> pin intersects at that point, where the number of <i>T. triandra</i> pin intersects at a point was >9.	149
6.1	Soil moisture transect samples at Yarramundi Reach grassland, October 2008.	162
6.2	Rainfall (mm) at the Australian National Botanic Gardens, Canberra, August to October 2008 and 1968-2010 averages.	163
6.3	Mean soil moisture (%) under <i>N. neesiana</i> and <i>T. triandra</i> along transects at Yarramundi Reach grassland, October 2008.	164
6.4	Significance testing of mean near-surface soil moisture under <i>N. neesiana</i> and <i>T. triandra</i> along selected transects at Yarramundi Reach grassland, October 2008.	164
7.1	Locations, areas and dates of assessment of <i>N. neesiana</i> patches used for vascular plant diversity studies.	176
7.2	Summary of the number of patches sampled, the number of 1 m ² quadrats sampled inside and outside the patches, the patch designations, patch areas and sampling dates at the three grasslands sampled for vascular plant diversity studies.	177
7.3	Occurrence and cover of unidentified taxa detected in floristic sampling and	177

	excluded from some analyses.	
7.4	Total numbers of native and exotic vascular plant species detected in the sampled quadrats inside and outside <i>N. neesiana</i> patches at each grassland, total native and exotic species m ⁻² , and the ratios of grasses to other species, native grasses to native forbs and of natives to exotics inside and outside patches.	180
7.5	Mean percent projective foliar cover of <i>N. neesiana</i> , all exotic grasses and native grasses in sampled quadrats inside and outside <i>N. neesiana</i> patches.	181
7.6	Analysis of mean foliar cover and mean species diversity of major plant categories inside and outside patches of <i>Nassella neesiana</i> at Yarramundi Reach grassland, ACT, May and October 2007.	182
7.7	Analysis of mean foliar cover and mean species diversity of major plant categories inside and outside seven patches of <i>Nassella neesiana</i> at Crace Grassland, ACT, 16-24 October 2008.	183
7.8	Analysis of mean foliar cover and mean species diversity of major plant categories inside and outside patches of <i>Nassella neesiana</i> at Laverton North Grassland, Vic., 25 November – 18 December 2007.	184
7.9	Mean number of native vascular plant species per square metre inside and outside <i>N. neesiana</i> patches at three grasslands.	185
7.10	Mean number of exotic vascular plant species (excluding <i>N. neesiana</i>) per square metre inside and outside <i>N. neesiana</i> patches at three grasslands.	186
7.11	The most parsimonious models identified by linear regression for the mean number of species m ⁻² inside <i>N. neesiana</i> patches.	188
7.12	P values for including and excluding terms in parsimonious linear regression models for each plant grouping.	189
7.13	Number of <i>Nassella neesiana</i> patches (out of 7) in which each vascular plant species was observed inside and outside the patch at Crace Grassland, ACT.	192
7.14	Number of <i>Nassella neesiana</i> patches (out of 15) in which each vascular plant species was observed inside the and outside the patch at Yarramundi Reach grassland, ACT.	193
7.15	Number of <i>Nassella neesiana</i> patches (out of 14) in which each vascular plant species was observed inside and outside the patch at Laverton North grassland.	195
7.16	Vascular plant s species (except <i>N. neesiana</i>) whose frequency was significantly or close to significantly different inside <i>N. neesiana</i> patches compared to outside the patches at the three grasslands.	196
7.17	Abundance and distribution, soil seed bank and disturbance response characteristics of floristic components of the vascular plant floras of temperate natural grasslands	200

	of south-eastern Australia.	
8.1	Sample site locations, dates and times of sampling and weather data for invertebrate search and sweep net samples.	216
8.2	Vegetation of the invertebrate sampling areas.	219
8.3	Effect of dominant grass type on the mean number of invertebrate species and individuals in search samples in the ACT in October 2007.	220
8.4	Effect of dominant grass type on the mean number of invertebrate species and individuals in search samples in the ACT in April 2008.	220
8.5	Effect of dominant grass type on the mean number of invertebrate species and individuals in search samples in the ACT in October 2008.	221
8.6	Effect of dominant grass type on the number of mean number of invertebrate species and individuals in search samples in the ACT, averaged over three sampling occasions.	221
8.7	Effect of dominant grass type on the mean number of invertebrate species and individuals in search samples in Victoria, averaged over March sampling occasions.	221
8.8	Effect of dominant grass type on the mean number of invertebrate species and individuals in search samples, averaged over all autumn sampling occasions in Victoria and the ACT.	222
8.9	Effect of dominant grass type on the mean number of invertebrate species and individuals in search samples, averaged over all ‘spring’ sampling occasions.	222
8.10	Number of individuals of the Portuguese Black Millipede <i>Ommatoiulus moreletii</i> and the native millipede <i>Onocladosoma</i> sp. detected by search sampling in grassland dominated by <i>N. neesiana</i> or <i>T. triandra</i> at Dudley Street and Constitution Avenue, ACT, October 2007 and April 2008.	222
8.11	Effect of dominant grass type on the mean number of invertebrate species and individuals in sweep net samples, averaged over all autumn sampling occasions.	223
8.12	Effect of dominant grass type on the mean number of invertebrate species and individuals in sweep net samples, averaged over all ‘spring’ sampling occasions.	223
8.13	Some commonly occurring taxa in sweep net samples inside and outside <i>N. neesiana</i> patches, showing the number of samples in which the taxon occurred and the total number of individuals of the taxon.	224
8.14	Observations of invertebrates, excluding Orthoptera, on <i>Nassella neesiana</i> , <i>Themeda triandra</i> and associated native and exotic grasses.	225
8.15	Observations of field host grasses of Orthoptera and grasses eaten in captivity.	228