Amenity migration and the changing nature of invasive plant management: a case study of Bega Valley, New South Wales, Australia

Shaun McKiernan

Follow this and additional works at: https://ro.uow.edu.au/theses1
Amenity migration and the changing nature of invasive plant management: a case study of Bega Valley, New South Wales, Australia

Shaun McKiernan

Bachelor of Arts (Honours Class I)

This thesis is presented as part of the requirements for the conferral of the degree:

Doctor of Philosophy (PhD)

Supervisors:
Associate Professor Nicholas Gill
Dr Jennifer Atchison

The University of Wollongong
School of Geography and Sustainable Communities

April 2018
This work © copyright by Shaun McKiernan, 2018. All Rights Reserved

No part of this work may be reproduced, stored in a retrieval system, transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior permission of the author or the University of Wollongong.

This research has been conducted with the support of an Australian Government Research Training Program Scholarship.
Declaration

I, Shaun McKiernan, declare that this thesis is submitted in partial fulfilment of the requirements for the conferral of the degree Doctor of Philosophy, from the University of Wollongong, is wholly my own work unless otherwise referenced or acknowledged. This document has not been submitted for qualifications at any other academic institution.

_____________________________
Shaun McKiernan

October 26, 2017
Abstract

Invasive plants pose serious challenges to the conservation of biodiversity and natural resources. In many rural communities in Australia, invasive plants are causing significant economic impacts on agriculture, grazing and forestry. However, despite the need to control invasive plants, management is far from straightforward. As rural landscapes undergo increasing lifestyle-orientated rural land ownership and the retreat of agriculture, invasive plant management is becoming increasingly complicated. The social heterogeneity of these ‘rural-amenity landscapes’ is changing how weed impacts are prioritised—from production to conservation—as well as the motivations and abilities of landholders to respond. Further, invasive plants can at times exceed human control, and despite the best efforts of managers, drive novel ways of living with these species. In this context, invasive plant management is more than the sum of ecological science that defines species’ invasiveness and the characteristics of landscapes that are ‘invadeable’, but is also bound within these complex and ongoing social and ecological relations. The inextricably social and environmental relationships that are changing the makeup of rural landscapes and invasive plant management are at the core of this thesis.

This thesis examines the human and more-than-human relationships that shape landholders’ attitudes and actions toward invasive plant management in a rural landscape in southeast Australia. It builds on growing national and international research on the changing social and environmental composition of rural landscapes, which is creating new, or perpetuating existing, natural resource management problems. Focusing on individual landholders’ and local government agency staff’s management attitudes, knowledge, and practices, I investigate the following: (1) whether increasing social heterogeneity is complicating attempts to coordinate invasive plant management across individual land parcels; and (2) how landholders’ management decisions are formed by, but also challenged by ecological conditions.

To investigate these questions a qualitative case study project was carried out in Bega Valley, New South Wales, Australia. The primary method involved narrative and walking interviews with landholders and natural resource management agency staff. The qualitative material resulting from these investigations provided insights into the personal, social, and environmental factors shaping landholders’ knowledge and practices of invasive plant management.

The thesis develops a complex and novel understanding of invasive plant management in a changing rural landscape. I demonstrate how landholders’ management knowledge, attitudes and actions toward invasive plants are bound within existing land use aspirations, social norms and
environmental processes. While existing research has provided valuable information into the cause-and-effect relationship between amenity migration and invasive plant distribution and management, this thesis reveals the complex interplay between values and practices that unsettles simplistic linear framings. The thesis focuses on the social and ecological agencies that reshape how landholders learn to both manage and live with invasive plants in the broader context of personal land use goals and external legal and social pressures. I illustrate how plants can escape the control of landholders and managers, shaping novel ways of living with these species outside of legal and discursive framings. Socially, I draw attention to the relationships that enhance or impede cross-property management of invasive plants. Rather than positioning amenity migration as either creating positive or negative outcomes for invasive plant management, this thesis details the relational construction of management knowledge that both complicates and facilitates collective responses to invasive plant management.

This thesis concludes with two related recommendations. First, invasive plant management in rural-amenity landscapes will benefit from apprehending the construction and deployment of management values into practice. Examining the human and nonhuman relationships that reshape or confront landholders’ management values illuminates the challenges of coordinating cross-property management, as well as the ways in which people learn and develop management responses in spaces of uncertainty. Second, in taking seriously the construction and deployment of management values, land managers might be better equipped to coordinate and respond to invasive plants issues in increasingly diverse and unpredictable social and ecological landscapes.
Statement of Authorship

The journal articles that constitute Chapters 2 – 5 of this thesis (outlined below) are primarily based on research carried out by the PhD candidate, Shaun McKiernan, during the period of candidature. Shaun designed the study and collected, analysed and interpreted data. Shaun is the lead or sole author of all journal article submissions in this thesis and wrote the first draft of each manuscript before responding to the editorial suggestions of his co-authors, Nicholas Gill and Jennifer Atchison where relevant. Shaun has been solely responsible for submitting each manuscript for publication to the relevant journals. The journal articles in this thesis were written under an agreement between Shaun McKiernan and the principal supervisor, Associate Professor Nicholas Gill, that the thesis by compilation format be used.

Chapter 2  Shaun McKiernan, Nicholas Gill and Jennifer Atchison (In Preparation)
More-than-native, more-than-invasive: examining how environmental change and legislation affects the everyday management practices of rural landholders

Chapter 3  Shaun McKiernan, Nicholas Gill and Jennifer Atchison (Under Review)
Watching the grass grow: how landholders learn to manage with an invasive plant in conditions of uncertainty

Chapter 4  Shaun McKiernan and Nicholas Gill (In Preparation) Invasive plants, amenity migration and challenges for cross-property management: opening the black box of the property-centric landholder

Acknowledgements

I would like to acknowledge a number of individuals in the completion of this dissertation. First and most strongly, thanks goes to my supervisors Nicholas Gill and Jennifer Atchison for their tireless reading of multiple drafts and constant support throughout the process. Nick, your encouragement and guidance has been valuable in providing me with the freedom to develop the thesis, while also offering the pragmatic advice needed for its completion. Jen, your encouragement and valuable suggestions have pushed me to achieve something beyond what I would have otherwise been comfortable with. You have both provided unwavering support, for which I am truly grateful.

The research would not have been possible without the landholders who volunteered their time, and kindly allowed me into their homes and properties to share their knowledge. Thanks to the many staff of the South East Local Land Services and the Far South Coast Landcare Association for assisting in the recruitment process. I am particular grateful to Graham Scott, Andrew Taylor, Wayne Schaefer, Rod Logan, Derek Lewis, and Dave Newell for opening their doors to me and encouraging landholders to participate in the research project. A special thanks to Josh Dorrough who not only helped in the recruitment process, but provided valuable information on invasive plants, and Bega Valley’s ecosystem, more generally.

The research benefitted greatly from research funding from the Australian Research Council Discovery Project: DP130102588 that I was fortunate to be a part of. Thanks to Laurie Chisholm and Chris Owers for providing spatial data for the broader ARC project that I adapted into this thesis. Thanks also to Natalia Adan for providing valuable research assistance for myself, and the broader ARC project.
Thanks also to the postgrads and staff that make AUSCCER a wonderful place to do research. In particular, thank you to Charlie Gillon, Alex Tindale, Ananth Gopal, Victoria Ikutegbe, Nick Skilton, Sophie-May Kerr, Elyse Stanes, and Justin Westgate for providing support as well as timely distractions during the PhD process. Thanks also to Elyse Stanes for providing technical support that made data collection and storage a lot more manageable. Thanks to Noel Castree for providing valuable theoretical advice and reassurance. Thanks to Chris Gibson and Chris Brennan-Horley for ongoing academic and professional advice and encouragement.

And finally, thank you to my partner Lauren, and to all my friends and family for their support and advice along the way.
# Table of Contents

Declaration.................................................................................................................................. ii  
Abstract..................................................................................................................................... iii  
Statement of Authorship............................................................................................................. v  
Acknowledgements.................................................................................................................... vi  
Table of Contents .................................................................................................................... viii  
List of Tables ............................................................................................................................ xii  
List of Figures .......................................................................................................................... xiii  
List of Boxes ............................................................................................................................ xiii  
List of Abbreviations................................................................................................................ xiv  

1 Introduction......................................................................................................................... 1  
  1.1 Invasive plants and changing rural landscapes .............................................................. 1  
  1.2 Research aim and objectives ......................................................................................... 6  
  1.3 The coproduction of invasive plants............................................................................. 7  
  1.4 Amenity migration and invasive plant management.................................................... 13  
  1.5 Theoretical framework: uncovering the co-construction and deployment of Nature... 17  
  1.6 Mobilising relational thinking for invasive plant management..................................... 24  
  1.7 Methodology ............................................................................................................ 27  
    1.7.1 Uncovering the coproduction of knowledge and amplifying partial realities ...... 27  
    1.7.2 Choosing the study site ....................................................................................... 29  
    1.7.3 Case Study: Bega Valley....................................................................................... 31  
    1.7.4 History of land use ............................................................................................. 33  
    1.7.5 Changing land uses and landholders.................................................................... 34  
    1.7.6 Participants ......................................................................................................... 37  
  1.8 Methods ..................................................................................................................... 39  
    1.8.1 Participant interviews .......................................................................................... 39  
    1.8.2 Participant observation: walking interviews......................................................... 41
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.8.3</td>
<td>Additional methods</td>
<td>45</td>
</tr>
<tr>
<td>1.9</td>
<td>Chapter outlines</td>
<td>46</td>
</tr>
<tr>
<td>2</td>
<td>More-than-native, more-than-invasive: examining how environmental</td>
<td>49</td>
</tr>
<tr>
<td></td>
<td>change and legislation affects the everyday management practices</td>
<td></td>
</tr>
<tr>
<td></td>
<td>of rural landholders</td>
<td></td>
</tr>
<tr>
<td>2.1</td>
<td>Introduction</td>
<td>51</td>
</tr>
<tr>
<td>2.2</td>
<td>Environmental change and management challenges</td>
<td>55</td>
</tr>
<tr>
<td>2.2.1</td>
<td>Management values in changing environments: impact discourses and</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td>vernacular disjunctures</td>
<td></td>
</tr>
<tr>
<td>2.2.2</td>
<td>Toward a more adaptive form of environmental governance</td>
<td>60</td>
</tr>
<tr>
<td>2.3</td>
<td>Case study: Bega Valley and the changing nature of environmental</td>
<td>61</td>
</tr>
<tr>
<td></td>
<td>management</td>
<td></td>
</tr>
<tr>
<td>2.3.1</td>
<td>Native vegetation: protection and problems</td>
<td>63</td>
</tr>
<tr>
<td>2.3.2</td>
<td>Hate to lovegrass</td>
<td>68</td>
</tr>
<tr>
<td>2.4</td>
<td>Discussion</td>
<td>73</td>
</tr>
<tr>
<td>2.4.1</td>
<td>Impact discourses for environmental management: challenges and</td>
<td>73</td>
</tr>
<tr>
<td></td>
<td>possibilities</td>
<td></td>
</tr>
<tr>
<td>2.4.2</td>
<td>Overcoming vernacular disjunctures and responding to environmental</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>change: the role of new environmental governance</td>
<td></td>
</tr>
<tr>
<td>2.5</td>
<td>Conclusion</td>
<td>79</td>
</tr>
<tr>
<td>3</td>
<td>Watching the grass grow: how landholders learn to manage with an</td>
<td>83</td>
</tr>
<tr>
<td></td>
<td>invasive plant in conditions of uncertainty</td>
<td></td>
</tr>
<tr>
<td>3.1</td>
<td>Introduction</td>
<td>85</td>
</tr>
<tr>
<td>3.2</td>
<td>Learning and the 'environment' in learning studies</td>
<td>88</td>
</tr>
<tr>
<td>3.3</td>
<td>Relational learning and existing approaches</td>
<td>90</td>
</tr>
<tr>
<td>3.4</td>
<td>Context: African lovegrass and uncertainty</td>
<td>94</td>
</tr>
<tr>
<td>3.5</td>
<td>Methods</td>
<td>96</td>
</tr>
<tr>
<td>3.6</td>
<td>Learning with African lovegrass</td>
<td>98</td>
</tr>
<tr>
<td>3.6.1</td>
<td>Discovery</td>
<td>98</td>
</tr>
<tr>
<td>3.6.2</td>
<td>Response</td>
<td>99</td>
</tr>
<tr>
<td>3.6.3</td>
<td>Personal learning</td>
<td>102</td>
</tr>
<tr>
<td>Section</td>
<td>Title</td>
<td>Page</td>
</tr>
<tr>
<td>---------</td>
<td>------</td>
<td>------</td>
</tr>
<tr>
<td>3.6.4</td>
<td>Learning to live with</td>
<td>104</td>
</tr>
<tr>
<td>3.7</td>
<td>Conclusions</td>
<td>106</td>
</tr>
<tr>
<td>4</td>
<td>Invasive plants, amenity migration and challenges for cross-property management: opening the black box of the property-centric landholder</td>
<td>111</td>
</tr>
<tr>
<td>4.1</td>
<td>Introduction</td>
<td>113</td>
</tr>
<tr>
<td>4.2</td>
<td>Amenity migration and shifting management priorities</td>
<td>116</td>
</tr>
<tr>
<td>4.2.1</td>
<td>Property-centrism and the implications for cross-property management</td>
<td>118</td>
</tr>
<tr>
<td>4.2.2</td>
<td>Invasive plants and collective action</td>
<td>120</td>
</tr>
<tr>
<td>4.3</td>
<td>Methodology</td>
<td>122</td>
</tr>
<tr>
<td>4.3.1</td>
<td>Empirics</td>
<td>126</td>
</tr>
<tr>
<td>4.3.2</td>
<td>Conservationist and regenerative NRLs</td>
<td>126</td>
</tr>
<tr>
<td>4.3.2</td>
<td>Lifestyle Agrarians</td>
<td>132</td>
</tr>
<tr>
<td>4.4</td>
<td>Discussion</td>
<td>136</td>
</tr>
<tr>
<td>4.4.1</td>
<td>Property-centrism: a more critical framework</td>
<td>136</td>
</tr>
<tr>
<td>4.4.2</td>
<td>Property-centrism and collective action: challenges and possibilities</td>
<td>138</td>
</tr>
<tr>
<td>4.5</td>
<td>Conclusion</td>
<td>141</td>
</tr>
<tr>
<td>5</td>
<td>Managing invasive plants in a rural-amenity landscape: the role of social capital and Landcare</td>
<td>145</td>
</tr>
<tr>
<td>5.1</td>
<td>Introduction</td>
<td>147</td>
</tr>
<tr>
<td>5.2</td>
<td>Conceptual background</td>
<td>150</td>
</tr>
<tr>
<td>5.2.1</td>
<td>Rural-amenity migration and the changing nature of environmental management</td>
<td>150</td>
</tr>
<tr>
<td>5.2.2</td>
<td>Landcare and social capital</td>
<td>152</td>
</tr>
<tr>
<td>5.2.3</td>
<td>Framing social capital and collective action: trust and social norms</td>
<td>154</td>
</tr>
<tr>
<td>5.3</td>
<td>Case study: Tindale Valley Landcare and invasive plants</td>
<td>156</td>
</tr>
<tr>
<td>5.4</td>
<td>Methodology</td>
<td>158</td>
</tr>
<tr>
<td>5.5</td>
<td>Results</td>
<td>160</td>
</tr>
<tr>
<td>5.5.1</td>
<td>Building trust, delivering action</td>
<td>160</td>
</tr>
</tbody>
</table>
5.5.2 The social norms of invasive plant management.................................164

5.6 Discussion..................................................................................................................167

5.6.1 Collective action in rural-amenity landscapes: the role of key leaders..............168

5.6.2 Contingencies for collective action.................................................................170

5.7 Conclusion.................................................................................................................172

6 Conclusion.....................................................................................................................175

6.1 Amenity migration and the changing nature of invasive plant management..........175

6.2 Theoretical contribution: combining cultural geography with natural resource
management..................................................................................................................177

6.3 Practical contribution: future directions for invasive plant management in rural-amenity
landscapes.......................................................................................................................180

6.4 Research limitations...............................................................................................185

6.5 Future research........................................................................................................188

References......................................................................................................................191

Appendix A: Participant Recruitment Flyer .................................................................223

Appendix B: Participant Information Sheet for Landholders.........................................225

Appendix C: Consent Form for Landholders .................................................................229

Appendix D: Indicative interview schedule (for landholders) .......................................230

Appendix E: Indicative Interview Schedule (for managers) .........................................232

Appendix F: Participant Weed Diary .............................................................................233

Appendix G: Using NVivo Interview Analysis Framework ........................................234
List of Tables

Table 1.1 New South Wales Far South Coast statistical division: agricultural production by industry per farm business in 2011 ................................................................. 34

Table 1.2 Average per farm financial performance, New South Wales beef industry .......... 35

Table 1.3 Land parcel subdivision in Bega Valley LGA: 2001–2012 ................................. 36

Table 1.4 Area of land cover based on primary land uses, Bega Valley LGA .................. 36

Table 1.5 Participant typology: Bega Valley, New South Wales, Australia ....................... 38

Table 2.1 Area of land cover based on primary land uses, Bega Valley LGA ................. 62

Table 2.2 Average per farm financial performance, New South Wales beef industry ....... 62

Table 3.1 Applications of learning theories in NRM, and the role of the environment ......... 89

Table 3.2 Landholder recollections of learning that their property had ALG, and that it is a serious weed .................................................................................................................. 99

Table 3.3 Landholder’s initial point of contact for managing ALG and the absence of knowledge about best practice ................................................................. 100

Table 3.4 Landholder observations and strategies in learning how to manage ALG ........... 102

Table 3.5 Landholders learning to live with ALG ............................................................. 104

Table 4.1 Area of land cover based on primary land uses, Bega Valley LGA ............... 123

Table 4.2 Land parcel subdivision in Bega Valley LGA: 2001–2012 ............................... 123

Table 4.3 Participant typology: Bega Valley, New South Wales, Australia ..................... 124

Table 5.1 Land parcel subdivision in the broader LGA: 2001–2012 ............................... 157

Table 6.1 Recommendations for policymakers and practitioners responding to management uncertainty in Bega Valley ................................................................. 182

Table 6.2 Recommendations for practitioners to improve collection action in Bega Valley . 184
List of Figures

Figure 1.1 Study site: Bega Valley, New South Wales, Australia.................................32
Figure 1.2 Participant property map, Candelo, Bega Valley..........................................41
Figure 2.1 An example of Poa tussock (foreground) and Black Wattle (background) on a participant’s property, Brogo, Bega Valley.................................................................67
Figure 2.2 A slashed strip in a paddock of African lovegrass, Candelo, Bega Valley.........71
Figure 3.1 A paddock that has been boom-sprayed with herbicide to remove ALG and re-introduce more preferable grasses (the brown area illustrates the extent and success of the herbicide application), Mogilla, Bega Valley.................................................................101
Figure 4.1 The before and after of Steve’s experiment to use goats for managing Blackberry (April-November 2014), Toothdale, Bega Valley.................................................................129
Figure 4.2 A neighbouring property with heavy African lovegrass (golden area) and Blackberry infestations (black/dark green patches), Kameruka, Bega Valley.................................131

List of Boxes

Box 1 Positionality Statement.........................................................................................44
List of Abbreviations

**ALG**  African lovegrass (*Eragrostis curvula*)

**CBNRM**  Community-Based Natural Resource Management

**LGA**  Local Government Area

**LLS**  Local Land Services

**NEG**  New Environmental Governance

**NRL**  New Rural Landholder

**NRM**  Natural Resource Management

**NSW**  New South Wales

**PVP**  Property Vegetation Plan

**RAMA**  Routine Agricultural Management Activities

**TVL**  Tindale Valley Landcare
1 Introduction

1.1 Invasive plants and changing rural landscapes

Invasive plants pose major threats to global biodiversity and impose substantial costs on agriculture (Pyšek and Richardson 2010; Simberloff et al. 2013). Invasive plants are defined as those species that naturalise or independently establish and produce reproductive progeny at considerable distance from parent plants\(^1\) (Richardson et al. 2000). Originating from global movements—both natural and human mediated—invasive plants overcome geographic, environmental, and dispersal barriers, effectively colonising disturbed and undisturbed ecosystems (Pyšek et al. 2012). These species are labelled problematic when they damage environments, the economy or human health. Ecologically, invasive plants can cause rapid and dramatic degradation, biodiversity loss, and homogenisation of regional biotas with significant impacts on ecosystem services (Vilà et al. 2011). Further, invasive plants can affect the functioning of ecosystems by changing the availability of resources, impacting native species richness and biodiversity (Hobbs et al. 2013; Pyšek et al. 2012). Economically, most expenses are calculated by management costs, including eradication, control, monitoring and environmental education programs. The most affected sectors incurring these costs are agriculture, forestry, health sectors, aquaculture, forestry and nature conservation (Pyšek and Richardson 2010). Research also documents plant invasions result in declining recreational or cultural heritage values of certain landscapes (Parker et al. 1999; Reid et al. 2009).

In Australia, more than 2770 exotic plant species are naturalised, of which 65% are considered a problem for natural environments, and approximately 35% considered a problem for agricultural

\(^1\) I have used this definition as a means to broadly categorise how invasive plants are classified within the ecological sciences. I provide a more comprehensive review of the disagreements and nuance in defining invasive plants in section 1.3.
systems (Coleman et al. 2015). It is estimated environmental weeds in Australia alone cost between $3.5 and $4.4 billion annually, and that the cost to local and central government on monitoring, control, management, and research is $116.4 million (Sinden et al. 2004\(^2\)). In rural Australia, invasive plants are particularly problematic. As Graham (2014: 87) states, ‘almost three-quarters of Australian farms are affected by weed-related issues and four-fifths of farms undertake activities to prevent or manage weeds.’ In farmlands, invasive plants threaten productivity when they invade crops, smother pastures, and, in rare cases, harm livestock (DiTomaso 2000). Invasive plants compete for water, sunlight and nutrients that can reduce crop yields and quality (Driscoll et al. 2014). This can lead to detrimental impacts on the production of livestock as certain plants slow animal weight gain, reduce the quality of meat, milk, wool or hides, and can even poison livestock. The net result is a significant increase in the costs of managing and producing livestock.

The combination of ecological and economic impacts of invasive plants is predicted to worsen under climate change. As Bradley et al. (2010: 310) note, ‘rising temperatures, altered precipitation, increased atmospheric carbon dioxide (CO2), [and] nitrogen (N) deposition’ has the potential to alter the distribution and impact of invasive plants. This is attributed to the traits of invasive species—broad environmental tolerances, short juvenile periods and long-distance dispersal—which allow them to persist in a changing environment compared with non-invasive species (Hellmann et al. 2008). Climate change may not only influence the distribution of invasive plants, but can also limit the effectiveness of existing management strategies (Hulme 2017). Managing invasive plants may become more challenging ‘if their fecundity, resilience to management (e.g. regrowth potential) or resistance to pesticides increases under climate change’ (Hulme 2017: 1298). The impacts of climate change on invasive plant management are uncertain.

\(^2\) A recent review by Hoffman and Broadhurst (2016) on the cost of invasive species in Australia still reference this figure when discussing the costs invasive plants, as does the Invasive Plant and Animals Committee’s (2016) ‘Australian Weeds Strategy 2017 to 2027’.
This uncertainty includes how ecosystems will be affected by invasive plants, but also how effectively managers will be able to respond.

The current challenges and future uncertainty presented by invasive plants raise important ecological and social questions concerning how people live with invasive plants and the outcomes for natural resource management (hereafter NRM) (Head et al. 2015a; Larson et al. 2013). Invasive plants and invasive plant management are bound within social relationships. This includes how plants become defined as invasive, how impact is measured, and the ongoing social and ecological processes and relationships that contribute to the introduction and spread of invasives. Social science research has documented the diverse perceptions, knowledge and skills among different communities toward invasive plants (Head 2017). Uncovering the social dimensions of invasive plant management reveals how the public’s experiential knowledge of invasive plants can both complement as well as conflict with the advice of ecological scientists. The diverse values and experiences of the public may be at odds with management principles from the natural sciences—for example native and non-native classifications (Sharma and Khandelwal 2010; Trigger et al. 2008)—or alternatively provide local knowledge that can assist in developing management responses (Bart and Simon 2013). In this context, invasive plant management is more complicated than simply providing the public with scientific information to act upon, but is also bound within existing social values and norms (Crowley et al. 2017; Larson 2007a). The social complexity of invasive plant management requires further examination into the relationships where management knowledge is formed, contested and applied.

The social dimensions of invasive plant management are particularly evident in rural landscapes experiencing amenity migration. The recent acceleration of amenity migration to rural areas has led to a range of land use and environmental management issues being at the forefront of policy and academic debate (Abrams et al. 2012; Argent et al. 2009; Mendham et al. 2012). Amenity migration, ‘defined broadly as the movement of largely affluent urban or suburban populations
to rural areas for specific lifestyle amenities’ (Abrams et al. 2012: 270), is diversifying the social, cultural and economic attributes of rural areas (Klepeis et al. 2009). As a result, these ‘rural-amenity landscapes’ are now characterised by a heterogeneous mix of landowners and land use types, shifting values from land productivity to natural amenities (Holmes 2006). This multi-scalar change is a complex process that is recreating rural landscapes via material transformations and via the ideals and imperatives driving this migration and subsequent land management (Abrams et al. 2012), with particular implications for invasive plant management.

Amenity migration complicates invasive plant management in two primary ways. First, amenity migration contributes to the broader biophysical change to rural landscapes though land subdivision and residential development (Abrams et al. 2012). The proliferation of land parcels creates new houses, gardens, roads, firebreaks and fencelines affecting flora and fauna (Gill et al. 2010; Maestas et al. 2003). The cause-and-effect relationship between amenity migration and biophysical change has also been observed to increase the distribution of invasive plants and raise the relative costs of control (Epanchin-Niell et al. 2010; Klepeis et al. 2009).

Second, research demonstrates the consequences of property turnover for cross-property management issues, including invasive plants (Marshall et al. 2016; Mendham et al. 2012). Amenity migrants—popularly referred to as ‘tree changers’ or ‘sea changers’ in Australia—have diverse conceptions of rurality that produce particular environmental changes (Gill et al. 2010). Amenity migrants alter landscapes through their own dispositions (e.g. preferences for exotic tree plantings rather than local natives) as well as their level of interest and skill in land management. In this context, amenity migrants may directly contribute to invasive plant problems through introducing species with the potential to become invasive (Yung and Belsky

---

3 Tree change and sea change are Australian terms that describe the migration of people from cities to rural coastal or inland areas for natural and/or cultural amenities and a change in lifestyle. Amenity migrant encapsulates both nomenclatures.
or by allowing invasive species to spread from their property due to ineffective management (Epanchin-Niell et al. 2010). While the environmental changes associated with amenity migration can be understood as recreating and reconstituting rural spaces, such processes are highly contextual and are not necessarily problematic. This thesis responds to Abram et al.’s (2012: 279) call for research on rural-amenity landscapes to go ‘beyond direct cause-and-effect relationships (e.g. the effects of roads, fences and housing development on existing ecosystems) to broader understandings of the complex interactions between individual actors, social processes, and ecologies.’ Such a response allows for a more detailed and context specific understanding of how invasive plants are defined, prioritised and managed across a range of landholder types.

Invasive plant management not only requires understanding the biophysical processes contributing to the spread of invasive plants, but also social and cultural values underpinning management decisions (Everts 2015; Head 2017; Robbins 2010). As Head (2017: 17075) asserts, ‘social complexity must be added to ecological complexity to understand the causal relationships underlying invasions’. Cultural analyses—such as those by cultural geographers—are particularly germane for identifying areas of conflict and compatibility among different groups of people engaged in invasive plant management. Rural-amenity landscapes provide an ideal setting to consider the social and cultural dimensions of invasive plant management. In rural landscapes that are undergoing increasing social and ecological diversity, the ability to coordinate management action is complicated by the increasing number of land parcels and the diversifying motivations and skills of amenity migrants (Epanchin-Niell et al. 2010; Marshall et al. 2016). Accordingly, research is required that not only documents biophysical change, but critically examines people’s attitudes, values and behaviours that affect the outcomes of invasive plant management.
1.2 Research aim and objectives

This project investigates how rural landholders in Bega Valley—located on the south coast of New South Wales, Australia—navigate the challenges of invasive plant management in the context of dynamic social and ecological change. The research is a response to the reality of land cover fragmentation and land use change occurring in rural Australia that is recreating rural landscapes and producing novel environmental management problems. However, rather than documenting the cause-and-effect relationship between land fragmentation and the distribution of invasive plants, I am concerned with unpacking the relationships between social, economic and ecological factors that manifest in landholders’ management decisions and practices. This is an attempt to move beyond framing amenity migration in either positive or negative terms, and to instead grapple with the everyday practices and relations where invasive plant management knowledge is formed, practiced, and challenged in a changing social and ecological landscape. Therefore, my aim in this thesis is to critically interrogate how rural landholders come to define, manage and at times, live with invasive plants against a backdrop of social and ecological change.

This aim is driven by the practical challenge facing rural landholders and land managers of how to prioritise and manage invasive plants in the context of social and ecological change. However, it also addresses the wider theoretical motivations of the thesis that concern the discourses and practices of environmental management in rural-amenity landscapes. Both the theoretical and practical ambitions of the thesis are outlined in the objectives below. In particular, these questions aim to combine cultural geography perspectives on nature and the environment with those from the field of NRM in order to build a robust conceptualisation of the social and cultural dimensions of invasive plant management, while also offering practical recommendations.
In order to achieve this aim I will:

1. Document and analyse how people learn about the invasiveness of particular plants, and in turn develop the skills necessary to manage and, at times, live with these species;
2. Examine how landholders interpret and navigate environmental legislation in the context of personal land use goals and ecological change;
3. Assess whether the diversifying management values and goals of landholders—associated with amenity migration—impede collective action for invasive plant management.

The following sections examine the social dimensions of invasive plant management. In accordance with the aim and objectives above, I discuss the social and cultural process that come to define invasive plants and complicate attempts to establish management goals. First, focusing on how invasive plants are defined in the ecological sciences, I detail the difficulties in providing objective markers to direct management action across diverse social and ecological landscapes. Second, after outlining the social science critique of the invasion sciences, I return to amenity migration and the implications for invasive plant management. In particular, I demonstrate how the multiple meanings and values that amenity migrants attach to nature complicate attempts to establish a single management focus. Extending from the critiques of invasive plant and amenity migration discourses, I then outline the theoretical and methodological frameworks of the thesis. Both frameworks provide the mechanisms to uncover how management discourses are reformed, challenged and applied in a changing socio-ecological rural landscape.

1.3 The coproduction of invasive plants

Invasive plants have received significant attention in the social sciences and the humanities (Head 2017; Frawley and McCalman 2014). This research is driven by a commitment to animate the social, cultural and economic factors influencing the introduction and spread of invasive
plants. This, in part, is a response to what Robbins (2010: 141) refers to as the ‘modern model of invasion’, which views invasion events through the axiom: ‘right plant, right place, right time’.

Social science research in particular has critiqued both the representation of invasion events based on this model, and the values underpinning invasive plant management. However, I do not intend to evoke a binary representation of social science and natural science perspectives on invasive plants. Indeed, both perspectives are necessary, and often interwoven, in understandings of invasive plant distribution and management (Larson et al. 2013; Shackelford et al. 2013).

Rather, in extending the social science critique of invasion sciences, I intend to call attention to the limitations within this framework and the consequences of characterising invasion events in these terms. As will be discussed below, this includes how invasion events are studied, the language of invasive science, and the framings of the ‘social’ within invasive plant management.

Returning to Robbins’s (2010) modern model of invasion, this framing encapsulates the definitions of invasive plants within invasion sciences. While I set out a broad definition of an invasive plant in the opening paragraph, this is far from settled. Indeed, Pereyra’s (2016: 524) review of biological invasion research found that overall authors ‘neither define what an “invasive species” is nor explain which criterion is used for a species to be considered “invasive”.’ Attempts to categorise invasive species tend to focus on characteristics relating to dispersal, survival and reproduction at multiple sites (Blackburn et al. 2011). Most commonly, ecological research contains an unwritten assumption that the criterion of spread, dominance and impact render a species with these characteristics invasive (Ricciardi et al. 2013; Simberloff et al. 2013).

Recently, ecological research has aimed to move beyond locating invasiveness solely in terms of the properties of the plant, to consider the characteristics of the invaded ecosystem (Simberloff et al. 2013). This is depicted in studies that examine whether invasive plants are ‘drivers’ or ‘passengers’ of ecosystem change (Macdougall and Turkington 2005). Such analyses extend from
a growing body of literature in the invasive sciences that argues plant invasions cannot be explained solely on competitive ability, but also need to account for the broader context of ‘environmental change, evolutionary adjustment, and life history trade-offs’ (Macdougall and Turkington 2005: 53). This reassessment of invasive plants supports Robbins’s (2010) modern model of invasion critique that highlights the relationship between the characteristics of a species (adaptiveness, growth and reproductive rates), and the landscape (similar habitat, disturbance, and simplified) as the key factors determining invasion events. However, as Robbins (2010) identifies this model, or at least the current discourse within invasive sciences, presents invasion events only in terms of biophysical factors (plant properties and the ecological compositions of landscapes), and as a consequence, conceptually removes people from the landscapes being invaded.

While the ‘right place’ for a plant to invade may take into account the role of land cover change set in motion by human activity, the continued interactions between people and plants are often neglected in favour of a more ordered and binary understanding of invasion events (Robbins 2010). This neglect divorces the social from the natural, treating them as interacting parts, rather than co-constitutive wholes (Robbins 2001). Subsequently, invasion science tends to prioritise the biophysical aspects of invasion events (the characteristics of the plant and ecosystem), at the expense of diminishing the role of social and cultural histories and trajectories (Robbins and Moore 2013). Although invasive sciences acknowledge the role of anthropogenic processes in invasive events (e.g. human-mediated dispersal), in practice ecological studies reinforce a separation between humans and the rest of nature (Head et al. 2015a; Larson 2007b; Robbins 2001), isolating invasive species as a scientific issue that can be divorced from the social world (Bradshaw and Bekoff 2001).

The guillotine cleaving the social from the natural is partly an outcome of the language of invasion sciences. Invasion science is replete with dualisms used to direct management. As
Larson (2007b: 995) argues, ‘invasion biology relies upon an underlying dichotomy between nature/non-human/native and culture/human/non-native that exemplifies the exclusion of human beings from ecological systems.’ Most common, and which has been subject to continued debate, is the use of native/non-native classifications (Brown and Sax 2004; Chew 2015; Davis et al. 2011; Larson 2007a; Simberloff 2011; Warren 2007). Delineating native from non-native species has been a central foundation of invasive science and management. Applying native/non-native classifications equips ecological scientists and policymakers with a framework to prioritise the species and ecosystems to be protected (i.e. those native to a region), and cautions against species being introduced, or that have become established outside of their biogeographical range (Simberloff et al. 2013). In Australia, the native/non-native distinction holds significant power in the practical and symbolic engagements with biophysical environments and conservation practices (Head 2012; Trigger et al. 2010; Trigger and Head 2010; Martin and Trigger 2015). The 1788 baseline is often used as a marker for nativeness, however as Head (2000) observes, ‘the ‘natural landscape’ is a mirage, receding when approached. Even if found … it is of limited value … as it existed under different boundary conditions, particularly of climate’ (4, 118). Consequently, what constitutes nativeness is predicated on a temporal boundary between the before and after of European colonisation, rather than based on the properties of the plants themselves. This distinction obscures the broader historic transformations and movements of flora and fauna pre-European arrival as well as ignoring the impacts of native species transported beyond their endemic range.

In an attempt to overcome the criticism of the native and non-native classifications, invasion sciences, more recently, have emphasised ‘species’ impacts’ as the primary motivator for management interventions (Ricciardi et al. 2013; Simberloff et al. 2013; Parker et al. 1999; Vilá et al. 2011). In this context, impacts are loosely defined in terms of a species causing some kind of significant ecological change (Colautti and MacIsaac 2004). These impacts can also be extended
to other assets, including the economy. Impacts discourses are championed as an objective response to the native/non-native impasse, whereby science can observe ecological changes being caused by a species, and appropriately classify this as impact (Simberloff 2003; Richardson and Ricciardi 2013). However, impact discourses have not escaped criticism. First, ‘impact’ remains a rather vague category that is seldom defined (Pereyra 2016), making it impossible for an invasive species not to produce an impact (Ricciardi et al. 2013; Simberloff et al. 2013). Second, while the impact of a species can be measured objectively, the interpretation of these impacts invariably reveals inherent bias toward certain natures (Larson 2011; Chew and Carroll 2011). In this sense, impact discourses reveal more about the kinds of environments ecological scientists want to protect, rather than the inherent impacts of a particular species. As Tassin and Kull (2015: 168) explain, ‘what humans dislike about invasive species is not their effects on nature per se, but their effects on a particular desired nature.’ Moreover, invasive plant impacts are rendered harmful when they threaten a more desirable nature. This is problematic when the desired nature is a stable construct tied to a historic marker of nativeness.

At times, the ecological focus of the invasive sciences tends to treat species’ impacts as objective truths, rather than subjective interpretations of preferred environments. In this context, invasive scientists argue that we can objectively define the environments in need of protection, and therefore work toward excluding species that are likely to unsettle this baseline, primarily though using markers of nativeness (Russell and Blackburn 2017; Simberloff et al. 2013). However, invasion scientists’ commitment to native/non-native distinctions is not universal. More recently, invasion scientists recognise that management decisions should be based on a consideration of species harm, abundance, and the human role played in their arrival or expansion, rather than primarily on markers of nativeness (Larson et al. 2017; Van der Wal et al. 2015). Additionally, the concept of novel ecosystems indicates a shift away from prioritising management based on historic reference points, toward developing new practices to manage ecosystems that have
departed entirely and irreversibly from their historical ranges (Hobbs et al. 2013). However, the ongoing contestation over the validity of the novel ecosystem concept (Murcia et al. 2014), and the unwillingness to forgo native/non-native classifications (Rejmánek and Simberloff 2017; Simberloff and Vitule 2014), indicates that the invasive sciences remain attached to spatial and temporal management baselines.

The response of invasive scientists to disagreements in prioritising and managing invasive plants has been to inculcate a generalised concern about species origin, with the potential to omit other perspectives, including the publics (Rejmánek and Simberloff 2017). In this context, any disagreement between scientists and the public is presented as an issue of knowledge-deficit—the public lack the required information—rather than a more fundamental problem concerning how different groups come to value and know the natural world. Simberloff et al. (2013: 64) sums this position up clearly when stating invasive scientists’ ‘proper role as scientists, in terms of public discourse, is to educate citizens in a way that informs debate within society about how to think about and manage invasions.’ However, this ‘information deficit’ model has been repeatedly criticised as ineffective and disempowering for the public (Callon 1999; Owens 2000). For example, Crowley et al. (2017) identify that top-down approaches to directing management responses across the public can be inadequate for gaining acceptance and support, due to the public feeling disempowered or losing trust in institutions. Additionally, the risks of public dissatisfaction can be exacerbated when invasive species management relies on the use of hyperbole, emotive language, and selective evidence to guide decision-making (Crowley et al. 2017).

Returning to the initial critique of the modern model of invasion, the lack of critical engagement with the social dimension in invasion events leads to dissatisfactions between policymakers and those on-ground when implementing invasive plant management (Head et al. 2015a). In particular, in treating the public as a homogenous whole, the dominant ecological frameworks
fail to account for the social heterogeneity that challenges how invasive plants are defined and species’ impacts are interpreted (Crowley et al. 2016). Responding to invasion ecologists’ separation of social and ecological agencies, social researchers are placing greater emphasis on how invasive plants are entangled in the social and economic histories of different populations (Barker 2008; Everts and Benediktsson 2015; Forde and Magnussen 2015; Head et al. 2015a). As Robbins (2010: 147) states, ‘together, invasion definition, social preparation for invasion, and uneven distribution of invasion effects among people and other species indicate a cultural and political ecology of species invasion.’ Invasive plant management not only requires understanding the characteristics of the plant and the landscape that determines the likelihood of an invasion event, but also the ensuing relations between people and plants and the broader social, cultural, economic and political factors provisioning them. This thesis focuses on the latter to account for the competing discourses within invasive plant management, and also the human and more-than-human relationships where management knowledge and practices are reformed, applied and contested in a diverse social and ecological landscape.

1.4 Amenity migration and invasive plant management

The social science turn in invasive plant studies encourages research to examine the social and ecological relationships that shape people’s attitudes and decisions toward invasive plant management. Rural-amenity landscapes provide the ideal space to explore the relationship between socio-ecological change and invasive plant management. These landscapes are characterised by rapid ownership change, land parcel fragmentation, diverse ownership, and changing configurations of environmental issues as production, consumption, and protection values are reworked (Argent 2002; Holmes 2006). As rural landscapes transform it creates biophysical changes that may assist the entry and distribution of invasive plants. The social changes in rural landscapes also diversify the incentives and skills needed to manage invasive
plants (Epanchin-Niell et al. 2010; Marshall et al. 2016). Rural-amenity landscapes thus provide an appropriate setting to detail how plant invasions are not simply biophysical outcomes, but are tied into existing and changing socio-ecological networks.

In this thesis, I am concerned with the social and ecological relationships influencing invasive plant distribution and management. The social, in this context, comprises both the relationships between individuals, but also the cultural and economic factors influencing individual and group decision-making. The social, cultural, and economic heterogeneity of rural landscapes—and rural landholders—presents novel challenges for invasive plant management. Research tends to frame amenity migration as creating poor outcomes for invasive plant management, resulting from a reduction in coordinated control; poorer management skills among landowners; absentee ownership; lack of knowledge and experience to manage and identify weeds; diverse land use goals; and lack of incentive (Epanchin-Niell 2010; Coleman and Sindel 2011). Moreover, research highlights that amenity migrants’ desire for a particular rural aesthetic contributes to their management decisions, which may not be environmentally beneficial (e.g. introducing ornamental exotic species or managing species based on aesthetic preferences) (Cooke and Lane 2015a; Klepeis et al. 2009; Klepeis and Gill 2016). In Australia, Mendham and Curtis (2010) found that newer amenity-driven landowners in South Australia expressed greater concern about biodiversity and NRM; however such concern did not necessarily translate into effective land use practices. Similarly, Klepeis et al. (2009) found that processes of land transfer and weed management among amenity migrants often resulted in landscapes becoming more susceptible to invasive grasses. Whilst amenity migrants may have ambitions of a more ‘sustainable’ and ‘preserved’ nature, it needs to be acknowledged that there remain disparities between ambitions and their execution (Gill et al. 2010).

Alternatively, research demonstrates the potential benefits of amenity migration for invasive plant management. Despite their potential lack of knowledge or skill, many amenity migrants are
eager to learn and are committed to NRM, with increasing participation in Landcare and similar groups (Klepeis et al. 2009). Amenity migrants can also encourage a positive change in ownership when they replace existing owners who may have reduced management efforts due to low returns on agriculture and expectations of land sales (Gill et al. 2010). Further, Wilson (2008) identifies that these new landholders are not tied to existing management cultures of farmers, and instead bring enthusiasm for environmental stewardship, a willingness to try new things, and the resources to put their ideas into practice. Although agricultural motivations can assist weed management, amenity migrants express a strong commitment to control these species outside of financial incentives (Gill et al. 2010; Klepeis et al. 2009). As Klepeis et al. (2009) note, the land use goals of amenity buyers are strongly connected to ideas of nature and conservation, and these are the most important drivers in controlling invasive species.

The critiques of amenity migration on invasive plant management focus, in part, on the diverse social, cultural and economic drivers that remove a single management focus across rural landholders. However, more recently research has examined the conceptualisations and reproductions of nature across these different social groups in guiding land management decisions (Gosnell and Abrams 2011; Larsen et al. 2011). In particular, research illuminates how the constructions of nature across different landholder types complicate attempts to coordinate management across individual land parcels (Boucquey et al. 2012; Cadieux 2011; Haggerty and Travis 2006). Broadly speaking, this may include a desire for performing the rural idyll through pastoral uses such as farming and livestock grazing, or alternatively an aspiration for restoring rural land through conservation projects (Abrams et al. 2012). The diverse conceptualisations of nature are most transparent between amenity migrants who seek a rural retreat and celebrate putatively pristine, non-urban spaces, and farmers who aim to derive income from their land and as such require specific ecological conditions. This has been noted to create conflicts in addressing cross-property management issues relating to wildfire (Edwards and Gill 2015), forest
management (Meadows et al. 2013), wildlife conservation (Haggerty and Travis 2006), and invasive plant management (Klepeis et al. 2009; Epanchin-Niell et al. 2010). Additionally, Cadieux (2011: 344) identifies misunderstandings between amenity migrants and environmental managers that occur through the ‘slippage’ in meanings of nature between these groups.

Nature is a multifarious category that varies across and within social groups. As Cadieux and Taylor (2013: 3) describe, while amenity migration is ‘predicated partly on a desire for contact with nature and all that nature represents’, understandings of nature are multiple and are not easily reducible to land uses. In the context of multifunctional rural spaces, rural landscapes may be envisaged as sites of ‘nature’ (Holmes 2006; Cadieux and Hurley 2009), ‘nativeness’ (Cooke and Lane 2015b; Gillon 2014), and the ‘wild’ (Buller 2004), with various outcomes for land management. For example, Cadieux (2011: 344) demonstrates that nature ‘may take the form of cultivating a refuge for indigenous flora and fauna or it might mean mowing a large lawn.’ In another example, Gillon (2014) identified how amenity migrants actively maintain ‘good’ and ‘bad’ natures that are delineated through perceptions of nativeness. Alternatively, Cooke and Lane (2015a) observed how some amenity migrants plant ornamental, often non-native trees, in an attempt to recreate a familiar nature. The outcomes of recreating these rural natures can be problematic (for example introducing ornamental plants that become invasive), beneficial (increasing biodiversity) or simply benign. However, in dealing with cross-property management issues such as invasive plants, further research is required that analyses how changing ‘neighbouring’ practices resulting from amenity migration ‘mediates the production of particular natures and the distribution of environmental harms and benefits’ (Abrams et al. 2012: 276).

The chapters of the thesis demonstrate that ecological change cannot be divorced from its social context. Both are interlinked. As Robbins argues (2010: 153), ‘species may be invasive, but networks determine histories of invasion.’ Moreover, species invasiveness cannot be separated from the social, cultural, and economic histories of a place. The ambiguity in assessing the
impacts of amenity migration on invasive plant management calls for further research into the motivations, skills and decision-making of landholders and the outcomes for NRM. This, in part, requires attending to the language of invasion science, environmental managers, and rural landholders, and how discourses of nature are coproduced, deployed and contested. The proliferation of nature-talk (Castree 2004) in management decisions, and the values placed on differing conceptions of nature complicates attempts to develop collective management responses based on shared goals (Cadieux 2011). This can fragment collective action as individuals embark along their own lines of management, or certain groups pursue management goals based solely on their own interests (Epanchin-Niell et al. 2010; Graham 2014; Marshall et al. 2016). Additionally, when claims of ‘naturalisation’ (Cadieux 2011: 344) are deployed to place certainty on management goals (e.g. native, non-native, invasive) it nullifies opportunities for collaborating and meditating across multiple landholders. This thesis attends to the coproduction of nature among rural landholders in order to gain important insights into individual and group decision-making for NRM, with the potential to better address collective action problems.

1.5 Theoretical framework: uncovering the co-construction and deployment of Nature

Understanding the processes that are recreating rural landscapes and invasive plant management requires a framework that treats the social and natural as inseparable. As rural landscapes continue to undergo social and ecological transformation, research needs to engage with the inherent socialness of this ecological change, but also the naturalness co-constituting people’s attitudes and practices. Such an approach requires moving beyond cause-and-effect analyses that understand amenity migration and environmental management as a series of interacting parts, to grapple with the coproduction of environmental change and the formation and reformation of landholders’ management attitudes and actions. I adopt a relational framework to trace how understandings of nature emerge and come to affect management values and practices. Such an
approach is not intended to merely complicate understandings of amenity migration and invasive plant management, but aims to provide important insights into how collective management issues can be better understood and addressed in rural-amenity landscapes.

Following this, the theoretical framework of this thesis is driven by a commitment to develop the knowledge gained through a relational ontology into practical responses. A commitment to make relationality practical is an attempt to move beyond ontological questions concerning what reality is, to make informed decisions about how management may proceed and in what direction. In order to contextualise the theoretical position of the thesis, I trace the existing ontological and epistemological debates on the topic of Nature. In particular, I am interested in how ideas of nature are constructed, deployed, and at times contested across different epistemic communities. In the context of rural-amenity landscapes, research needs to uncover how the changing social and ecological makeup of these spaces affects the construction and representation of nature in environmental management. Attending to the construction and representation of nature as a category is not to simply ingeminate the nature-culture divide, but provides the building blocks to develop practical responses to theoretical questions. This thesis attempts to apply the knowledge provided by relational scholars to the everyday practices of invasive plant management. Concurrently, I utilise the existing frameworks of NRM to mobilise relational thinking into practice. Rather than one discipline speaking at another, I aim to perform a dialogue between both perspectives in order to better address the issue of invasive plant management in rural-amenity landscapes.

Before detailing the theoretical framework it is first important to outline the antecedents of relational thinking in nature-culture studies. Following Braun (2004: 151), the career of the nature-culture problem can be dissected into four moments: cultural ecology, political ecology, cultural studies of the environment, and ‘nonmodern’ ontologies. The first three of these ‘moments’, Braun suggests, worked in their own ways to position nature and culture as separate
domains, and frame their interactions as problematic. This began with cultural ecology (or human ecology) prioritising the extent to which the material environment influenced culture. In doing so, this approach collapsed culture into nature, at the expense of ignoring history, politics and relations of power that continually influence culture (Butzer 1989; Turner 1989). Political ecology countered the depoliticising language of cultural ecology by turning to the social. The response was to no longer understand nature as an external realm that people adapted to, but to frame nature as a social product whose characteristics are determined by politics and history (Blaikie and Brookfield 1987; Zimmerer 1996). However, by doing this, political ecology reversed the position of cultural ecology, reinstating the same divide between nature and culture (Braun 2004). Thirdly, ‘cultural studies of the environment’ (Braun 2004), followed a similar approach to the political ecology mentioned above through understanding the role of knowledge and power in shaping people’s relationships with the natural world. However, cultural studies of the environment aimed to move beyond the structuralism championed in political ecology through attending to the social constructions that reproduce nature in materially discursive ways (Castree 2003). While this cultural turn has been applauded in studies of society and the environment, it is also criticised. Most pertinently, Braun (2004: 168) in paraphrasing relational thinkers, argues that by ‘locating agency solely in the “social” or “cultural” domains, cultural studies is no longer able to say anything about what nonhumans contribute to the world, including to the social worlds of humans.’ Following this, critics have called for the abandonment of the nature-culture divide entirely, replacing it with a series of concepts defined loosely as relational or nonmodern ontologies.

Ontologically, I follow this nonmodern (or relational) position, which treats the domains of society/nature and subject/object as the products of relations, which cannot be separated (Latour 1993). Extending from Latour’s (1993) conceptualisation, ontology is not the realm of the given, but the realm of experimentation or practice. This ontological position is opposed to
the common perspective in Western philosophy that defines ontology as the realm of Being, or ‘what is’ of the world—ontology is synonymous with the immutable. Latour departs from this ontology-as-immutable position through an ‘ontology of becoming’: the world does not consist of discrete things that are brought into relation, but instead consists of flows and connections within which things are continually co-constituted. This ontology opposes the acts of purification that divides the social from the natural and represents the world as a series of interacting stable parts. Latour (1993) identifies this appeal to separate and represent the world in this way as the outcome of the ‘Modern Constitution’. For Latour (1993), the power of the Modern Constitution resides in the ability of science to separate content from context, producing ‘matters-of-facts’ that are presented as universal and are universally applied. The Modern Constitution asserts that we come to understand the natural or social world through their separation. However, this emphasis on technological or economic fixes—framed as objective matters-of-facts—downplays the socio-material complexities and context constituting their interdependencies (Healy 2005), and thus obscures the intermediary relationships and things that are never purely social or natural (Latour 1993).

Hybrid networks (Whatmore 1997), Assemblages (Deleuze and Guattari 1988) and Actor-Network Theory (Callon 1986; Latour 2005) are among the list of responses to the nature-culture divide, aiming to ontologically shift the way we conceive of the relationships between people and the nonhuman world. These approaches tear down the ontological borders ordering the world into discrete categories. As Braun (2004: 171) explains:

The world does not consist of discrete ‘things’ that are brought into relation … resulting in hybrids that are mixtures of pre-given pure forms, but instead consists of flows and connections within which things are continuously (re)constituted.

A relational ontology forces us to see a world that is not secured by the arrangement of discrete categories (nature, culture, economies, politics), but is unstable and whose composition is in flux.
Nobody and nothing is outside these relations. Importantly, agency, identity and subjectivity are not properties of the individual, but are the outcomes of relations. To quote Donna Haraway (2003: 6, 20) ‘Beings do not pre-exist their relatings,’ which means the relation becomes the smallest unit of epistemological enquiry. Such an epistemological position requires grappling with multispecies knots that can never be untied.

Having briefly established my ontological position, I will now set out the epistemological project of this thesis. As mentioned, I am concerned with understanding how ideas of nature are constructed, and how these constructions are contested or complemented when reproduced across different spaces. This is an epistemological question as it is concerned with different ways of knowing, and how this knowledge is used to represent the world. Two primary ways of thinking about nature are pertinent to this thesis: social constructionism and relationality. Social constructionism is concerned with how people represent, or make claims on behalf of nature (Demeritt 2002). This includes the meanings we attach to certain kinds of natural objects that encourage specific ways of thinking and acting. The intention of social construction literature is to illuminate that nature is not simply natural, but is socially made in discourses and practices—it is not an ontological given (Castree 2005). For example, Castree (2014) documents the multiple representations of nature-as-natural, demonstrating how these representations not only construct specific images of nature, but also constructs the world and people’s relationship with it. Such constructs are never closed and absolute, but contingent on the epistemic communities knowledge, tools and intentions in constructing nature (Willems-Braun 1997). Importantly, there is not an objective nature ‘out there’ free from social contamination (Cronon 1996). Rather, we are left with a relative representation that is contingent on a group’s episteme (way of knowing) (Castree 2005). Social constructionism accounts are fundamental in unpacking what kinds of nature are subject to what kinds of constructions, and with what consequences (Castree 2003). These authors reveal that any attempt to make reference to nature as it is, is laden with value
judgments that are not simply about projecting facts, but about representing nature in distinct ways for specific purposes (Demeritt 2002; Proctor 2001).

However, others remain underwhelmed by the language of social construction. In what Castree (2014: 305) labels ‘post-constructionist’ approaches to nature, these authors including, but not limited to, Bruno Latour (2005), Tim Ingold (2011) and Donna Haraway (2008) aim to illuminate nature’s construction as not purely a social act, but as more-than-human. While acknowledging the importance of interpreting human purposes, discourses and practices, these post-construction (or relational) perspectives consider social construction too lumbering in identifying how this knowledge is produced (Lorimer 2005). Following from the relational ontologies outlined earlier, these post-construction perspectives (i.e. Hybrid networks, Assemblages and Actor-Network Theory) centre humans as the central actors to illuminate how nonhumans—the stuff of nature—influence human knowledge, subjectivities and actions (Haraway 2008; Latour 2005; Bawaka Country et al. 2016; Ingold 2011). In this context, knowledge is not gathered by the separation of the researcher from the researched through processes of purification (Latour 1993), but instead is generated through socio-material relations (Law 2004). Focusing on how knowledge is generated attempts to move past the language of separation that orders a messy world into neat categories (e.g. society/nature, facts/values, truths/beliefs), and instead comes to terms with the products of these relations that can never be cleaved apart. In particular, this position does not separate knowing (epistemology) from that which is known (ontology) (Castree 2005). Moreover, we come to know by doing, and we do because of what we already know in an iterative process where the material world affect us and we affect it (Castree 2005: 230). This onto-epistemology (Barad 2007) treats nature as not simply the outcome of social processes of power and political-economic rationalities, but is mutually constituted through human-nonhuman encounters and performances.
This thesis extends both social constructionism and relational epistemologies in addressing the issue of invasive plant management. It is worth briefly mentioning how both perspectives are compatible rather than contradictory. Speaking of social constructions runs the risk of seeming ontologically inconsistent to the relational ontology discussed above. It appears to represent the socialisation of nature, rendering nature immutable and only given identity and meaning when placed in a specific social, cultural and economic context. However, following Castree (2014), I do not wish to grant agency entirely to the social realm in the construction of nature. In applying a relational epistemology, I aim to reveal how constructions of nature are relational; temporally emergent products of human-nature relations. This may be better phrased as the co-construction of nature, in which the agency of defining nature is not relegated to the social realm, but, and following a relational ontology, is co-produced and mediated by a range of human and nonhuman actors, which cannot be separated. Bringing a relational epistemology to bear on social constructionism allows for a more detailed and complex understanding about how nature is constructed, and the sources of tensions that arise when certain representations of nature are deployed across different epistemic communities.

I am driven by an epistemological commitment to understand how nature is represented, but more importantly to uncover the relations between humans and nonhumans where knowledge emerges, changes, and is performed. While relational ontologies stress the relation as the smallest unit of analysis (for which things cannot be cleaved apart), it is the proliferation of nature-talk (Castree 2004) and the insistence from politicians, scientists, environmentalists and so on, that nature and society are ontological distinct (implicitly or explicitly) that means this fiction still has real effects (Castree 2003). While a relational episteme provides the tools to uncover the fallacy of the Modern constitution, it is social construction analyses of how representations of nature manifest and influence practices, which expose that there is still much work to be done before moving beyond ideas of nature all together.
1.6 Mobilising relational thinking for invasive plant management

The understandings of nature set out in the previous section, while useful, are difficult to mobilise in response to environmental management issues. While there has been much progress toward a more-than-human political-ethic (extending from the seminal works of Latour 1993, Stengers 2005; Whatmore 2002), these approaches remain more concerned with rethinking existing ontological and epistemological positions to bring actors in, rather than acting out these theoretical positions to achieve normative goals. Relational and social construction epistemologies provide valuable insights into how people come to learn, understand, and value environments. However, these approaches are less effective in offering ways forward for how environmental management can act in real time. This thesis aims to develop the epistemological insights of relationality and social constructionism into practical recommendations.

Developing pragmatic responses to address the environmental problems requires avoiding the pluralism championed by relationality lapsing into an indecisive form of relativism (Light and Katz 1996). This echoes similar critiques of social constructionism, which argue that attempts to expel truth claims toward nature have created an ‘abyss between constructivists and anticonstructivists [that] is simply too large to be productive, as it fuels little more than misinterpretation and intellectual hostility among scholars of nature’ (Proctor 1998: 353).

Avoiding management indecision also accords with recent calls in human geography to move nondualism or relational accounts beyond description, and instead investigate ‘how nondualism works’ (Mansfield and Doyle 2017: 26). Similarly, Jones (2008) notes the value of pragmatism in moving relational ontologies (specifically non-representational theory) from general statements and declarations of intent to become operationalised in more specific engagements with the world. Such an undertaking brings us closer to Hinchliffe’s (2007: 191) plea that:
rather than offering interpretations of nature, or analytical concepts, the injunction must be to join the doings, to experiment, to engage in the doings of environments, to environ them in better ways.

Recent attention to the formation and application of lay knowledge in environmental management demonstrates the value in attending to the human-nonhuman relations where environments are shaped and knowledge is formed. However, these relational approaches also encourage policy, particularly consultation and capacity-building exercises, to take seriously the socio-material practices where lay knowledge is formed in order to build more pluralistic forms of environmental governance. For example, Eden and Bear (2012) demonstrate how lay anglers engage in specialised practices that shape environments and their own knowledge of these spaces. Importantly, Eden and Bear (2012) extend this relational epistemology to argue that such specialised knowledge needs to be expanded and recognised politically. Healy’s (2009) study of the Botany Community Participation and Review Committee (CPRC) provides further direction into how lay knowledge can become mobilised into environmental management decision-making. Healy (2003: 691) advocates a form of epistemological pluralism, ‘in which all relevant perspectives and insights, whether conceived representationally or not, are accounted for’. In this context, mobilising lay knowledge requires both attending to the relations (human and nonhuman) where learning takes place, but also providing a collaborative space where lay and expert knowledge can be exchanged and implemented to address environmental management challenges.

In this thesis, I think critically through the co-construction of nature to not only identify how invasive plant discourses are formed, practiced and contested, but also how these discourses can unify or divide collective management action. In what is set out in more detail in Chapters 4 and 5, collective action research examines the relationships across individuals in coordinating and delivering management responses to address common-pool and public good resource problems (Ostrom 2003). Importantly, collective action is not simply about individuals taking responsibility
for managing weeds but, as Graham (2013: 125) identifies, it ‘involves communities sharing information, providing support and applying pressure so that individuals have the capacity and motivation to act.’ In the context of rural-amenity landscapes, the diversifying values and skills of landholders creates particular challenges in establishing collective interest and action for managing natural resources, particularly from invasive plants (Marshall et al. 2016). Developing collective action requires research to examine how NRM policy and governance can interpret and collaborate between the multiple constructs of nature, identifying how they emerge, how they differ, and their vulnerability to change. Such a collaborative approach requires a form of ‘epistemological pluralism’ that provides the processes and procedures for all relevant knowledge, perspectives and viewpoints to be considered (Healy 2003).

This thesis weeds through the epistemological thicket concerning how nature is co-constructed across landholders and managers and in doing so attempts to provide practical responses for invasive plant management. I argue that it is not enough to simply complicate environmental management through revealing the multiplicity of nature as a social construct. Instead, I aim to push cultural geography perspectives toward a productive direction by incorporating this research with existing NRM frameworks. This is an attempt to acknowledge how unfolding and rapidly changing social and ecological conditions are creating novel management problems and priorities that require adaptive and productive management responses. While cultural geographers have been particularly adept in highlighting the pitfalls in the current episteme of environmental management, these approaches are less clear on how those on-ground may implement this knowledge. Bringing NRM perspectives to bear on the multiple epistemes in invasive plant management provides the necessary tools to understand the sources of conflict that arise in managing invasive plants, while remaining committed to advancing collective management responses.
1.7 Methodology

1.7.1 Uncovering the coproduction of knowledge and amplifying partial realities

The ontological and epistemological position of this thesis demands critical reflection on the methodological approach. Understanding ‘truth’ as a social construction goes against the positivist tradition, which treats methods as a set of guiding principles that act as short circuits linking us in the best possible way to reality (Law 2004: 9-10). Following Law (2004), the research process merely uncovers one interpretation within the ontological multiplicity of the world. It is a process of detecting, resonating with, and then amplifying ‘particular patterns of relations in the excessive and overwhelming fluxes of the real’ (Law 2004: 14). The world is too textured and filled with uncertainty to understand it in its entirety (Law 2004; Thrift 2007). Instead, we can only come to understand reality in the particular (Law 2004). The research questions are not an attempt to hold a belief up to the world ‘out there’ as if it were a mirror that we can polish to achieve a more accurate reflection. Rather, realities are particular, contingent on the practices and relations that make things absent and present (Jones 2008). The multiplicity of the world ‘leaves room for contingency, liberty, novelty, and gives complete liberty to the empirical method, which can be indefinitely extended’ (Dewey 1982: 29). Extending from these methodological insights, I aim to uncover and explain the coproduction of knowledge-events, specifically those actors and relations that co-constitute understandings of environments and environmental management.

My research design is best described as an underlying scheme that governs the functioning, development and unfolding of research, in accordance with the questions and conceptual framing of the thesis (Maxwell 2005: 1). Rather than treating the research process as a linear progression from research questions to findings, I use the term unfolding to recognise and facilitate greater reflexivity in the design and application of qualitative research. The research process is iterative: ‘it’s about the shaping and reshaping, moving on and returning, thinking of
the consequences that accompany philosophical choices’ (Whatmore 2003: 68). Moreover, we know through what we do (onto-epistemology) and how we do things affects what we know. This iterative process requires a research design that acknowledges the relationships where data is generated, rather than gathered, and how this produces particular understandings of the world. To this end, I adopt a qualitative case study methodology to uncover the coproduction of management knowledge and practices for invasive plant management in the Bega Valley.

The ‘case’ in a qualitative case study approach refers not only to the geographic location, but also to the social and ecological context. A case study research design offers the opportunity to analyse in-depth the phenomena and relations of a particular place, gaining valuable insights to specific realities that are enacted through practice (Baxter 2010; Cooke 2013; Stake 2005). Additionally, and extending from ethnographic methodologies, a qualitative case study methodology provides a distinctive approach to what constitutes ‘data’, paying particular attention to social practice (what people do) and social discourses (what people say) (Vannini 2014). As a result, this methodological approach requires methods that can apprehend how knowledge is produced in practice (participant observation), and reproduced in discourse (interviews) (I discuss the specifics of how I done this in section 1.9 Methods) (Atkinson et al. 2001; Crang and Cook 2007; Herbert 2000).

One key ethnographic principle this methodology extends is reflexivity, with particular attention to the everyday contexts of human action (Davies 2008; Hamersley and Atkinson, 2007). A more reflexive methodology allows for ‘recollections stimulated by, and grounded in, the landscape’ (Riley and Harvey 2007: 395). Such recollections open the possibilities to consider how knowledge is formed through these experiences and the different actors involved, moving beyond broad references to the ‘landscape’ to begin differentiating between more-than-human agencies. This methodology is also indicative of Ingold’s (2000: 21) ethnography whereby people develop knowledge, not by receiving information but through ‘direct perceptual engagement
with environments’, which attunes their attention. Thus a qualitative case study approach brings greater sensitivity to the relationships influencing constructions of nature, how this is translated into practice, and the iterative processes between knowledge and practice.

Finally, my research methodology does not attempt to test a hypothesis in different settings. Many of the research questions and aims were reformulated through scoping the research site and during fieldwork. However, it is also important to demonstrate the relevance of this methodology beyond the case study site, to extend generalizable or transferrable findings (Baxter 2010). The qualitative case study approach still allows the research to contribute to collective knowledge development regarding invasive plant management in rural-amenity landscapes. As Sayre (2004: 673) notes, ‘qualitative research cannot be expected to yield causal predictions for other sites, but it can identify conditions that appear to make sustainable rangeland uses possible or impossible, likely or unlikely.’ Such a methodology requires pulling together narratives (including, but not limited to interviews) and developing a rich tapestry that pieces together a particular reality in a generalizable or transferrable way. As will be discussed below, establishing the rigour of this research requires careful consideration of the methods, research site, participants and my own positionality during the research process.

1.7.2 Choosing the study site

The PhD research is situated within a larger Australian Research Council (ARC) Discovery Project: DP130102588, ‘Mobile ecologies, complex landscapes: Cultural environmental research to understand and enhance invasive plant management in high amenity rural areas’. As such, this PhD requires two key components: (1) the study area is as a rural-amenity landscape, inhabited by diverse land owners with mixed land uses; and (2) the study area is affected by invasive plants (ecologically and economically). The ARC project outlined the Bega Valley and Shoalhaven (both

---

4 The Australian Research Council (ARC) is a one of Australia’s main agencies tasked with allocating research funding to academics and researchers in Australian universities.
located on the south-coast of New South Wales) as two study areas given both regions are characterised by high levels of lifestyle property ownership with contrasting but comparable land uses and invasive plant problems. Initially, the PhD project was to include both regions. I began recruitment exercises in both the Shoalhaven and Bega Valley. This involved emailing NRM organisations in both Bega Valley and Shoalhaven, including the Department of Primary Industries, Catchment Management Authority, South East Local Land Services, Noxious Weed Officers and Landcare groups\(^5\). This scoping stage involved meeting with managers and also landholders in these regions, discussing the aims of the research project, and confirming the relevance of the research questions in the context of these landscapes. Most importantly, establishing connections with these organisations allowed for the distribution of recruitment flyers to invite participants.

Following this initial scoping activity I decided to focus solely on Bega Valley, and forgo the Shoalhaven as a comparative study. Bega Valley was selected following the initial success of the scoping exercise—strong support of the research project was given by local NRM organisations—as well as fact that the broader aims of the research project mapped neatly atop the diverse landscape of Bega Valley. Once the research site was confirmed, it then became a matter of recruiting landholders and NRM staff to participate in the research. The primary recruitment method involved distributing a research recruitment flyer (see Appendix A) through the South East Local Land Services (hereafter LLS) email server, as well as cognate organisations such as Far South Coast Landcare, Farmers Network, Towamba Valley Landcare, and Far South Coast Conservation Management Network. I also attended various information sessions and Landcare ‘working bees’ in order to observe and participate in management operations as well as

\(^5\) Local Land Services is a state funded NRM and primary production agency; there are 11 Local Land Services bodies across New South Wales. Landcare is a federally funded volunteer NRM program operating throughout Australia; there are up to 3000 Landcare groups in New South Wales. I provide more detail on Landcare operations in Chapter 5.
recruit landholders. Landcare working bees provided a means to recruit other Landcare members, as well as observe and participate in weed management work. I also visited a Holistic Management workshop, and more casual gatherings such as local agricultural shows in order to recruit participants, but also talk more informally with residents. Informal conversations provided a broader understanding of people’s concerns relating to weeds, but also land management more generally (e.g. drought and agricultural pests). Additionally, work was done with a grasslands ecologist, who was conducting a research project in collaboration with LLS on the invasive plant African lovegrass (*Eragrostis curvula*). Assisting with grassland surveys of commercial pastures, provided valuable knowledge about grassland dynamics and African lovegrass, but also allowed me to ‘piggyback’ on this research and recruit farmers who were participating. Following initial interviews with landholders, purposeful snowball sampling was adopted in order to recruit other landholders (this process is further discussed in Chapter 5).

### 1.7.3 Case Study: Bega Valley

As discussed, the research is situated within the Bega Valley Local Government Area (LGA), located on the south coast of New South Wales, Australia. Bega Valley land area is 627,683ha, with a population of 33,235 (ABS 2016a). The population of Bega Valley has steadily increased over the past decades (from 27,483 in 1991). As with other amenity migration hotspots this is partly attributable to the natural amenities (Holmes 2006). Bega Valley stretches from the Pacific Ocean across lowland plains to the mountains of the Great Dividing Range, and as a result features a diverse landscape of forests, lakes, beaches. Bega Valley’s coastline is also a significant attraction to the region. The coastline stretches 225 kilometres and features many popular tourist and sea change areas including: Bermagui, Tathra, Merimbula and Pambula. The proximity to major urban centres also contributes to the in-migration of tree and sea changers as well as absentee owners. The major population centre Bega is located approximately 350km south of Sydney, 170km south-east of Canberra, and 430km north-east of Melbourne (see Figure 1.1).
Figure 1.1 depicts the main locations participants were interviewed. The research was primarily located in rural-west Bega Valley. The population of this part of the region is approximately 5094, with a land area of 334,210ha (although some participants were located further north in Cobargo) (.id 2011). The population of this region expanded throughout the late 1800’s when
small townships were established and continued to grow during the post-war periods (.id 2011). The population marginally increased during the 1990’s, but has remained relatively stable from 2001, with an increase in the number of new dwellings, but a decline in the average number of people per dwelling (.id 2011). The primary land uses are conservation and timber production, but the region also contains a strong agricultural industry of beef and dairy farming, with some sheep grazing. The region features steep undulating hills, granite soil, and a mix of native grasses and exotic introduced pastures, as well as irrigated farms. Bega Valley has rich biodiversity: 91 vegetation types have been recorded, at least 2000 plant species (native and introduced) and 960 known vertebrae species. Bega Valley also contains 11 endangered ecological communities\(^6\).

Adding to this, 77 per cent of Bega Valley area is designated as National Park or State Forest.

1.7.4 **History of European land use**

European settlement dates back to 1829, when the region soon became a viable site for cattle and sheep farming. This rapidly expanded, and by 1846 the district held large stock runs ranging from 1000 acres to 40 000 acres (Lunney and Leary 1988). The New South Wales government’s introduction of the Robertson Land Acts (1861) and increasing migration from the neighbouring Eden and the Monaro areas resulted in more intensive agriculture networks (Ryan 1964). Epitomised by the establishment of Kameruka Estate in 1864, the landscape drastically changed under increasing agriculture pressure and infrastructure underpinned by neo-manorial social ideals (Ryan 1964). The landscape was significantly altered by land clearing for forestry and agriculture (Chapter 2 sets out in more detail this history of land degradation). Following the establishment of many townships throughout the 1850’s and 1860’s, the dairy industry quickly expanded with the support of Kameruka Estate, overtaking beef cattle as the dominant industry

\(^6\) An ecological community is a naturally occurring group of native plants, animals and other organisms living in a unique habitat. Endangerment is determined by the New South Wales Scientific Committee in accordance with the Threatened Species Conservation Act 1995.
By the 1860’s dairy had become the primary industry, and today Bega Cheese remains an icon of the Valley, being sold across Australia and worldwide.

### 1.7.5 Changing land uses and landholders

The dairy industry remains significant in Bega Valley, being the second highest employer. While the number of farms has declined (from 132 in 2001 to 87 in 2011) (ACIL Allen Consulting 2015), the size of farms and production of dairy products has been increasing (see Table 1.1). The expansion of dairy farms, in part, has resulted from the acquisition of smaller plots that became unviable following the deregulation of the dairy industry in 2000. Also, many dairy farmer’s agist cows on other properties in the region, particularly for those aspects of the dairy industry that rely on dry land operations, freeing up irrigated land for milking herds. Both factors have contributed to the continuing growth of the dairy industry in Bega, although this expansion has been facilitated by the collapse of smaller grazing enterprises.

<table>
<thead>
<tr>
<th>Industry</th>
<th>Economic value (annually) ($AUD)</th>
<th>Number of agribusiness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairy</td>
<td>$43,058</td>
<td>87</td>
</tr>
<tr>
<td>Beef</td>
<td>$80,12</td>
<td>294</td>
</tr>
<tr>
<td>Sheep</td>
<td>$18,58</td>
<td>116</td>
</tr>
</tbody>
</table>


The expansion of dairy farming is also an outcome of the productivity that the dairy industry still maintains in comparison to beef and sheep grazing. Cattle and sheep grazing is the most extensive agricultural activity in terms of land area; but returns far less profit than dairy farming. Bega Valley’s beef industry reflects the state of the beef industry across New South Wales more

---

7 This, and the subsequent tables in this section, will be reproduced throughout the thesis in order to build and maintain a cohesive narrative in the individual chapters below. Tables are given a new cross-reference in order to maintain consistency in formatting.
broadly (see Table 1.2). While the number of beef and sheep farms remains relatively high, the majority of these properties are not profitable, and landholders instead derive their income from off-farm employment. In Bega Valley, many large beef cattle farms have been subdivided and individually sold as the land value is high relative to the production capacity. Additionally, the rise in sheep grazing is partly attributed to the increasing price of lamb meat in comparison to beef (lamb in April 2017 is priced at 665 c/kg, and beef (medium cow) 231.9 c/kg) (MLA 2017), but also because sheep are a useful management option for weeds, particularly fireweed (*Senecio madagascariensis*).

Table 1.2  Average per farm financial performance, New South Wales beef industry

<table>
<thead>
<tr>
<th>Year</th>
<th>Population (farms)</th>
<th>Farm Cash income</th>
<th>Farm Business profit</th>
<th>Total off-farm income</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>4939</td>
<td>$29398</td>
<td>$-20739</td>
<td>$33259</td>
</tr>
<tr>
<td>2005*</td>
<td>3802</td>
<td>$85734</td>
<td>$14779</td>
<td>$17359</td>
</tr>
<tr>
<td>2015</td>
<td>5463</td>
<td>$68741</td>
<td>$-21723</td>
<td>$66218</td>
</tr>
</tbody>
</table>

*Note: 2005 was the only recorded year since 1990 where farm business profit was positive. Data sourced from ABARES (2016).

Declining farm incomes and increasing running costs are significant factors contributing to the subdivision of land parcels. Table 1.3 illustrates the number of land parcels that have been subdivided and their size. Increasing land subdivision between 2001 and 2012 is attributed to two factors. One is the rise of rural residential development around major centres such as Bega and Pambula. The other is the increase in farm subdivision. Table 1.4 indicates a steady decline in the area of land under of dryland agriculture and production in relatively natural environments over a decade. These declines are partly a result of the increasing land area for conservation. However, the decline in agricultural land also corresponds with the growing trend toward land subdivision, and the subsequent changes in land uses. Amenity migrants moving into subdivided farming properties may turn portions of their property into conservation areas (for example
through conservation covenants), and while stock may still graze these properties farming is no longer commercially viable.

Table 1.3 Land parcel subdivision in Bega Valley LGA: 2001–2012

<table>
<thead>
<tr>
<th>Class</th>
<th>2001 cadastre</th>
<th>2012 cadastre</th>
<th>New parcels (2001-2012)</th>
<th>% new</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 0 (&lt;2ha)</td>
<td>16145</td>
<td>19611</td>
<td>3466</td>
<td>18</td>
</tr>
<tr>
<td>Class 1 (2-20ha)</td>
<td>5918</td>
<td>7453</td>
<td>1535</td>
<td>21</td>
</tr>
<tr>
<td>Class 2 (20-50ha)</td>
<td>1620</td>
<td>1970</td>
<td>35</td>
<td>18</td>
</tr>
<tr>
<td>Class 3 (50-200ha)</td>
<td>529</td>
<td>763</td>
<td>234</td>
<td>31</td>
</tr>
<tr>
<td>Class 4 (&gt;200ha)</td>
<td>11</td>
<td>23</td>
<td>12</td>
<td>52</td>
</tr>
<tr>
<td>Total</td>
<td>24223</td>
<td>29820</td>
<td>5597</td>
<td></td>
</tr>
</tbody>
</table>

Data sourced from Land and Property Information (2014)

Table 1.4 Area of land cover based on primary land uses, Bega Valley LGA

<table>
<thead>
<tr>
<th>Land use description</th>
<th>92-93</th>
<th>93-94</th>
<th>95-96</th>
<th>98-99</th>
<th>00-01</th>
<th>01-02</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conservation and Natural Environments</td>
<td>1996</td>
<td>1996</td>
<td>2348</td>
<td>3104</td>
<td>3130</td>
<td>3223</td>
</tr>
<tr>
<td>Production from dryland agriculture and plantations</td>
<td>232</td>
<td>201</td>
<td>140</td>
<td>137</td>
<td>230</td>
<td>128</td>
</tr>
<tr>
<td>Production from irrigated agriculture and plantations</td>
<td>101</td>
<td>86</td>
<td>93</td>
<td>116</td>
<td>106</td>
<td>179</td>
</tr>
<tr>
<td>Production from relatively natural environments</td>
<td>3923</td>
<td>3969</td>
<td>3672</td>
<td>2896</td>
<td>2785</td>
<td>2723</td>
</tr>
</tbody>
</table>


Increasing land subdivision is contributing to the changing makeup of the region, as small land parcels sit alongside larger commercial farms creating a patchwork of land uses and land cover.

Today, Bega Valley contains multiple industries and land uses. Rural production is now one of many industries in the Valley. Retail, accommodation and tourism are now the primary industries for employment in Bega Valley (Bega Valley Shire Council 2010). The region is also undergoing significant youth-outmigration (net outmigration of 18-24 year olds was 930 in 2011) (.id 2011), as well as having an aging population (median age has increased from 45yrs in 2006 to 51 in 2016) (ABS 2016b).
1.7.6 Participants

Table 1.5 provides a summary of research participants. In total 51 interviews were conducted, including 45 private landholders and 6 NRM managers. Landholder categories are adapted from Gill et al.'s (2010: 330) typology of New Rural Landholders’ (hereafter NRL) stewardship. However, for the purpose of this thesis I have grouped together regenerative and conservationist NRLs as there is significant overlap between these categories in the study area. I have also included a typology for production farmers and absentee landholders (see Table 1.5). First-round interviews were carried out between April-June 2014. Additionally, follow-up interviews were conducted with 9 landholders and 1 NRM manager during November 2014. Interview questions with landholders focused on their prior knowledge of land management, their chosen information sources, and their history of management practices. More specifically, questions were steered toward their attitudes of invasive plants, including what species are deemed the biggest issue (personally and for the community); the impacts of invasive plants; and how invasive plant management is learned and practiced (see Appendix D). For managers, questions were broadly themed around how invasive plants are prioritised; the factors helping or hindering invasive plant control; the main challenges in recruiting new and existing landholders; and the abilities and attitudes of new and older residents for invasive plant management (see Appendix E). To this end, the research was not concerned with a specific invasive plant, but instead sought to uncover what species are an issue through the interview process. This approach allowed for other—potentially unknown—weeds to become a focal point, rather than conversation being steered by invasive plants that have been given the most attention in the media or local government documents.

8 The relevant ethics procedures were followed in accordance with the Human Research Ethics Committee, the approving body within the University of Wollongong. For supporting documentation, including the participant information statement and consent form, see Appendix B and C.
Table 1.5 Participant typology: Bega Valley, New South Wales, Australia

| Types of landholders                     | Land use characteristics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Property Size (acres) *
|------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------
| Production farmers (beef, sheep, dairy)  | - Focus is primarily on production. Farming methods are geared toward productivity. This includes pasture improvement through ploughing and resowing pastures with other pasture species, boom spraying invasive plants with herbicides, and a large number of livestock (up to 1000 total).<br>- Grazing is generally extensive, with lower stocking numbers across larger areas, as opposed to cell grazing, which involves heavy stocking numbers in small paddocks and frequent stock rotation.<br>- Besides dairy farmers, all have some form of off-farm employment, or use superannuation as a means of supporting their business.                                                                                                               | 300+              |
| Lifestyle Agrarian                       | - Production is the primary goal, however the management techniques and attitudes about the environment often differ from commercial graziers. This is reflected in a greater commitment to merge environmental protection with grazing through lower stocking rates; fencing-off riparian areas; and destocking in order to preserve pastures.<br>- In terms of methods, lifestyle agrarians present greater openness to alternative grazing techniques (e.g. cell grazing), as well as grazing a mix of livestock, such as goats with cattle.<br>- They are generally financially independent from their land and while some make a profit, the majority admit their grazing enterprise ‘pays for the running of itself’ (e.g. fencing, stock treatment, equipment, general maintenance).                                                                 | 50-300            |
| Regenerative and Conservationist         | - Focus on native species reintroduction and protection.<br>- Pastures are not managed for production, but for increasing biodiversity and cultivating native species.<br>- Small number of livestock (no more than 5) as a hobby. This includes animals for recreation, such as horses and a small number of livestock (e.g. sheep and cattle) for self-sufficiency or to ‘keep pastures down’.<br>- Similar to lifestyle agrarians, these landowners are financially independent from their land and are often interested in restoring the damage done from a history of production.                                                                                           | 5-100             |
| Absentee                                 | - Similar to Regenerative and Conservationist landholders in stewardship values. Main difference is the time available to manage their property.<br>- Main activities include weed removal, and at times native vegetation control (particularly black wattle and tea tree).<br>- No livestock, unless agisted in order to keep down pastures.<br>- Generally properties are visited fortnightly on weekends.                                                                                                                                                                                          | 0-5               |

Adapted from Gill et al. (2010); * Property size is represented in acres, rather than hectares to accord with how participants referred to their property.
1.8 Methods

1.8.1 Participant interviews

Given the research focus on landholders’ everyday encounters and experiences in invasive plant management, interviews and participant observation were the most applicable means for generating data. There exist multiple and varied techniques for both interviews and participant observation. This includes, but is not limited to oral history, phenomenological and narrative interview techniques, which have varying interpretations on how data is generated (Rosenthal 2004). I deployed a narrative interview technique in order to elicit stories of land management from participants. Narrative interviews and analysis offers a ‘powerful way to connect the intimate details of experiences, attitudes and reflections to the broader social and spatial relations of which they are a part’ (Wiles et al. 2005: 98). In particular, narrative interview techniques allow for the elucidation of specific events and actions; illuminating what was done, experienced and how this is reflected on (Cameron 2012; Holloway and Jefferson, 2000; Mishler 1986). This approach allows the life stories of individuals to reveal the wider phenomena co-constituting these experiences (Maynes et al. 2008; Riessman 2008).

Practically, narrative interviews aimed to move beyond the initial questions, and ask for further elaboration, often in the form of a story (Kvale and Brinkmann 2009; Wiles et al. 2005). Rather than seeking direct answers from questions, this approach allowed for greater reflection on past practices and encounters that are potentially unavailable through more structured interview processes (Maynes et al. 2008). Participant narratives emerged informally, needing little prompting. This is largely the result of the semi-structured interview guide (Dunn 2000). The questions asked during the interviews were content focused, directed more toward general themes (e.g. invasive plants, information sources, neighbours), allowing for greater flexibility in the question and the expectations of participant responses. Taken this way, the interview schedule served as a guide that allowed for participants to reflect, often in the form of a story, on
the themes implicit in the interview question. As the interviewer it was simply my job to remain a listener (Kvale and Brinkmann 2009: 131), promoting further elaboration on answers or to pick up on themes that often turned into another narrative. Specifically, I avoided using ‘why’ questions as a further prompt, as such questions tend to evoke a theorised response, rather than a reflection on a past experience (Cooke 2013; Holloway and Jefferson 2000). Similar to oral histories, narrative interviews reveal ‘not just what people did, but what they wanted to do, what they believed they were doing, and what they now think they did’ (Portelli 1981: 99-100). These interviews lasted approximately 30-60 minutes.

In addition to interview questions, I used a map of participants’ properties to prompt further discussion about specific areas of weed management and concern (see Figure 1.2). The original intention of these maps was to provide another layer of data to complement the remote sensing imagery for the broader ARC project. Participants were asked to sketch and explain areas where the most weed management work has been conducted (silver), and the areas of worst infestation (gold). However, aside from the spatial data collected, the maps became a significant tool for eliciting further discussion about weed management and areas of infestations that was perhaps more difficult to articulate without the visual stimulus of the map. In this way, the use of participant mapping supports Brennan-Horely and Gibson (2009) and Boschmann and Cubbon (2014) findings that ‘sketch maps’ facilitate further reflection and discussion from the interviewee, which in turn evolves the interview process. These sketch maps also supported the narrative interview process by promoting further discussion and context of past management activities. In addition to follow-up interviews with 10 research participants, I also asked participants to complete a ‘weed diary’ (see Appendix F).
1.8.2 Participant observation: walking interviews

Following the indoor interviews, informal walking interviews took place on participant properties. This served to provide a memory trigger, capturing conversations and insights unavailable through indoor interviews (Hitchings and Jones 2004). Walking interviews offer a more sensitive approach to the interplay of thoughts and surroundings. As Hitchings and Jones (2004: 9) explain, ‘in trying to discover people’s attachment to plants and their knowledge of the environment we both found that walking in place triggered conversations and insights which a sterile interview room might well have neglected.’ In the context of the research project, walking interviews were essential in order to better understand and observe people’s management practices and interactions in the landscape. This is also referred to as the ‘walkabout method’ (Strang 2010) or ‘go-alongs’ (Evans and Jones 2011), which provide a means for the researcher to witness participants’ interactions with material environments that shapes knowledge and influences attitudes and actions. The value of this approach was also demonstrated by Knapp
and Fernandez-Gimenez (2009: 502) in researching ranchers farming practices, suggesting ‘because local knowledge is often tacit, the field component was helpful for connecting knowledge to specific places and practices.’ Walking interviews lasted approximately 40-90 minutes. All interviews were audio recorded and transcribed verbatim before being coded and analysed using the qualitative data software Nvivo 10 (for more detail on the coding strategy used, see Appendix G and Chapter 3).

Walking interviews provided an important mechanism to apprehend and understand how plant agencies come to be felt and interpreted in the everyday encounters of participants. This has been well developed in research on human-garden relations (Head and Muir 2006; Hitchings 2003; Hitchings and Jones 2004; Power 2005). However, as Pitt (2015) identifies such observations of how plants affect gardening practices obscures the specificity of plant agency and how it differentially affects people, and also how plants act independently of humans. In the context of human-plant relations, it is essential to bring life to plants: not as backdrops to human activity, or simply a feature of the landscape, but as actors in the formation of knowledge. Following Kirksey and Helmreich (2010: 545), I aimed to bring ‘organisms whose lives and deaths are linked to human social worlds’ closer into focus as living co-constitutive subjects, rather than simply relegating them to ‘part of the landscape, as food for humans, (or) as symbols’. As Pitt (2015: 54) claims: ‘to understand how humans treat plants and why, we need to recognise their particular agency’. Walking with participants through their properties amplified the lives of the plants discussed during indoor interviews.

Walking interviews provided two key outcomes otherwise unattainable through the semi-structured interviews outlined previously. First, plant agency became illuminated through my encounters with participants on their property. This occurred through more deliberate observations. For example, some participants would show sites of weed infestations, commenting on how the plants spread, the properties of the plant that make them problematic,
and pointing out how the landscape is being transformed as a result. Taking part in these
demonstrations—with different people and plant species—highlighted the diversity of what is
termed ‘plant agency’ and the differing ways it comes to affect knowledge and action. Further,
plant agency also became known through more serendipitous moments. Walking participants’
properties also provided an opportunity for plants to insert themselves into conversations. In
simply prompting participants to “show me around their property” (either by walking or
driving), it led them to direct me to specific sites of weed management, or heavy infestations, but
in transit also provided impromptu human-plant encounters. Such moments illuminate how
plants come to matter, and the specific capacities of plants that draw a response and demand
attention.

The second benefit of this methodology is the knowledge I gained through walking with
participants. Not having a background in invasive science or botany required me to rely on other
research documents and government weed identification booklets in order to build an
understanding of invasive plants in Bega Valley (further reflection on this process is available in
the positionality statement see Box 1). However, it was through encountering these plants in the
field where this knowledge was forged. In particular, as participants located different plant
species, my identification skills rapidly improved. Further, many of the property walks also
involved participant observation, in which I would assist in hand removing invasive plants.
Undertaking these management practices allowed for a deeper understanding of plant properties,
observing how easily seed heads break off, the depth of the roots, and the feel of the leaves. It
also provided a better sense of the labour required to manage invasive plants. As such, walking
interviews facilitated a form of participant observation that directly encounters ‘plantiness’ (Head
et al. 2012), adding further knowledge into the differing agencies of plant species, unattainable
through interviews alone. This was an attempt to follow Pitt’s (2015) advice to encourage plants
to tune our attention toward their agency and characteristics. However, relating to the overall
methodology, such knowledge of plant life is only ever partial. We can only partially know plants; we speak about them not for them (Atchison and Head 2016; Pitt 2015). As Atchison and Head (2016: 188) note, researching with plants requires us to recognise ‘the limits of our own human sensing capacity.’ Therefore, while walking interviews provided important insights into plant agencies, such knowledge is only ever partial, contingent on our human capacities to understand and interpret plantiness.

**Box 1 Positionality Statement**

Researching rural landscapes brings some challenges regarding the positionality of the researcher. As previous research notes, the insider/outsider binary is an important factor for researchers to overcome in order to gain trust (Hellawell 2009, Kelly 2014, Rubin 2012). My attempts to transverse this divide were largely achieved through gaining the support of local NRM institutions. Given the extent to which some of these networks (LLS and Landcare in particular) assist landholders in the region, their support accelerated the recruitment process as my research—by association—was ‘vouched for’. However, this also created certain expectations that needed to be addressed. First, there was a level of expectation placed on my knowledge of invasive plants. Participants were often hopeful that my research would provide a solution to the problem at hand, or that I would be able to assist personally in helping plan and manage invasive plants on their property. Such attitudes may have encouraged their participation in the research project, but also made for somewhat awkward moments once they learned that the objectives of the research was to learn and understand their experiences. As the research progressed, my knowledge improved. However, it was important that I remained honest and cautious about identifying invasive plant species, as well as prescribing recommendations on how to control particular plants. Being open and honest required continually reminding participants (and at times myself) of my skills and knowledge as a social scientist and the goals of the research. It was also important that I established my independence as researcher from organisations, such as LLS, to ensure that I was not misrepresenting these groups, but also to avoid resistance from landholders who may distrust government organisations.
Another factor influencing my actions as a researcher was the expectations about the outcomes of the research. As mentioned, the connection with the African lovegrass research project added further anticipation, as this invasive plant is such a significant issue and management knowledge is limited and still developing. During fieldwork it was important to remain responsible, and not overextend the ambitions of the research project. Reining in the ambitions of the research project required downplaying both my own knowledge about invasive plant management, but also the potential outcomes of the research. Although at times participants seemed bemused by my motivations (“why do you want to know what I think about weeds?”), it nonetheless ensured that I was not shifting the goals of the research in order to accommodate participant hopes—a potentially dishonest manoeuvre. At times, participants expressed scepticism, particularly farmers, whose previous experiences with researchers has often resulted in little change to their personal circumstances, and therefore view interviews to be little more than self-serving. This scepticism was often in contrast to tree changers who often expressed significant interest in the research, perhaps as the result of ideological rapport based on their education or employment background. Overall, the fieldwork process required continued monitoring of how I positioned myself as a researcher when interacting with participants, remaining wary that the knowledge I gained is only ever partial, and thus needs to be tempered to avoid misleading participants and misrepresenting myself.

1.8.3 Additional methods

Policy analysis was an important method in unpacking and understanding the language of weed legislation. This analysis served the basis for analysing the discourses of weed legislation and relating these narratives to the theoretical debates concerning the efficacy of native, non-native and invasive discourses in invasion science and legislation. As Waitt (2010: 218) explains, a discourse analysis seeks to ‘uncover the social mechanisms that maintain structures and rules of validity over statements about particular people, animals, plants, things, events, and places.’ This analysis was based on two documentary sources: 1) New South Wales and federal government weed legislation; and 2) promotional and explanatory documents and pamphlets from local NRM institutions. Additionally, I surveyed existing literature in the invasive sciences. These documents were analysed in terms of their language used to describe non-native and invasive
plants. Such analysis provided an overall account for how invasive plants are positioned in terms of the existing native/non-native debate as well as species' impact. Given the pervasiveness of this debate between the invasive sciences and humanities, it was essential that I consider how these discourses are reproduced in legislation and whether this manifests in the everyday practices of invasive plant management (See Chapter 2 for specific examples of this).

1.9 Chapter outlines

The order of the research papers in Chapters 2-5 is structured in a way that allows the research to unfold in a coherent manner. While the chapter order does not reflect the development of the research process, the structure provides a means to develop and elaborate on the environmental and social aspects of invasive plant management, somewhat separately, before bringing them together in the conclusion. Each chapter begins with a linking statement that provides a brief summary of the paper, and its connection to the previous or subsequent chapter.

Chapter 2 traces the history of social and ecological change in Bega Valley to explore the intersection between land management goals and environmental legislation. This chapter provides the context of land settlement and agriculture in Bega Valley, paying particular attention to transformation of ecological conditions as well as the introduction of environmental legislation. I draw on participant interviews with rural landholders (predominantly graziers) to examine the relationship between changing environments, legislation, and land management practices. Focusing on two pieces of environmental legislation, I first detail how rural landholders interpret native vegetation legislation in their management practices and the arising vernacular disjunctions. Second, I set out how an invasive plant exceeds landholders’ management capacities and triggers new ways of living with the plant outside of legislative framings. Taken together, this chapter aims to establish how an environment—characterised by
dynamic change and uncertainty—unsettles management discourse and practices, requiring adaptive and collaborative legislative and management responses.

Chapter 3 extends from the previous chapter to explore how graziers are learning to live with an invasive plant that can no longer be eradicated. Following from the findings of how the invasive plant African lovegrass exceeds management control, this chapter unpacks in further detail exactly how graziers are managing this invasive plant in the absence of effective institutional management knowledge. In particular, I demonstrate how the distinctive capacities of African lovegrass affect the learning process in specific ways. The chapter builds from recent research linking relational ontologies with experiential learning, to consider how graziers are learning to live with a species that is creating significant ecological and economic problems. I argue that research on environmental learning, particularly in the context of management uncertainty, needs to attend to how people learn through direct encounters with plants, apprehending this learning process and also the outcomes of this knowledge for land management. This chapter provides a detailed examination into the multiplicity of nonhuman agency as a category and how it shapes, in distinctive ways, landholders’ management responses in spaces of uncertainty.

While the previous two chapters focus primarily on graziers and the environmental processes challenging land management, Chapter 4 centres on amenity migrants. In this chapter, I detail how amenity migrants’ management values are shaped and come to affect invasive plant management. This approach shifts from the previous two chapters’ attention to environmental factors by focusing on the social complexities of invasive plant management. Extending from existing critiques of amenity migrants’ ‘property-centric’ management, I examine both the formation and performance of this management disposition and the outcomes for invasive plant management. In particular, this chapter both defines and traces the formation of property-centric management to highlight the existing barriers to cross-property management. Rather than positioning amenity migrants’ land use aspirations as inherently problematic to collective action,
I highlight the social and environmental relationships that reproduce or reshape these management dispositions with particular outcomes for invasive plant management. Ultimately, this chapter illuminates how amenity migration complicates the cross-property management of invasive plants, and the need for land managers to develop more strategic engagement strategies.

Chapter 5 extends from the previous chapter’s focus on collective action in rural-amenity landscapes by detailing how a Landcare group enrols new landholders and maintains control of invasive plants in a diversifying rural area. This chapter examines the role of social capital (with particular reference to trust and social norms) in recruiting landholders to participate and effectively control invasive plants. In particular, I trace the activities of a key Landcare leader in maintaining management efforts across a diverse range of landholders, despite increasing property turnover. This chapter brings attention to the value of effective NRM leaders in responding to the increasing heterogeneity of management values in rural-amenity landscapes. In particular, when NRM groups establish norms of reciprocity and demonstrate competence and goodwill trust, the conditions to address the collective action problems that characterise rural-amenity landscapes are provided.

Chapter 6 concludes the thesis, returning to the aims and objectives to forward a more critical understanding of invasive plant management in rural-amenity landscapes. In particular, I reflect on the benefits of combining cultural geography and NRM perspectives for understanding the social and cultural dimensions of invasive plant management, and in turn how this knowledge may improve management outcomes. I also offer recommendations for how managers in Bega Valley can improve existing management practices in the context of a changing social and environmental landscape. I also note the limitations of my study, and suggest potential avenues for future research.
2 More-than-native, more-than-invasive: examining how environmental change and legislation affects the everyday management practices of rural landholders

This chapter is currently in preparation for publication as McKiernan S, Gill N, and Atchison J, ‘More-than-native, more-than-invasive: examining how environmental change and legislation affects the everyday management practices of rural landholders’. The chapter focuses on the land use history and current management practices that have come to form, and continue to shape Bega Valley’s environment. The chapter provides a useful introduction into the background of Bega Valley, the history of land use change, and existing legislation that governs environmental management.
Abstract

Contemporary environmental management is characterised by the role of humans in influencing the scale and rate of change occurring to ecological systems. Climate change, invasive species, and biodiversity loss are among the environmental challenges accelerated by human activity and with which land managers must contend. In farming landscapes that rely on a certain level of ecological predictability and stability, environmental change presents significant obstacles to maintaining production and protecting natural resources. In addition, those tasked with developing and implementing environmental legislation are faced with the challenge of responding to and setting management priorities within unpredictable environments. This paper examines how rural landholders interpret and navigate a complex and changing social and ecological landscape. Drawing on participant interviews with landholders and government agency staff in Bega Valley, New South Wales, Australia, we detail how a history of land cover change and existing land management practices confronts the normative goals of environmental legislation. We focus on native vegetation and noxious weed legislation to demonstrate how plants can transgress their discursive placement, unsettling landholders’ land use goals as well as the ability of land managers to protect natural resources. In recognising the potential fallibility of environmental legislation, this paper extends from polycentric governance literatures to promote a more collaborative and adaptive form of environmental management that may reduce vernacular disjunctures, without compromising environmental objectives.

Key Words

Invasive plants, native vegetation, environmental legislation, ecological uncertainty, vernacular disjunctures
2.1 Introduction

Contemporary environmental management is characterised by the role of humans in influencing the scale and rate of change occurring to ecological systems. Climate change, invasive species, and biodiversity loss are among the environmental challenges accelerated by human activity and with which land managers must contend (Ellis and Ramankutty 2008; Lorimer 2012; Robbins and Moore 2013). Significantly, research indicates that the scale and rate of these changes are resulting in new ecological configurations typified by changes in ecosystem structure or function, which may or may not be as stable and productive as past analogues (Brown and MacLeod 1996; Holling 2001; Walker et al. 2004). Far from exhibiting static equilibria, environments undergoing significant change feature an ongoing process of novelty, selection and adaptation, and ‘inevitable uncertainty’ (Rammel et al. 2007: 10). This ongoing process of novelty is reflected in the dynamic interplay between human activity and NRM systems that can transform ecological assemblages and create unpredictable environments where management knowledge is uncertain (Hobbs et al. 2013; Ellis 2015). As human activity continues to ‘push’ environments into novelty it challenges the normative position and practical possibilities of environmental management (Robbins and Moore 2013).

Environmental and economic weeds exemplify the role of humans in transforming environments, as well as the potential for these species to create novel management challenges. For example, human-mediated global movement of plants and animals is creating new species assemblages, as plants and animals naturalise in areas outside of their historic range, with the potential to become invasive (Peel et al. 2017; Van Kleunen et al. 2015). Once established, invasive plants pose significant threats to biodiversity, ecosystem functions, agricultural production, and costs billions of dollars to manage each year (Driscoll et al. 2014). While managing invasive plants can be relatively straightforward if outbreaks are acted upon swiftly and there is sufficient funding and labour, better established invasive plants are difficult, if not
impossible to eradicate, leading to significant ecological and economic challenges (Hobbs et al. 2013; Pyšek et al. 2012). Similarly, unpalatable native shrubs, commonly referred to as ‘woody weeds’, can create problems akin to those of invasive introduced plants when they dominate pastures, suppress perennial grasses and make livestock management more difficult (Walker and Janssen 2002). This can lead to a drastic decline in the diversity of native flora and fauna, creating what Condon (1986: 40) refers to as an ‘ecological desert’, as well causing significant economic losses through reducing the carrying capacity of grazing lands (Booth et al. 1996). This paper examines the social and ecological relationships coproducing weeds, focusing on how these plants unsettle the management values and goals of landholders and environmental legislation.

When landscapes can no longer be restored due to the severity and extent of environmental change—even before the logistical implications for labour and finance are considered—the existing frameworks used to prioritise and enforce management action become increasingly tenuous. For example, notions of species’ impact are often used to prioritise management action and designate the environments to be protected (Davis 2011; Warren 2007). Defining species impacts involves first identifying plants or animals driving ecological change (typically based on species compositions or ecosystem functions), and then formulating management plans to halt this change and restore existing ecological conditions or processes (Ricciardi et al. 2013; Simberloff et al. 2013). Pertinent to this study, the Native Vegetation Act (2003) and the Noxious Weed Act (1993)⁹ are two examples of legislation which aim to protect environments in New South Wales, Australia, and for which land managers are legally responsible on their properties.\r

The Native Vegetation Act (2003) aims to protect existing native vegetation by restricting the clearance of remnant vegetation and post-1990 regrowth, while the Noxious Weed Act (1993),

---

⁹ The Native Vegetation Act 2003 was repealed on 25 August 2017. Current legislation governing the clearing of native vegetation is the Local Land Services Act 2013 and the Biodiversity Conservation Act 2016. Similarly, the Noxious Weed Act 1993 was repealed on 1 July 2017, and replaced with the Biosecurity Act 2015. Amidst these changes, this paper is written with respect to the legislation in force at the time of fieldwork and interviews.
prioritises and directs management of invasive plants based on classifications regulated by local
governments. However, as clear as these legal obligations might appear, implementing this
legislation is increasingly complicated as it is operationalised within diverse and rapidly changing
social and ecological landscapes.

The uncertainties presented by environmental change are particularly problematic for people
tasked with the dual responsibilities of production and stewardship (Gill 2014). In rural
landscapes, landholders are often confronted with having to maintain production in changing
environments, often at localised scales, while also navigating existing environmental legislation
(Bartel 2014; Marshall 2009). While legislation is often responsible for setting the parameters of
management responses to environmental change, such responses may at times conflict with the
experiences and aims of those people on-ground. For example, in their study of land managers
living with invasive plants, Head et al. (2015) highlight the tensions that emerge when regulatory
frameworks enforcing management action do not relate to the pragmatic experiences of what is
possible. Further, Bartel (2014) identifies the ‘vernacular disjunctures’ that arise between farmers
and policymakers over native vegetation legislation that is seen by landholders to be out-of-touch
with local circumstances and restricting desired and reasonable management practices. In these
contexts, problems arise when the value systems inherent within legislation come into conflict
with the immediate aims and values of those land managers directly responding to environmental
change. Consequently, environmental legislation is in a difficult position of having to recognise
and prevent environmental harms while also responding to the concerns of land managers.

In this paper, we examine how land managers interpret and operationalise two pieces of
environmental legalisation in an environment they have helped shape but which is now also
exceeding their control. More specifically, we detail the challenges of prescribing and practicing

---

10 In New South Wales, local government councils are tasked with enforcing the Noxious Weeds Act 1993 and are
referred to as Local Control Authorities.
environmental management in a landscape developing ecological novelty, and where people depend on grazing production for their livelihood. Drawing on interviews with rural landholders (predominately graziers) on the south coast of New South Wales, we detail the presence and absence of environmental legislation in guiding land management practices, with particular attention to the sources of tensions between the graziers and policymakers. In doing so, this paper has two primary aims. First, we aim to examine how environmental change is experienced on-ground, and the challenges for land management as well as existing legislation. Second, and relating to the first aim, we evaluate the possibilities for a more adaptive and polycentric form of environmental governance that can respond to environmental change and better address the vernacular disjunctures between landholders and policymakers.

We begin by outlining research on environmental change and the implications for environmental management. From here, we build on existing critiques of environmental management discourses to position two pieces of vegetation legislation in New South Wales, Australia. After outlining the methodology, we trace the history of land use and land cover change in Bega Valley, New South Wales, which is part of a broader history of settlement and extensive environmental impact and changes that has led to the environmental laws and regulation covered in this paper. In particular, the empirical material details how managers are dealing with dynamic landscapes characterised by historical vegetation clearance, ongoing grazing and other rural activities, and unruly native and exotic species. Focusing on native vegetation and the introduced invasive plant, African lovegrass (*Eragrostis curvula*) (hereafter ALG), we illustrate how landholders observe and act to manage these species both within and beyond the confines of legislation. Attending to these on-ground experiences provides one means to enunciate the scale and rate of change occurring in this landscape, as well as illuminate the challenges for contemporary environmental legislation and management.
2.2 Environmental change and management challenges

Climate change, nitrogen eutrophication, increased urbanisation and other land use changes exemplify the impacts humans are having on ecosystems globally, and the contemporary challenges facing environmental management (Davis et al. 2011; Ellis 2015; Hobbs et al. 2009). Rather than simply witnessing ecological change, human activity is both directly and indirectly driving new abiotic and biotic assemblages that pressure land managers to respond (Hobbs et al. 2013). A range of terms have been used to describe and categorise these emerging environments, including novel ecosystems (Hobbs et al. 2006), socio-natural sites (Winiwarter et al. 2013), socioecological futures (Mansfield et al. 2015), melting-pots (Kull et al. 2013), anthropogenic biomes (Ellis and Ramankutty 2008), rambunctious gardens (Marris 2011), and multinatural geographies (Lorimer 2012). Although there are important distinctions between these nomenclatures, they all share in common two important characteristics of contemporary environmental change that have particular implications for management. First, these novel environments are coproduced through social and ecological relationships. Second, the coproduction of these ecological states is characterised by uncertainty. This includes uncertainty about the rate and scale of change, and uncertainty as to how to manage these unfolding ecologies (Allen et al. 2011; Robbins and Moore 2013; Seastedt et al. 2008). Importantly, the uncertainty and novelty of this ecological change challenges the spatial and temporal analogues (i.e. comparable ecosystem functions or structures) of management that have traditionally informed and guided decision-making (Head and Atchison 2015).

The significance of environmental change, coupled with the uncertainty in managing these novel ecosystems, is creating significant challenges for land managers. The human activities that at times instigate rapid ecological change cannot be easily halted or reversed. Instead, land managers are left to manage environments that both impede land use and require adaptive management responses (Chaffin and Gunderson 2016). In the environmental sciences, research
emphasises the historical relationships between environmental and social change, illuminating
the novelty and non-linear behaviour of ecosystems (Briske et al. 2003; Leach et al. 1999). The
inability of managers to predict how these changes will affect existing land uses, and the
shortcomings of existing management frameworks, present significant questions for land
management in relation to policy and governance, but the more immediate concern is that they
are already being confronted and experienced by those on-ground (Head et al. 2015a).

In rangelands, for example, a history of native vegetation clearing, inappropriate grazing or
stocking densities, and altering fire regimes has contributed to the proliferation of invasive plants
and continued ecological change (Mooney and Hobbs 2000). While at times this change has been
the result of a deliberate strategy of land managers to improve production, these strategies have
also created conditions that exceed managers’ control and threaten ecological and economic
resources. Walker and Janssen (2002) observe how degradation of grasslands from grazing
pressure results in the loss of highly-quality fodder perennial grasses that are replaced by
unpalatable annual or perennial grasses and woody plants. Further, if grazing pressure is
maintained, woody plants continue to proliferate on rangelands, which can then no longer be
restored to grasslands for up to 30–40 years (Walker and Janssen 2002). Both woody plants and
invasives present significant concerns for graziers. These plants lack feed value, suppress more
desirable species, and transform grassland compositions, significantly impacting grazing
management. In this context, land managers are confronted with the legacies of land
management that are now impeding desired land use goals, and where knowledge of how to
respond is limited.

As noted above, the unpredictability of environmental change also challenges the spatial and
temporal analogues guiding management action. These challenges are faced by landholders,
particularly graziers, who often rely on specific pasture compositions for productivity, as well as
land managers more broadly who are tasked with developing management responses to
ecological change. However, despite ecological science indicating the dynamic and non-linear characteristics of environments, management of these unpredictable ecosystems, at times, tends to prioritise stability or restoration (Cronon 1996; Hinchliffe 2008; Pimm 1991; Trigger et al. 2008). Restoration approaches to land management often evoke past analogues—signalling specific species or ecological assemblages—that guide management decisions (Grumbine 1997; Hobbs et al. 2014; Monaco et al. 2012). This command-and-control management approach begins by defining the compositions and functions of an ecosystem that are most valued (ecologically or economically), and then attempts to protect and maintain these conditions against natural and human mediated change (Holling et al. 1996; Karkkainen 2002).

However, command-and-control management has undergone extensive critique in environmental science (Hobbs et al. 2014; Holling et al. 1996), management (Plummer et al. 2012) and governance literatures (Karkkainen 2002; Holley et al. 2012). In particular, the centralised top-down application, insistence on uniform rules, and attachment to spatial and temporal analogues of command-and-control management has been labelled as costly, cumbersome, and inefficient, largely because of insensitivity to local conditions (Holley et al. 2012: 2). Additionally, graziers are also experiencing the limitations of managing pastures based on a model of control and stability, as abiotic (e.g. lower rainfall) and biotic changes (e.g. invasive species) challenge conventional management practices and creates management uncertainty (Walker and Janssen 2002). However, responding to ecological change is not purely determined by ecological conditions, but is also contingent on the management values that influence personal management decisions, or are imposed through legislation. We focus on the intersection between management values (personally and in legislation) and ecological change, detailing how graziers navigate dynamic grasslands alongside environmental legislation and existing land use goals.
2.2.1 Management values in changing environments: impact discourses and vernacular disjunctures

Attending to the discourses in environmental legislation reveals the role of management values in directing management action, and at times, causing disagreements between landholders and policymakers. One discourse that is particularly prominent in environmental management is species’ impact (Davis 2011; Warren 2007). Impact discourses serve to direct management toward species that threaten, and create instability in, existing ecologies (Parker et al. 1999). In particular, the ecologies under threat are those of either ecological significance (e.g. native vegetation communities), or economic value (e.g. pasture communities for grazing). An impact-focused approach remains the official basis of much environmental legislation and policy in Australia. For example, in Australia *Weeds of National Significance* (WoNS) is a list agreed on by Australian governments that prioritises weeds based on their ‘invasiveness, potential for spread and environmental, social, and economic impacts’ (Department of Environment and Energy n.d., emphasis added). Additionally in New South Wales, the Noxious Weed Act’s (1993) main objective is to ‘reduce the negative impact of weeds on the economy, community and environment’ (NSW DPI 2014a, emphasis added).

The prevalence of impact discourses in environmental legislation is further demonstrated in the Native Vegetation Act (2003). In New South Wales, the Native Vegetation Act (2003) was until recently the overriding legislation governing the management and protection of native vegetation. The main objective of ‘the Act’ was to manage ‘native vegetation on a regional basis in the social, economic and environmental interests’ of New South Wales (NSW Government 2003 SECT 3). This Act was introduced to restrict broad-scale land clearing for agriculture; however clearing of native vegetation is still permitted if it maintains or improves environmental outcomes, protects or improves native vegetation of high conservation value, and if it encourages revegetation. In this context, impacts are determined by monitoring the changes to
specific vegetation communities, and then attributing such change to specific, and problematic actors, most commonly humans.

Impact-focused approaches have been lauded as an objective approach to environmental management (Davis 2011). However, while attempts to monitor environmental change, and identify the species responsible can be quantified, management responses based on this knowledge are not completely innocent of value-judgements (Tassin and Kull 2015). Impacts are perceived differently across different epistemic communities and are bound within social, economic and ecological context (Larson 2007b; Crowley et al. 2016). Consequently, applying fixed markers for management can fail to account for the contingencies of local circumstances, leading to tensions between policymakers and the public. Returning to the Native Vegetation Act (2003), Bartel (2014: 901) highlights the tensions between farmers and policymakers as resulting from vernacular disjunctures defined as:

This distance between the regulated and regulators [that] appears to be overall due to a disparity between what farmers, informed by vernacular knowledge, consider to be appropriate land management and the universal and universalising model imposed by the legislation and government using their bureaucratic (and technocratic) knowledge.

When environmental conditions are shifting rapidly and in unpredictable ways, legislation that attempts to implement management based on fixed notions of species’ impact may at times clash with local experiences. A similar criticism has been made in the context of invasive plant management. In addition to landholders, Head et al. (2015) show that government employees’ practical experiences are often in tension with legislative and policy procedures they are required to administer. Documenting multiple cases of managers living with invasive plants, Head et al. (2015) demonstrate the tensions arising when legislative framings of non-native and invasive species become disconnected from the on-ground experiences.
2.2.2 Toward a more adaptive form of environmental governance

In response to the challenges outlined above, environmental management research in theory and practice has been developing cooperative and collaborative governance arrangements to improve NRM (Holley et al. 2012; Marshall 2009; Plummer et al. 2012). These collaborative approaches aim to better understand and respond to environmental change, and also overcome the tensions between epistemic communities when management goals are in conflict (Allen et al. 2011; Plummer et al. 2012; Karkkainen 2002). New environmental governance (hereafter NEG) is one example of a framework that aims to develop a ‘collaborative, polycentric forms of governance at sub-state levels that are capable of effectively and legitimately governing the impacts of human activities on the environment’ (Holley et al. 2012: 8). This framework extends from existing research into polycentric and adaptive governance systems that involve a process of refining or modifying policy and public agencies to more effectively recognise and address the wants and needs of constituents (Cook et al. 2010; Marshall 2009). The result is an explicitly multi-scalar and polyvocal process, in which multiple stakeholders with different knowledges and from different locales and scales work collaboratively to establish management goals and work collectively (Bartel and Graham 2015; Marshall 2009). These forms of polycentric governance, including NEG, are heralded for building cooperation across social groups, but for also enhancing the ability of institutions to respond to complex environmental problems (Holley et al. 2012; Karkkainen 2002).

NEG provides space to better account for and adapt to dynamic environments. This requires policymakers and at times land managers remain open to the fallibility of existing management discourses, and establish social networks that can to respond to management uncertainties. The effectiveness of polycentric environmental governance, such as NEG, is determined by five characteristics: collaboration, participation, deliberation, learning, and new, more horizontal forms of accountability (Holley et al. 2012: 12). Incorporating these characteristics into
management programs allows for the lateral flow of information that can overcome the marginalisation of local actors, and improve the efficiency to which information is received, acted upon, and learnt from (Cook et al. 2010; Holley et al. 2012). Rather than providing an example of polycentric environmental governance in action, we consider the usefulness of NEG for better understanding the sources of tensions between public and policymakers in implementing environmental legislation, as well as for developing more adaptive responses for living with these changing environments (Cook et al. 2010; Holley et al. 2012).

2.3 Case study: Bega Valley and the changing nature of environmental management

The subsequent sections detail the history of land cover change, legislative responses, and current landholder experiences in Bega Valley. Bega Valley is a LGA located on the far-south coast of New South Wales stretching to the Victorian border. The region has a significant history of agricultural production, particularly beef and dairy production. Whilst still popularly recognised for its dairy industry, deregulation in 2000 drastically reduced the number of dairy farms; however remaining dairy farms have become far more expansive. In comparison, low returns on beef farming have reduced the number of commercial farms, and also the extensiveness of grazing land for beef cattle. Table 2.1 illustrates the declining land area of dryland agriculture and production from relatively natural environments, which is used for beef grazing. This is partly attributed to the expansion of conservation lands under State Forests and National Parks, the steady increase in irrigated agriculture for dairy industry, as well as the subdivision of retired farmland. Table 2.2 highlights the narrow margins for beef grazing in New South Wales. Taken together, both tables depict the changing nature of beef production in Bega Valley, as total land area is reduced and the costs of production exceed the financial returns.
Table 2.1 Area of land cover based on primary land uses, Bega Valley LGA

<table>
<thead>
<tr>
<th>Land use description</th>
<th>92-93</th>
<th>93-94</th>
<th>95-96</th>
<th>98-99</th>
<th>00-01</th>
<th>01-02</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conservation and Natural Environments</td>
<td>1996</td>
<td>1996</td>
<td>2348</td>
<td>3104</td>
<td>3130</td>
<td>3223</td>
</tr>
<tr>
<td>Production from dryland agriculture and plantations</td>
<td>232</td>
<td>201</td>
<td>140</td>
<td>137</td>
<td>230</td>
<td>128</td>
</tr>
<tr>
<td>Production from irrigated agriculture and plantations</td>
<td>101</td>
<td>86</td>
<td>93</td>
<td>116</td>
<td>106</td>
<td>179</td>
</tr>
<tr>
<td>Production from relatively natural environments</td>
<td>3923</td>
<td>3969</td>
<td>3672</td>
<td>2896</td>
<td>2785</td>
<td>2723</td>
</tr>
</tbody>
</table>

Data sourced from ABARES National Land Use Data 92-2002.

Table 2.2 Average per farm financial performance, New South Wales beef industry

<table>
<thead>
<tr>
<th>Year</th>
<th>Population (farms)</th>
<th>Farm Cash income</th>
<th>Farm Business profit</th>
<th>Total off-farm income</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>4939</td>
<td>$29398</td>
<td>$-20739</td>
<td>$33259</td>
</tr>
<tr>
<td>2005*</td>
<td>3802</td>
<td>$85734</td>
<td>$14779</td>
<td>$17359</td>
</tr>
<tr>
<td>2015</td>
<td>5463</td>
<td>$68741</td>
<td>$-21723</td>
<td>$66218</td>
</tr>
</tbody>
</table>

*Note: 2005 was the only recorded year since 1990 where farm business profit was positive. Data sourced from ABARES (2016).

The research project included interviews with a total of 49 landholders and 5 NRM agency staff from April–June, with follow-up interviews conducted with 10 participants in November 2014. Participants included government weeds officers, LLS, Landcare staff, research scientists and landholders. This paper focuses on interviews with NRM agency staff, production farmers (particularly beef and sheep graziers), and lifestyle agrarians (non-commercial grazing enterprises). The empirical material below is organised under two main sections. First, we contextualise the history of land use in Bega Valley and its impacts on local ecologies. Focusing on native vegetation, we detail the changes to native vegetation in Bega Valley, the response of legislation, and how these processes are currently experienced by landholders. Second, we illustrate how this history of land management also assisted the spread of invasive plants (in particular ALG), which are now challenging these same management practices.
2.3.1 Native vegetation: protection and problems

Bega Valley is a landscape formed not only by environmental processes, but also by its social and cultural history. Native vegetation changed significantly throughout Bega Valley as agriculture transformed the area (Lunney and Leary 1988). In Bega Valley, agriculture (primarily beef and sheep for meat and wool) is reported as early as 1829 (Lunney and Leary 1988). This rapidly expanded, and by 1846 the district held large stock runs ranging from 1000 acres to 40 000 acres (Lunney and Leary 1988). The New South Wales government’s introduction of the Robertson Land Acts (1861) and increasing migration from the neighbouring Eden and the Monaro areas resulted in more intensive agricultural settlement networks (Ryan 1964). This significantly transformed the landscape as fire regimes were altered with the dispossession of Indigenous owners, herbivore densities increased, new predators arrived, digging and burrowing marsupials disappeared, and land was cleared to create open pastures (Dorrough 2008; Lunney and Leary 1988). However, native plants still dominated the woodlands and grazing lands until the 1950’s when widespread use of superphosphate and annual legumes changed the composition of the ground layer flora almost entirely (Dorrough and Scroggie 2008). Maintaining productive grasslands required (and still does) heavy inputs of fertilisers increasing soil phosphate, sulphur, nitrate, and the ratio of carbon to nitrogen (Dorrough and Scroggie 2008). As native plants are more likely to persist in low level nutrient or unfertilised soils, native species were gradually succeeded by exotic grasses (Dorrough et al. 2004; Dorrough and Scroggie 2008).

The changes witnessed in Bega Valley are emblematic of land clearing and the transformation of grasslands that occurred in New South Wales and Australia more broadly (Kyle and Duncan 2012). Rising national concerns over land clearing, biodiversity loss and carbon emissions prompted all State governments to introduce programs and legislation to restrict the clearing of native vegetation and protect remnant vegetation, particularly from agricultural and urban development (Halpin 2004). New South Wales was one of the last States to act when it gazetted
the ‘State Environmental Planning Policy No. 46—Protection and Management of Native Vegetation (SEPP-46)’ in 1995. The subsequent Native Vegetation Conservation Act (1997); Native Vegetation Act (2003); and also Native Vegetation Regulation (2005), have been the foundations of native vegetation management and protection since then (for a comprehensive review see Bartel and Graham 2015).

**Unintended consequences: native plants and landholder restrictions**

The introduction of the Native Vegetation Act (2003) has led to significant tensions between some graziers and policymakers. In the most serious example, a compliance officer was fatally shot by a farmer in 2014 during an alleged confrontation about land clearing (Feneley 2014). Although not without some dissent among farmers (Gilbert 2016), more generally farmer representative bodies have campaigned for changes to the law and for greater farmer autonomy around vegetation management. While research has extensively documented the history of ecological change in New South Wales and legislative responses, there remains considerable scope for research to understand how this history of land use change and legislation manifest in current land management practices.

In Bega Valley, native vegetation remains a contentious issue among graziers. This is largely due to the legacies of land management that have transformed grasslands to favour grazing production and management. The history of land management and the current imperative of graziers to maintain production have increased soil fertility to the extent that many pastures are now dominated by exotic grasses (native grasses are generally unable to tolerate the higher fertility levels). These pastures allow for increased carrying capacity and provide higher nutritional value for livestock. In these so called ‘improved’ grazing systems, native grasses are conventionally perceived as less productive, but can at times dominate when environmental

---

variables (such as lower rainfall) reduce the vigour of exotic grasses. In contrast to other areas of New South Wales, particularly the Western division, where the history of land management, climate, and soils make native grasses valuable for production (Noble 1998), participants in Bega Valley frequently remarked on their inability to maintain commercially productive grazing systems solely with natives, as well as the risk of native tussock grasses ‘taking over’ pastures. One example of a problematic native grass is Poa (*Poa labillardierei*), which forms tussocks that lack palatability and have less nutritional value. Historically farmers have sought to ‘improve’ pastures by removing this species. However, the protection of native species directed by the Native Vegetation Act (2003) complicates this management practice:

> Poa tussock if it's in a pasture with more than 50% natives it's absolutely illegal to spray one of them, but yet in our farming system around here you will lose your pasture to Poa tussock, you won't make money. (Noel, Production farmer: beef and sheep)

Noel refers to section 20(a) of the Act, which states that ‘clearing of native vegetation that comprises only groundcover is permitted if: the vegetation comprises less than 50% of indigenous species of vegetation’ (NSW government 2003 sect 20). However, Poa is problematic in grazing systems as the species has low palatability; nutritive value; and herbage yields. As a result, graziers argue that the legislation restricts their desired management and their ability to maintain farming productivity.

Poa tussock offers an intriguing example into the complexity of the Native Vegetation Act (2003). The spatial extent of Poa tussock is partly the result of historical and contemporary management. Unlike other native grasses, Poa responds well to increases in soil fertility and grazing (Garden et al. 2000). Additionally, the proliferation of Poa is compounded by the set stocking method adopted by commercial graziers, which facilitates the spread of Poa through preferential grazing of other species. The prevalence of Poa tussock is not simply an outcome of the species’ nativeness and other characteristics, but can itself be an outcome of past as well as
current land management practices. There is little intrinsically natural or pre-European about contemporary Poa distribution. Legislation is thus in a difficult position to ensure the protection of native species, while simultaneously recognising the processes that allow them to proliferate, and the subsequent impacts on land management.

Graziers’ opposition to certain aspects of native vegetation legislation is further emphasised with the regrowth of native woody plants. While native grasses (particularly Poa) were lamented by graziers, native regrowth is an issue stretching across landholder types. The breadth of concern is summed up by a local Landcare Project Officer:

> People around here are absolutely gobsmacked at native vegetation legislation and it doesn’t matter whether they’re hippy greenies or the redneck farmers or the modern farmers they all cannot believe they are not allowed to reduce scrub and reduce wattles and tea trees. (Roger, Landcare coordinator, Tindale Valley)

Roger’s role as project officer involves close relationships with a range of landholders documenting concerns and aiding in decisions around property management. His observation of landholders’ responses to the Act is indicative of other participants who were unable to manage Tea Tree (*Leptospermum laevigatum*) and Black Wattle (*Acacia mearnsii*) as they wished. Both are native colonising species that rapidly respond to land cover disturbance and preferential grazing. Tea tree is a particular concern for landholders:

> Just that it [tea tree] covers ground, and it gets stronger and stronger, so where it is, you’ve got to give up farming and it becomes a harbour for rabbits, kangaroos, the foxes, things like that. Things disappear in it and you can’t manage it, and I’ve lost quite a few cows because they’ve gone in to calve in areas of Tea Tree, and I can’t see them. (George, Production farmer, beef and sheep)
There’s a concern because you can’t clear that [tea tree]. The environmentalists won’t allow that to be done, and to me that’s silly because I can’t manage the weeds in there and you will see a lot of serrated tussock\(^{12}\) grows in there. ‘And how do I get in there to spray that?’ I can’t. And so the rabbits get in there and whereas if I was allowed to clear it ‘isn’t that more productive, and isn’t that more sustainable? Aren’t I managing the weeds better?’ (Paul, Production farmer: beef and sheep)

![Image](72x333 to 476x636)

**Figure 2.1** An example of Poa tussock (foreground) and Black Wattle (background) on a participant’s property, Brogo, Bega Valley

Similar to Poa tussock, the first quote demonstrates the impact of tea tree on production. This impact reflects existing research on ‘woody weeds’ (Bartel 2014; Booth et al. 1996; Noble 1998) that highlights how woody regrowth such as tea tree disrupts grazing operations, leading to conflicts between policymakers and the public. The second quote demonstrates the potential for

---

\(^{12}\) Serrated tussock (*Nassella trichotoma*) is a ‘Weed of National Significance’. It is a high management priority for government agencies and land managers due to its invasiveness, potential for spread and economic and environmental impacts. It is highly problematic for agriculture as it is not palatable for livestock and has little feed value. Additionally, the invasiveness of serrated tussock is a serious threat to native fauna and flora.
noxious weeds and pest animals to proliferate in areas of protected regrowth. In this example, when the Act is applied to grazing contexts it can create unintended environmental and economic damages.

In response to similar concerns across the State, regulations within the Native Vegetation Act (2003) have been developed to allow landholders to manage native vegetation. For example, Routine Agricultural Management Activities (RAMAs) allow landholders to manage native vegetation without approval from Local Land Services (though a Property Vegetation Plan (NSW Government 2013)). This is particularly common for managing ‘Invasive Native Scrub’, such as Black Wattle and Tea Tree. Additionally, landholders can clear remnant native vegetation or protected regrowth if they obtain a Property Vegetation Plan (PVP) from Local land Services, which is a legally binding contract stipulating how native vegetation will be managed. Despite this, graziers in Bega Valley still remain concerned with the legislation. There are two potential sources for this continuing tension. First, some landholders lack knowledge and understanding of the legislation and its allowances for native vegetation management in the form of RAMAs (Gill 2012). Second, managers enforcing the Native Vegetation Act (2003) are in a difficult position of needing to accommodate flexibility, without giving free rein and compromising the legislation’s environmental objectives. While the Act, on paper, is quite flexible, the existing restrictions remain a point of concern for graziers that necessitates further consideration of the processes and procedures governing native vegetation management.

2.3.2 Hate to lovegrass
European settlement not only resulted in drastic changes to native vegetation, but also contributed to the introduction and spread of invasive plants. Weed control has an extensive history in Australia. Legislation was first introduced by the South Australian government in 1851 to control Scotch thistle (Cirsium vulgare) (Reeve et al. 2015). Similar legislation was enacted by the other Australian colonies over the next 20 years (Parsons and Cuthbertson 2001). In Bega Valley
weed legislation was introduced for ‘Blackberry (Rubus fruticosus agg.) and spotted cabbage thistle (probably Silybum marianum)’ around 1870, and within half a century other introduced plants, ‘including Paterson's curse (Echium sp.), inkled (Phytolacca octandra) and verbena (Verbena sp.) had spread so widely that they were declared noxious weeds (Lunney and Leary 1988: 70).’ Today, nine plant species are identified as priority weeds in Bega Valley Shire: ALG, Bitou Bush (Chrysanthemoides monilifera), Blackberry (Rubus fruticosus agg.), Cape Broom (Genista monspessulana), Crofton Weed (Ageratina adenophora), Fireweed (Senecio madagascariensis), Paterson's Curse (Echium spp.), St John's Wort (Hypericum perforatum) and Serrated Tussock (Nassella trichotoma). It is estimated the cost of invasive plants to agriculture in Bega Valley is between 10 and 20 million dollars (AUD) for weed management (herbicides etc.), as well as yield losses (ACIL Allen Consulting 2015).

In the history of expanding weed priorities in Bega Valley, ALG is now the main focus. ALG is widespread in Far South Coast New South Wales, posing major management problems for farmers and significant threats to other environmental assets (Firn 2009). Numerous agronomic types of ALG were introduced by State governments across Australia from the early 1900’s to the early 1980’s for pasture improvement (Firn 2009). The species had been valued in the summer rainfall regions of southern Africa, USA and Argentina as a productive pasture species. However, ALG has failed to meet original expectations. In Bega Valley, a population of ALG was first noticed in 1945, but was not considered a problem until 1982 when it was found to have spread over approximately 8300ha after a number of dry years in the 1960s–70s (Campbell 1983). ALG now dominates many pastures in Bega Valley, threatening agricultural production as well as Lowland Grassy Woodlands, a current endangered ecological community (Firn et al. 2017). Compounding its spread, ALG is often unpalatable to stock, low in crude protein, and continues to invade pasture communities, woodlands, riparian areas and roadsides (Firn, 2009).
Managing ALG is enforced by local governments in accordance with the Noxious Weed Act (1993). In New South Wales, the Noxious Weed Act (1993) identifies, classifies, and prescribes management for noxious weeds. While there is no clear definition of a weed, policy considers the impacts on agriculture, the environment and human health (NSW DPI 2014a.). Management of noxious weeds is enforced by Local Control Authorities, usually local governments with the majority of responsibility placed on private landholders (with the exception of public lands). In Bega Valley, ALG is currently ranked as a class 4 noxious weed in accordance with the Noxious Weed Act (1993). Class 4 noxious weeds are locally controlled and require containment in a manner that supresses its spread (NSW DPI 2014b). Previously, ALG was listed as a class 3 weed in Bega Valley—regionally controlled and must be fully and continually suppressed and destroyed (NSW DPI 2014b)—however the spatial extent and density of ALG makes this rule impossible to enforce. As a result, legally enforcing ALG management is largely ad hoc; with attention placed primarily on isolated outbreaks.

**Living with African lovegrass**

The spread and proliferation of ALG is closely tied to the legacies of land management that have transformed grasslands. In grasslands, the highest diversity of species occurs in lower nutrient soils (Dorrough and Scroggie 2008). However, grazing management often involves increasing soil fertility to carry more livestock. Most often this results in a decline in native grasses, while exotic species increase (Dorrough and Scroggie 2008). This leads to an overall reduction in biodiversity, and consequently grasslands become more vulnerable to invasive plants (Dorrough et al. 2004). This is evident in Bega Valley, as preferences for exotic grasses have made pastures more vulnerable to drought, and subsequent ALG infestations. As opposed to native grasses that have acclimated to cope with the variability of Australia’s climate, during dry periods exotic pasture grasses lose vigour, become overgrazed and eventually expose bare ground. This results in an absence of pasture competition that allows ALG to proliferate. When ALG dominates
pastures it is problematic for agriculture due to its low palatability, impacts on routine farm management (e.g. mustering livestock), and suppression of more preferred pasture grasses (Firm 2009). The introduction of ALG, and the ongoing relationships that have assisted its spread, results in significant economic (loss of productivity and increased management costs), and ecological consequences (changes to the composition and functions of grasslands).

The difficulty for graziers to control ALG complicates land management and weed legislation. The spatial extent of ALG renders weed legislation impractical, as landholders are unable to control the plant despite its status as a class 4 noxious weed. While the financial burden of ALG may lead some graziers to sell their property, others are beginning to develop new methods for managing ALG. For example, some graziers are beginning to use the plant as another pasture species, employing familiar methods of grassland management:

I’ve learnt to manage with the ALG and the main strategy is slashing, keeping it short. (Adam, Lifestyle agrarian: beef and sheep)

Figure 2.2 A slashed strip in a paddock of African lovegrass, Candelo, Bega Valley
Various strategies are employed to manage ALG for grazing, such as altering stocking rates; changing livestock rotations; as well as increasing the frequency of slashing. In many ways ALG is managed as another pasture species, rather than an invasive grass. As these graziers begin to live with ALG they soon observed potential benefits of the plant. For example, despite invading post-drought, ALG is becoming increasingly valued in dryer periods for its ability to provide feed for livestock as other grasses die-off:

During drought the lovegrass is quite a useful feed, I had 2 or 3 ordinary years including one that was incredibly dry. During those years you can keep the cows going on lovegrass; it's actually quite a reasonable drought feed. (Adam, Lifestyle Agrarian: beef and sheep)

I'm not in a hurry to get rid of Lovegrass in case of drought, because in drought, they are my haystack. I always try to keep at least 25% of the farm with some fairly old growth Lovegrass, because I can go into drought here at any time. Drought doesn’t bother me at all now. (Bruce, Production farmer: beef)

In some ways ALG’s value during drought is not surprising. The species was introduced into Australia for its tolerance to dryer climates. However, it is also the plant’s ability to cope with less rainfall that makes it particularly invasive during and after drought. Over time some graziers no longer view ALG as an invasive enemy, but instead value the plant in grazing systems. As Susan details:

The sheep, when it’s in its mature state, and they’re lambing, find they are nice nesting places and it’s actually good for them. If it’s a cold snap or, it gets really windy here the lovegrass offers a certain degree of protection. The other good thing is it is a summer grass, and if you do slash it and it grows really well, it grows really fast and it’s a good, the animals seem to like it and get onto it. (Susan, Production farmer: sheep)

This example highlights the value of ALG beyond a drought tolerant pasture grass. As sheep and lambs rest within the ALG tussocks a new relationship is brought to life: one that prioritises the welfare of the sheep over the status of the plant. Within this eclectic mix of sheep and lamb bodies, ALG tussocks, and cold winds, the plant becomes integral in grazing systems.
While the above example is not common among Bega graziers, it reflects a recently shifting attitude toward ALG. Indeed, the inability to eradicate ALG is leading some graziers to learn and understand the potential benefits of the plant. The shifting status of ALG—from an invasive plant needing to be eradicated to a valued pasture grasses needing to be cultivated—highlights the fluidity of the categories used to position this invasive plant and direct management action. The assemblages of human and more-than-human actors working together to form and change the landscape of Bega Valley, also throw into question the discourses used to fix certain species to particular outcomes. As a result, and because legislation can be slower moving in recognising such change, the prevailing discourses that are used to instruct managers may no longer be useful, or worse, hinder adaptive responses.

2.4 Discussion

In Bega Valley, the changing ecological conditions that both result from, and exceed human control pose significant challenges for land managers and existing environmental legislation. Environmental legislation must somehow respond carefully and pragmatically to ecological conditions that are rapidly changing, while also addressing the vernacular disjunctures arising over species protection. Additionally, those on-ground need to respond to this ecological change in the context of their land management goals, as well as to environmental legislation. In the remaining sections, we reflect on the challenges of prioritising management based on species’ impact in Bega Valley’s changing environment. Noting these challenges, we return to NEG to consider how environmental legislation may proceed in dynamic environments, in order to overcome vernacular disjunctures and effectively address these ecological and social issues.

2.4.1 Impact discourses for environmental management: challenges and possibilities

Species-led management is used to identify a common goal for management across the public. If most people have a clear object to manage or manage toward, it allows for collective action (Graham 2013). However, social perspectives tell us that impacts vary across different epistemic
communities, and establishing management goals based on these qualifiers is open to contestation (Larson 2007b). The tensions over the Native Vegetation Act (2003) highlight, in part, the difficulty in establishing agreed upon impacts in order to direct management. For graziers, impacts are bound within the economic need to produce from the land, but are also contingent on existing social norms that have created certain expectations about the kinds of management practices that are necessary to ensure productivity (Tonts 2005). Consequently, as legislation—infomed by environmental science—attempts to curb the rate of land clearing and biodiversity loss, impacts are no longer bound within the context of farming production, but are often aiming to prevent the very management practices that graziers want to have autonomy over. As a result, graziers position legislation, particularly the Native Vegetation Act (2003), as restrictive and antithetical to production. While impact discourses are a useful heuristic in identifying those species that threaten economic and ecological assets, when differing interpretations of impacts emerge, mobilising impact discourses can create vernacular disjunctures and potentially compromise the aims of environmental legislation.

In contrast, the example of ALG reveals the irrelevance of impact discourses when eradication is no longer possible. The Noxious Weed Act’s (1993) species-led approach not only prioritises what should be managed, but also the outcome—eradication or containment. However, when invasive plants can no longer be removed, those on-ground are faced with management responsibilities regardless of legislation (Head et al. 2015a). For graziers in Bega Valley, the extensiveness of ALG renders legislation redundant; merely serving as a vestige of the discursive construct that position invasive plants as an intolerable ‘enemy’.

However, while the Noxious Weed Act (1993) does not compel landholders to manage ALG (as opposed to the example of the Native Vegetation Act), it poses a dilemma in terms of how well prepared legislation is to adapt and respond to the uncertainty of changing environments (Grumbine 1997; Leach et al. 2012). For example, and as mentioned previously, ALG’s re-
classification as a class 4 noxious weed requires that ‘the growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread.’ Despite the legal freedom granted to landholders living with ALG, the language of the legislation, which calls for continued control and suppression, restricts—or at least prolongs—the range of necessary responses. While changes in the classifications of noxious weeds are informed by local government (at times in consultation with landholders), such changes are slow moving and risk delaying adaptive responses. Similarly, when legislation positions invasive plants (such as ALG) as needing to be eradicated or contained, it prevents the immediate resourcing of alternative management strategies that are needed when existing management practices begin to fail. In this context, the inflexibility of the Noxious Weed Act (1993) is not due to the restrictions it imposes on what landholders can do (as is the case with the Native Vegetation Act), but is, in part, an outcome of mobilising impact discourses that limit the scope of possible relationships with invasive plants (outside of eradication and containment), and in turn can trammel necessary responses.

2.4.2 Overcoming vernacular disjunctures and responding to environmental change: the role of new environmental governance

Tracing the construction and reproduction of impact discourses highlights the values inherent within these definitions. As illustrated above, the manifestations of these values through legislation can be a source of conflict between epistemic communities (e.g. policymakers and graziers), or restrict the scope of management responses when ecological benchmarks are shifting rapidly. However, there are actions that can be taken to address vernacular disjunctures, as well as develop adaptive responses to environmental change. For example, within the Native Vegetation Act (2003) considerable steps have been taken to overcome the issues of vernacular disjunctures and develop regulations that aim to maintain native species protection while also meeting the concerns of graziers. We have mentioned RAMAs and PVPs as two regulations aiming to address local concerns within the context of the Native Vegetation Act (2003). The
practical flexibility built into the Act through these two regulations is an attempt to allow farmers
the opportunity to maintain production, without compromising its environmental objectives.
However, as the case study demonstrates, farmers still feel that legislation is impinging on their
desired management practices. Paradoxically, research suggests that the ‘self-assessable codes’ in
RAMAs are leading to a lack of effective monitoring into native vegetation removal, which is
proliferating native vegetation removal (EDO NSW 2014). This indicates that as opposed to
being restricted, farmers in New South Wales are using these caveats to facilitate land use change
(EDO NSW 2014; Johnson 2014).

The inconsistencies between farmers’ perceptions of the Native Vegetation Act (2003) and the
reported environmental outcomes of this legislation highlights the need for more effective
engagement strategies between farmers and those tasked with implementing the legislation. PVPs
in particular attempt to balance economic and ecological interests through providing financial
and technical support to farmers, while maintaining and ensuring the protecting of specific
native vegetation communities. However, there has been significantly fewer PVPs established in
Bega Valley than other catchment management areas (particularly Murrumbidgee), which
suggests that the strength of PVPs is not being effectively communicated to landholders (EDO
NSW 2014).

The vernacular disjunctures over the Native Vegetation Act (2003) highlight the need to improve
communication across governance levels and ensure legislation is appropriately understood.
Returning to NEG, this in part requires better developing the capacities of government agency
staff to collaborate across landholders (Holley et al. 2012). Enhancing the vertical and horizontal
flow of information between stakeholders can mitigate the existing weakness of the Native
Vegetation Act (2003) and limit vernacular disjunctures. This will provide the opportunity for
greater communication of the Act to improve understandings of regulations such as PVPs and
RAMAs that may benefit landholders. Additionally, collaboration will enhance the accountability
of state and local actors (including graziers), allowing for better monitoring of the implementation of these regulations to ensure environmental objectives are not being compromised.

Developing a more collaborative network can also improve the ability of landholders and government agencies to respond to, and learn how to live with changing environments. Part of the challenge in living with invasive plants, such as ALG, is coming to terms with rapidly shifting ecologies and recalibrating management goals (Head et al. 2015a). As Holling et al. (1996: 332) note: ‘ecosystems are moving targets, with multiple potential futures that are uncertain and unpredictable. Therefore management has to be flexible, adaptive, and experimental at scales compatible with the scales of critical ecosystem functions’. In Bega Valley, landholders are learning how to live with changing ecological conditions that are beyond control. Rather than draining resources into the impossible task of maintaining ecological stasis, landholders are adapting to this changing environment, shifting the normative goals of management in the process.

In Bega Valley, relaxing the classification of the Noxious Weed Act (1993) is a pragmatic response to the spatial extent of ALG. However in doing so, it also removes any legislative pressure to manage the plant. This provides landholders the freedom to develop management responses to live with the species, rather than restricting management to narrow modes of eradication. At the same time, landholders’ responses to changing ecological conditions may be enhanced through: (1) a more critical reflection on the language within legislation; and (2) illuminating the more-than-human relationships that challenge such discourses.

First, and extending from the learning principle in NEG (Holley et al. 2012), it is essential that government agencies not only recognise the potential impracticality of existing legislation, but also develop and support mechanisms to assist landholders respond to environmental changes
As NEG research indicates, when NRM groups fail to share information and experience between collaborative groups (horizontally), or between collaborative groups and agencies (vertically) they miss considerable opportunities to diffuse innovations and enhance management responses to environmental change (Holley et al. 2012). In the case of ALG, there is the need for landholders and agency staff to share information between and across groups in order to improve collective management responses.

However, and turning to the second point, it is also necessary for legislators to recognise the potential for legislative discourses to halt the responsiveness of managers, and consequently prevent the diffusion of innovation among those who are aiming to live with invasive plants, such as ALG. One strategy for addressing this discursive and practical dilemma is to expand the range and types of actors taking part in learning networks. More specifically, NEG principles can be improved upon by attending to the agency of plants in shifting landholders’ management goals and challenging legislation. NEG, to date, focuses on the role of human actors in collaborative NRM projects. In this context, NEG is concerned with the role of power and social values in defining management goals across epistemic communities that can assist or hinder management projects. In addition to these insights, we also recommend greater attention to the capacity of plants to transgress their discursive placement (i.e. natives-as-benign and requiring no management versus non-natives-as-harmful and needing to be eradicated). As the case study demonstrates, plants do not always map along these pre-determined categories, and at times can invert them. Creating the space to bring plants into these learning networks will be valuable in not only recognising the potential fallibility of existing legislative discourses, but also for building management knowledge in times of ecological uncertainty.

Finally, by adopting this relational impulse, NEG, and NRM agencies more generally, will be better positioned to respond to the tensions that arise when legislation is perceived as inflexible (as in the case of the Native Vegetation Act), as well as to better facilitate the responses to
ecological change and uncertainty. In regard to the former, the case study has demonstrated the capacities of native plants such as Poa and Tea Tree to disrupt graziers’ routine management practices, and simultaneously complicate the objectives of the Native Vegetation Act. While graziers’ may perceive the Act as inflexible based on their social, cultural and economic context, such attitudes are also contingent on the properties of the plants. Moreover, discussions about the arising tensions between graziers and policymakers over Poa tussock cannot exclude the plant’s lack of palatability; lower nutritional value; and increasing distribution in response to increases in soil fertility. For NEG, considering human and nonhuman actors within the principles of learning and collaboration holds significant potential for improving landholders’ and land managers’ responses to changing ecological conditions, as well as apprehending the role of specific plants to influence vernacular disjunctures.

2.5 Conclusion

In this paper we have illuminated how rural landholders’ land management practices are unsettled by changing environments and environmental legislation. We have aimed to better understand how environmental change is experienced on-ground and in turn how this affects land management. The challenges of environmental change include the capacities of invasive plants to exceed control and create novel modes of living with them, but also how landholders’ interpretation of legislation affects their ability to respond to changing environments. In particular, as environments change it calls into question how species’ impacts are defined and deployed to prescribe management action across different epistemic communities. The example of the Native Vegetation Act (2003) reveals the ambiguities in defining the impact of species. Species’ impacts vary according to social groups, and for graziers their dependence on predictable and consistent ecological conditions leads them to quickly position certain species as problematic and in turn remove them. Consequently, when legislation restricts these desired practices it leads to vernacular disjunctures that can impede effective engagement and
information sharing across landholders and government agencies. Examining the mobilisation of impact discourses in environmental legislation provides a means to uncover these sources of tension and better address vernacular disjunctures.

The example of ALG highlights the ability of species to transgress their discursive placement, and create novel relations. When invasive plants, such as ALG, can no longer be eradicated, managing these species requires immediate and adaptive responses outside of legislative framings. As Godfree et al. (2017: 1236-37) identity, ‘in situations where land managers simply have to live with non-native [invasive] grasses, understanding their utility in multifunctional, connected landscapes will be of immediate practical value.’ In Bega Valley, developing ways of living with ALG is crucial in order to maintain grazing systems and protect natural resources. In part, this requires moving past command-and-control strategies that aim to secure specific ecological compositions and functions, toward embracing more dynamic environments. Importantly, environmental managers need to apprehend how landholders are developing ways of living with ALG in order to facilitate and improve collective management responses. Moving beyond restrictive framings that position invasive plants as causing only negative impacts, provides the space for greater experimentation in developing alternative ways for living with these species.

As environments change, environmental legislation needs to develop processes that can cope with the dynamism, uncertainty and complexity of environmental problems. NEG provides a framework to move beyond command-and-control strategies and develop more adaptive and polycentric forms of environmental management to address the concerns of landholders, while also remaining committed to meeting environmental objectives. Balancing both objectives requires improving the ability of managers and policymakers to collaborate across different epistemic communities, and in doing so, create new forms of accountability that can better communicate the regulations assisting graziers manage native vegetation, while also recognising
the ability of these amendments to be abused and perpetuate environmental degradation (Holley et al. 2012). In addition to NEG’s emphasis on participation and deliberation across stakeholders, learning how to develop the capacities to live with changing environments will also be improved through attending to the agency of plants. Opening space to include plants as actors taking part in, and challenging, the implementation of environmental legislation will provide a more complex account of the relations that unsettle impact discourses, and shape management responses. Overall, environmental research in theory and practices will benefit from taking seriously the mobilisation and contestation of management values and priorities across different epistemic communities and actors (human and nonhuman), in order to better address vernacular disjunctures and in turn develop collaborative management responses in changing environments.
3 Watching the grass grow: how landholders learn to manage with an invasive plant in conditions of uncertainty

This chapter is currently under review as McKieman S, Gill N, and Atchison J, ‘Watching the grass grow: how landholders learn to manage with an invasive plant in conditions of uncertainty’. This chapter extends from the previous chapter, by unpacking in greater detail how graziers are learning to live with ALG in the absence of institutional management advice. The previous chapter’s focus on living with ALG outside of legislative framings necessitates further investigation into the processes and relations where landholders’ discover, respond to, and eventually learn to live with this species.
Abstract

Invasive plants present significant challenges for natural resource management. While, for some species at least, invasive plant management can be relatively straightforward if there are sufficient resources and adequate knowledge, at times, the ability of invasive plants to spread and establish populations can exceed the capacities and knowledge of land managers and management agencies. This can create uncertainty as to how these species may be managed in order to protect ecological communities as well maintain existing land uses. Drawing on empirical research with rural landholders’ living with the invasive plant ALG on the southeast coast of Australia, we detail how these landholders learn and develop management responses in the absence of formal institutional knowledge. Building from recent insights on nonhuman agency and environmental learning, we adopt a relational learning approach to explicate the distinctive capacities of ALG to influence how landholders learn to live with the species, and in turn manage their land. Given recent attempts to link local knowledge with scientific expertise that addresses NRM issues, we argue that greater emphasis on the role of nonhumans in shaping local knowledge is helpful in developing adaptive responses to protect economic and ecological resources.

Key Words

Invasive plant management, environmental learning, nonhuman agency, natural resource management, uncertainty
3.1 Introduction

Invasive plants now threaten existing ecological communities and production landscapes (Pyšek and Richardson 2010). In Australia, more than 2770 exotic plant species are naturalised, of which 65% are considered a problem for natural environments and approximately 35% considered a problem for agricultural systems (Coleman et al. 2015). It is estimated environmental weeds alone cost between $3.5 and $4.4 billion annually and that the cost to local and central government on monitoring, control, management, and research is $116.4 million annually (Sinden et al. 2004). Despite the need to control invasive species, management is not straightforward. Lack of finances, time, and impediments to collective action can prevent effective control for landholders and NRM groups (Graham 2013; Klepeis et al. 2009). Further, in some regions the sheer scale of infestation is itself transforming ecosystems and can make eradication impossible (Head et al. 2015a; Hobbs et al. 2013). Government agencies and landholders alike are faced with landscapes of uncertainty as invasive plants, often facilitated by climate change (Pyšek and Richardson 2010), continue to push ecosystems beyond past benchmarks, where spatial and temporal analogues for management no longer exist and where priorities and scales of management are changing (Head et al. 2015a). Consequently, there is a lack of effective knowledge about how to manage landscapes in order to maintain production or protect natural resources. These challenges indicate the need for further research into how land managers are developing the capacity to manage and live with changing and unpredictable conditions.

In this paper we examine how rural landholders learn to manage and cope with an invasive plant in conditions of uncertainty. This uncertainty involves how to protect grazing enterprises from an invasive plant in the absence of effective management advice from formal institutions. Current learning research explores how individuals and groups of people understand and manage in novel conditions (Armitage et al. 2008; Armitage et al. 2009; Allen et al. 2011). Multiple
Frameworks have been developed to identify how learning is achieved and is effective (Armitage et al. 2008; Fazey et al. 2005). In the context of uncertainty, particular attention is given to how people learn on-ground (Fazey et al. 2005) or in ‘place’ (Leith and Vanclay 2017). This includes how people ‘learn-by-doing’, whereby management knowledge and skills are acquired through experiences (Erkisen and Prior 2011; Fazey et al. 2005; Leith and Vanclay 2017). However, despite the emphasis on learning in the environment, the environment itself remains under-conceptualised within learning research, with little consideration of the specific roles its constituent elements actively play in generating knowledge. Building from critical interpretations of the environment in learning studies (Cooke and Lane 2015a; Leith and Vanclay 2017), we focus on how people learn within the environment, or more specifically, with the range of nonhuman actors which together constitute the environment. This approach not only aims to improve understandings of the environment in learning studies, but is also an attempt to decentre the role of human-to-human social networks in learning, particularly when conventional information sources are unable to provide effective management advice.

In this context, we aim to advance existing approaches to learning in an NRM setting by bringing critical social science perspectives to bear both on what constitutes the environment in learning processes, and on the nature of its role in these processes. We draw from more-than-human and relational ontological perspectives that dismantle the nature/culture binary and call attention to the relations between humans and nonhumans (plants, animals, and technologies) where agency, subjectivity and knowledge emerge (Latour 1993; Whatmore 2002). In this perspective not only is agency granted to nonhumans, but more recently it includes calls for recognition of species and inter-species differences that are currently obscured under broad references to landscape, environment, or nonhuman agency (Bear 2011; Head et al. 2015b; Lulka 2009). We extend these insights to further recent work that incorporates nonhuman agency into learning frameworks (Cooke and Lane 2015a; Fenwick 2010; Plumb 2008), by adopting a relational learning approach.
We define a relational learning approach as an investigation into the human and more-than-human relationships where knowledge is formed, practiced, and contested. In particular, relational learning aims to decentre human agency through apprehending the distinctive capacities and contributions nonhumans make to learning processes, and the coproduction of new knowledge.

Our focus is the invasive plant ALG in Bega Valley, New South Wales, Australia. In Bega Valley, ALG presents a current threat to agricultural production as well as Lowland Grassy Woodlands, an endangered ecological community. However, although ALG was introduced by the New South Wales government for pasture production and improvement (Firm 2009), how it should be managed now that it is invasive, and its pasture quality is less than anticipated, remains an open question. In light of these challenges, this paper has two key aims: first, we aim to improve understandings of the learning process by illuminating the role of ALG—with other nonhuman plants and animals—in guiding management responses. In doing so, we move beyond treating the environment as a homogenous whole, to unpack the distinctive capacities of an invasive plant and how it affects the learning process in specific ways. Second, in taking a relational approach to learning we aim to reveal how landholders learn to cope with an invasive plant in the absence of formal institutional knowledge. Invasive plants not only have the potential to push ecosystems into novel conditions with uncertain results, but they can exhaust existing management resources and options, leaving landholders and the land vulnerable to further infestations.

We begin by outlining how the environment has been conceptualised in learning studies and what a relational learning approach is and its relevance for NRM, before turning to the context and methodology of the study. We then present the original empirical results by detailing participants’ ‘learning journeys’ as they discover, respond, learn about, and then learn to live with ALG.
3.2 Learning and the ‘environment’ in learning studies

Learning is central to the ability of individuals and groups of people to respond to changing environments (Tarnoczi 2011). In NRM, learning research centres on how and why individuals learn (Fazey et al. 2005), the inter-linkage of the learning process across multiple scales (Leys and Vanclay 2011), and the outcomes of learning that are transformative (Muro and Jeffrey 2008). Table 3.1 illustrates three learning theories commonly applied in NRM studies including experiential, transformative and social learning. These theories all reflect upon the human experience of learning, both at an individual and a group level. Significantly, the environment is positioned as a key influence or as a driver for learning; however, in these approaches it remains a blanket term that obscures and objectifies the environment, distancing it from the human learners. For example, Larsen et al. (2011) in describing social learning for NRM acknowledge the integration of personal, inter-personal, and ecological interactions, which is defined as the ‘process by which the individual is guided to focus on those environmental signs and signals’ (85). These signs and signals then build knowledge through individual or group observation and reflection. However, the authors do not provide the same level of reflexivity on how these signs and signals manifest to affect human learning, or the species involved in these ecological interactions that affect the learning process in distinct ways.
### Table 3.1 Applications of learning theories in NRM, and the role of the environment

<table>
<thead>
<tr>
<th>Learning Theories</th>
<th>Key Characteristics</th>
<th>Application</th>
<th>The environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiential learning (Fazey et al. 2006; Kolb 1984; Seaman 2008)</td>
<td>Experiential learning is a process, whereby knowledge is created through ‘learning-by-doing’ or trial-and-error experiments. The learning process is a cycle consisting of four stages: concrete experience, reflective observation, abstract conceptualisation, active experimentation. Put simply, an individual has a concrete experience or observation and then goes through a process of cognitive reflection. Reflecting generates change in knowledge and abstract concepts that in turn triggers different actions and experiences. It is a cycle of learning-by-doing and observing.</td>
<td>Adaptive management (Armitage et al. 2008; Blackmore 2007), land/property management (Cooke and Lane 2015a; Eriksen and Prior 2011; Measham 2006)</td>
<td>The role of the environment is bundled under ‘environmental influences’. Learning occurs through individual’s observing and then reflecting on their interactions with the environment. However, the environment is positioned as a discrete category separate from social and cultural factors. It remains a blanket term that obscures ecological diversity and its differing effects.</td>
</tr>
<tr>
<td>Transformative learning (Lange 2004; Mezirow 1991; Percy 2005)</td>
<td>Transformative learning is a reflective process concerned with the alteration and transformation of individual perceptions and consciousness. There exist three domains of learning: Instrumental (individuals engage in task-oriented problem-solving); Communicative (understanding what others mean e.g. intentions, values, feelings, and beliefs); and Emanicipatory (critical self-reflection). Transformation occurs when there is a change in an individual’s ‘frame of reference’ (habitual thoughts/practices) in any or all of these domains. In sum, transformative learning occurs through a process of critical self-reflection and in-depth questions of the guiding assumptions and values of individual or group experience.</td>
<td>NRM (Wilner et al. 2012), farming (Lankester 2013), sustainability (Tarnoczi 2011)</td>
<td>Contains similar characteristics to experiential learning with emphasis on human-environment interactions. However, as with experiential learning the individual remains autonomous and separate from the environment, whereby knowledge is derived by distancing oneself from the object of study.</td>
</tr>
<tr>
<td>Social learning (Keen et al. 2005; Keen and Mahanty 2006; Leeuwis and Pyburn 2002; Muro and Jeffrey 2008; Rodela 2013; Schusler et al. 2003)</td>
<td>Social learning involves the communication and interaction of different actors in a participatory setting. These interactions result in a set of social outcomes, such as the creation of new knowledge, the acquisition of technical and social skills, as well as the development of trust which may facilitate collective action.</td>
<td>NRM (Davidson-Hunt 2006; Krasny and Lee 2002; Larsen et al. 2011; Nykvist 2014), Adaptive co-management (Berkes 2009; Løys and Vråland 2011), environmental governance (Armitage et al. 2008; Plummer and Armitage 2007; van Tol Smit et al. 2014)</td>
<td>Focus is placed on the social construction of knowledge, whereby learning occurs through sharing knowledge and developing a common social reality. The environment remains a broad category that is separate from social relations. While the environment and indeed ecological issues drive the research, less attention is given to how the environment influences individual and group values and actions. In sum, the environment is ‘out there’ separate from social and cultural factors.</td>
</tr>
</tbody>
</table>
While experiential, transformative, and social learning all acknowledge the environment as affecting human learning, these perspectives present the learning process as series of *interactions* between humans and/or nature. In doing so, learning approaches in NRM reproduce the ontological divide between culture and nature, whereby humans actively and autonomously move in and out of connection with nature during the learning process. However, not only is this separation of culture and nature a fallacy (Latour 1993), but in isolating these two poles, nature itself is understood to exist as an objective reality ‘out there’. As a consequence, the environment becomes a ‘black box’, in which the diversity of nonhumans that come to categorise the environment are obscured and their agency flattened. Despite the recent emphasis on socio-ecological relations in learning studies (Kayes 2002; Lankester 2013), the ontological distinctions inherent within these analyses forgo detailed examination of the ecological, and as a result reinstates nature and culture as immutable categories.

### 3.3 Relational learning and existing approaches

In response to the ontological divide between culture and nature that is reified in learning approaches in NRM, we employ a relational ontology to consider the relationship between the environment and learners differently. In particular, we understand the learning process as co-constituted through human and more-than-human relations—plants, animals, tools and technologies—that cannot be cleaved apart. A relational ontology illuminates, in part, the multiple ways in which human lives are entwined within the environment in the coproduction of knowledge and action (Bawaka Country et al. 2016; Ingold 2000; Latour 1993; Whatmore 2002). Importantly, this perspective grants agency to nonhumans in not only shaping environments, but also in influencing human knowledge and subjectivities (Haraway 2008). Fundamentally, this approach differs from contemporary studies of environmental learning through an ‘ontology of becoming’ (Latour 1993), whereby the world does not consist of discrete things that are brought into relation through ‘interactions’, but instead consists of flows and connections that are
continually made and remade through their being together. A relational approach also contrasts with a social constructionism representation of landscape and the environment, as evident in the social learning approach in Table 3.1, which treats the natural world as a blank canvass for culture to paint over (Greider and Garkovich 1994; Stedman 2003). Instead, relational ontologies understand both nature and culture to be mutually co-constituted; nature does not come into contact with culture or vice versa, but both rematerialise through these relations (Latour 1993).

Such an ontological shift suggests a different approach to investigating the relationships coproducing knowledge and learning. Multiple scholars have examined the coproduction of learning in relationships between people and various nonhumans, lending support to the idea that the environment is not a passive backdrop to human learning, but a complicated assemblage and an active part in the coproduction of knowledge (Cooke and Lane 2015a; Fenwick 2010; Plumb 2008). For example, actor-network theory (ANT) has been employed in learning studies to trace the networks of actors (human and nonhuman) that influence the learning process (Aberton 2012; Fenwick 2010; Hamilton 2011). Extending from the seminal work of Callon (1986), learning approaches in educational research for example have adopted the epistemological and methodological tools of ANT to trace the symmetries (the human and nonhuman actors that influence the assembling and mobilising of learning networks), moments of translation and stabilisation (the negotiations between actors and actants that work to create and maintain these networks), processes of enrolment (locking actors into place while excluding others), and dissidence (where people and things transgress their placement, or new quasi-objects emerge that bring about new actors and effects) within the learning process (Fenwick 2010; Fenwick and Edwards 2011). Most crucially, using ANT unlocks the preoccupation with the human in learning studies, refusing the rigid separation of the social from the natural to bring attention to processes and performances of the learning process, rather than the outcome (Callon 1986; Latour 2005).
Place-based learning is another approach that provides a comprehensive understanding of human-environment relations. Place-based perspectives articulate how people’s experiences with the environment influence their conceptions of place, identity and knowledge (Leith and Vanclay 2017). Extending from other relational thinkers (particularly Ingold), contemporary place research understands place, and the human and nonhuman components from which it is formed, as both agents of change and that which is changed. This approach treats place and placed knowledge as actively co-constituted through these relationships—place is emergent (Wylie 2007). For example, Leith and Vanclay (2017: 157) attend to ‘specific localised reasonings’ and understandings of place through the narratives of farmers. In doing so, the authors highlight the importance of attending to placed knowledge in order to build appropriate management responses in climatic uncertainty. Importantly, this and related studies (Dominy 2001; van der Ploeg 1993) indicate how farmers gain knowledge through their connection to the land. Rather than simply transforming a landscape through cultural expressions, these land management practices emerge through the mutual exchanges between ‘culture’ and ‘nature’.

While place research is significant in drawing attention to the role of the environment in creating knowledge and influencing management actions, we argue that similar to learning studies in NRM, the environment remains largely a general category. In generalising the environment, place research black boxes nonhumans and their agency insofar that it remains abstract, and the specific properties and agency of diverse constituent elements are not elaborated on to a significant extent. In the case of invasive species management, this is highly problematic when new or emergent problem species ‘appear’ in unexpected places, or are changing the ecological compositions of the places where this knowledge is derived from. In times of environmental uncertainty, placed knowledge that arises through a historic connection with a specific landscape may no longer be able to prevent or control a species spreading and impacting land management. Thus, land managers’ ‘gut feeling’ (Leith and Vanclay 2017: 166), which is temporally dependant
on place but also developed over a long temporal duration and experience, may no longer be as relevant or an appropriate recourse when things are changing quickly. This is even more evident for newly arrived landholders who are still acquiring or refining their gut feeling. Importantly, when gut feelings—or knowledge of a place as it was—can no longer determine management responses, how people learn is increasingly dependent on their relationship with problematic species and uncertain conditions.

In response, we draw inspiration from Cooke and Lane (2015: 45) who incorporate ‘landscape agency’ with experiential learning in understanding how newly-arrived peri-urban residents become environmental stewards, but we differ in that our focus is on a specific invasive plant. To do so, we extend from recent work in human geography that aims to not only draw attention to nonhuman agency, but also the need to articulate the specificity of nonhuman life (Bear 2011; Lulka 2009). This means moving beyond broad categories such as ‘the environment’, ‘nonhuman’, or ‘landscape’ agency to delve into the distinctions between living things. In overcoming general conclusions about what species do, Lulka (2009: 385) for example argues for a ‘thick hybridity’ that avoids lumping together nonhumans as stable constructs by attending to the diversity of nonhuman agency, with and without humans. To paraphrase Ingold (2007: 9), nonhumans such as plants or animals do not present themselves as tokens of some common essence—the environment—that endows every nonhuman with its inherent agency. Two examples illustrate this. Firstly, Bear and Eden (2011) identify how anglers do not merely engage with fish, but with various collectives and individuals, which behave differently in different circumstances. In this example anglers’ knowledge of fish is never singular, but plural; contingent on the modes of encounter (e.g. from boat or land), but also the species and whether they act as collectives or individuals. Second, in their work on rubber vine in Northern Australia, Head et al. (2015b) extend this to plants, drawing attention to plant capacities, or ‘plantiness’. Plants have their own ‘dynamic manifestations’ (Head et al. 2015b: 405), which affect other human and
nonhumans differently. Engaging with different categories of plants (e.g. trees, seeds, grasses, and flowers) reveals different insights about the plants themselves, and our relationship with them (Atchison and Head 2013). Building from these approaches, we propose the term *relational* learning to capture the experiences of people coming to grips with managing a specific invasive plant.

### 3.4 Context: African lovegrass and uncertainty

In what follows, we trace how the specific capacities of ALG create new challenges for land management that cannot be adequately encompassed through references to the landscape, environment, or even nonhumans. In NRM, a key question is how land managers learn to manage in a context of uncertainty. We use the term uncertainty here to characterise the lack of knowledge held by formal institutions (i.e. government funded NRM agencies and groups), and private landholders in developing the capacity to manage changing environmental conditions. Thus there is uncertainty over future changes to natural resources, as well as current uncertainty in maintaining them. Invasive plant management may be relatively straightforward if there are adequate resources and existing knowledge to control specific plants. However, invasive plants contribute to management uncertainty when the species exceeds existing knowledge and experience, as well as financial and physical resources (time, equipment, skills) and ecological thresholds (Hobbs et al. 2013). When invasive plants can no longer be controlled, managers need to develop long-term strategies to manage the plant and protect natural resources.

To date, there is limited research as to how people learn to live with invasive plants in the absence of institutional knowledge and advice. We address this by considering how rural landholders (predominately graziers) learn to live with the invasive plant ALG. In Bega Valley, ALG is slowly taking hold, outcompeting existing native and improved pasture species and forcing new management arrangements. Numerous agronomic types of ALG were introduced
across Australia from the early 1900’s to the early 1980’s for pasture improvement (Firn 2009). The species was valued in the summer rainfall regions of southern Africa, USA and Argentina as a productive pasture species. However in Australia, ALG has failed to meet original expectations. Instead, the species is often unpalatable to stock, low in crude protein, and has invaded pasture communities, woodlands, riparian areas and roadsides (Firn, 2009).

However, the damage being caused by ALG is not a complete surprise. During experimental testing, researchers raised alarms about the lack of palatability of ALG, and also noted the species vigour as a weed (Firn 2009). While ALG’s fast growth rate, seed production, and tolerance for dryer climates motivated the initial trials for pasture improvement, its lack of palatability presented a significant concern. As Leigh and Davidson (1968) noted, ‘with appropriate husbandry it [ALG] might be a valuable pasture; without this it might be an embarrassment’ (quoted in Firn 2009: 86). Since then ALG has become a major problem across Australia. Indeed, the properties of ALG that warranted its introduction (i.e. ability to survive harsh soil and climate conditions) have facilitated its spread. Additionally, ALG’s lack of palatability accelerates preferential grazing, reducing pasture competition and allowing the species to dominate.

In areas of Bega Valley the geographic distribution and density of ALG means eradication is impossible, and containing its spread is increasingly difficult. Compounding the physical inability to eradicate or contain ALG, formal NRM and primary production institutions (e.g. Landcare and LLS) remain uncertain about the precise methods needed to manage ALG, and while there is agreement on what people want to achieve, there is both indeterminacy and ignorance about how to achieve it. This institutional uncertainty stems from a lack of effective information on how to control the species, but also the inapplicability of existing strategies in different geographical contexts. As Firn (2009) notes, there exist a high amount of diversity within the species *Eragrostis curvula*, to the extent that it is comprised of 7 agronomic types: Curvula,
Conferta, Short Chloromelas, Tall Chloromelas, Robusta Green, Robusta Blue and Robusta Intermediate. The variations and overlap between these agronomic types creates uncertainty for land managers attempting to predict the impacts of the species, as well as assess the suitability of existing control methods. Further, while all agronomic types of ALG (with the exception of Consol), are now considered undesirable plants within Australia, declaration of the complex as noxious weeds has not occurred in all States and regions (Firn 2009). As a result, management experiments, and the distribution of results, remain uncoordinated and are often limited to the local government areas.

3.5 Methods

This article reports on fieldwork over a one year period in 2014 that is part of a larger project on invasive plant management in the Bega Valley. Purposeful snowball sampling (Tashakkori and Teddlie 2003) was used to recruit a mix of tree change and commercial farming properties. Research recruitment flyers were also distributed through Landcare and LLS email servers and newsletters. A total of 49 landholders and 5 NRM agency staff were interviewed from April–June and follow-up interviews were conducted with 10 participants in November 2014. Participants included government weeds officers, LLS, Landcare staff, research scientists and landholders. This paper focuses on interviews with NRM agency staff, production farmers (particularly beef and sheep graziers); lifestyle agrarians (non-commercial grazing enterprises); and conservationist and regenerative NRLs.

The two research methods were semi-structured interviews and a walking methodology (Hitchings and Jones 2004). Semi-structured interviews were useful to ensure research topics remained focused around participant attitudes and behaviours toward invasive plants, while also providing participants freedom to tell stories about their history of land management, generally. This narrative approach (Rosenthal 2004) was valuable in understanding how landholders have learned about ALG, and how this has changed over time. During semi-structured interviews,
participants were asked about their prior knowledge of land management, whether their property had weeds before their purchase (and if they were aware of any weeds), their history of management practices, and how they learned about weeds. Semi-structured interviews lasted approximately 30-60 minutes. Following this, informal walking interviews took place on participant properties. This served to provide a ‘memory trigger’, capturing conversations and insights unavailable through indoor interviews (Hitchings and Jones 2004). For example, by directly engaging with ALG in the field, participants were able to reflect on specific characteristics of the plant that would be difficult to articulate during the indoor interview. This not only prompted further discussion about the problems with ALG, but strengthened the researcher’s understanding of why the specific properties of ALG matter. Walking interviews lasted approximately 40-90 minutes.

Interviews were recorded and transcripts were imported into the qualitative software program NVivo. The interviews were coded using an open thematic approach (Bazeley 2007), whereby descriptive characteristics are grouped to build toward a holistic theme. For example, while participants describe how certain plants trigger specific responses (nonhuman agency), this became meaningful when contextualising these descriptions under the ‘environmental learning’ theme. Upon reviewing this theme it became apparent that not only do different species impact learning in various ways, and to varying degrees, but that this learning is processual. This was epitomised in the context of ALG where participants described various stages of learning about the plant. Following this, the empirical section is structured around four themes of the learning process: from discovering the problem of ALG, to realising existing knowledge is insufficient, and finally experimenting with ways of living with the plant. Within each theme new actors (human and nonhuman) emerge that affect the learning process in different ways. The empirical material is organised into tables with each of the four sections of the learning journey comprising
three descriptions. While only one quote is provided for these descriptions, this material is representative of other participants’ experiences.

3.6 Learning with African lovegrass

The following section details landholders’ learning journey with ALG. This journey is separated into four processes: discovery, response, personal learning, and living with. These four processes of learning are not prescriptive; many landholders engaged in these scenarios simultaneously and non-linearly. In detailing learning journeys, we specifically focus on how landholders develop the capacity to manage ALG in spaces of uncertainty, characterised by a lack of formal management advice.

3.6.1 Discovery

For landholders learning about ALG, it first involves discovery. Identifying ALG was often assisted by neighbours (11 participants), NRM staff (15 participants), or weed identification booklets/online sources (8 participants). While this is a necessary step in confirming the species presence, landholders learned of and about the consequences of infestation differently. The process of discovering the effects of ALG is connected to the plant’s behaviours in relation to other nonhumans and the elements. This includes the weather (e.g. drought), livestock, and the reactions of other pasture species. Table 3.2 captures some landholders’ experiences in discovering ALG as a problem.

ALG emerges as weed when it disrupts land management. This is an issue facing production and non-production properties. In particular, NRLs discover the problem of ALG when attempting to manage the species for fire prevention, in gardens, or along fence lines. Its fast growth rate and seed reproduction demands immediate and sustained control efforts. Landholders’ hand-removing ALG remark on the strength of the roots, and density of the tussock, that make the task overwhelming. Consequently, the inability to remove the plant facilitates its spread.
Table 3.2 Landholder recollections of learning that their property had ALG, and that it is a serious weed

<table>
<thead>
<tr>
<th>Learning about ALG</th>
<th>N=</th>
<th>Example quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Livestock: witnessing how livestock interact with ALG informs ideas of plant desirability</td>
<td>9</td>
<td>You see it in the calves, you put good fresh cattle in there out of the good country and you move them [into ALG] and you see the cows dry off, the milk drops, they lose condition. (Tony, Production farmer: beef)</td>
</tr>
<tr>
<td>Plant condition: changes in ALG colour and size guides ideas of plant suitability</td>
<td>9</td>
<td>when it rained, all this tall grass came up, initially green, and half a meter high along. I thought, ‘wow, look at this place go!’ And then it just realised itself as it matured, and turned into this senescing ALG that nothing would eat. (Bruce, Production farmer: beef)</td>
</tr>
<tr>
<td>Spread: observing the extent to which ALG outcompetes other pasture species</td>
<td>10</td>
<td>It was a really bad drought and the ALG came back like oats. I’ve gone, ‘Jesus why would you want to spray it now, how good is it?’ The cows are eating it, and then in no time it just took off. In no time it was everywhere. (Stuart, Production Farmer: beef and sheep)</td>
</tr>
</tbody>
</table>

For graziers, ALG emerges as an issue by observing how livestock interact with the plant. When ALG matures the senescing leaves turn brown, becoming rank and unpalatable. The tussock of the plant grows wide, forming a hard, sharp surface making it difficult to move through and creates problems for animals’ feet. ALG’s ‘weediness’ is partly a result of the agency of the plant: how it grows, feels, and changes appearance. However these changes only become meaningful in relationship with livestock. For example, the tall brown leaves of ALG become a problem when livestock avoid the plant. Also, graziers learn through livestock condition (losing weight, drying off) that the plant is low in protein. While wider social networks warn landholders about ALG, individual experiences clarify these concerns and contextualise them personally.

3.6.2 Response
The discovery of ALG elicited a range of responses. These varied from anger over lack of transparency at sale time from real estate agents (3 participants), shock about the severity or extent of the weed (8 participants), and naivety over the difficulty in control (8 participants).

Following the discovery of ALG, participants sought information from NRM agencies. LLS and Landcare are common points of contact in learning about the species, its impact, and available
management options. These groups serve as knowledge-brokers disseminating information in digestible formats to assist in land management. However as Table 3.3 indicates, ALG stretches and exceeds their knowledge, limiting their capacity to assist landholders.

Table 3.3 Landholder’s initial point of contact for managing ALG and the absence of knowledge about best practice

<table>
<thead>
<tr>
<th>Information sources</th>
<th>N</th>
<th>Example quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agronomist</td>
<td>2</td>
<td>It started with a district agronomist. Basically, he had no knowledge at all of managing ALG other than burning it. He had no idea. I asked him how to get rid of it. He said, ‘When you find out, let me know’. (Bruce, Production farmer: beef)</td>
</tr>
<tr>
<td>NRM agencies</td>
<td>5</td>
<td>I started with pasture improvement because that was the Department of Agriculture advice. Whether through bad luck or bad judgment on my part, I don't know. I’ve had three goes at pasture improvement and none of them have been successful. (Vince, production farmer: beef and sheep)</td>
</tr>
<tr>
<td>Social networks</td>
<td>8</td>
<td>I’m also a member of the farmers network so that’s a good thing that we’ve been getting info from … what my mates are doing and how it responds and just trialling and stuff. (Tony, Production Farmer: beef)</td>
</tr>
</tbody>
</table>

Some graziers sought advice from agronomists to remove ALG through pasture improvement, which involved spraying ALG with herbicide and then resowing pastures with different species. However, participants reported these strategies were unsuccessful. Further, attempts to pasture improve with more preferred species, were costly, with one participant lamenting spending thousands of dollars on ‘a fizzer’, or totally unsuccessful control (see Figure 3.1 for an example of the outcome of this management). These experiences challenge the relevance of existing knowledge-brokers as traditional management responses fail to meet the desired outcomes.
Landcare and LLS also admit to a lack of knowledge about managing ALG; however, they are engaging in a variety of strategies to learn. One strategy involves working with informal social networks such as friends and neighbours to gather information about the different strategies to control ALG, such as different herbicides, as well as altering grazing practices through varying stocking rates and paddock rotations. The value of this informal knowledge is demonstrated by the local Landcare organisation: the Far South Coast Farmers Network. This network aims to collaborate with and between farmers in managing ALG. While organised by Landcare this information comes from informal sources. In the absence of institutional knowledge, Landcare and the LLS collate different experiences in the hope of developing strategies and a knowledge-
base for coping with ALG. Given both landholders and extension services value others’ experiences in learning about ALG, it poses a deeper question about how this learning occurs.

### 3.6.3 Personal learning

In the absence of institutional knowledge, some landholders began personal experiments to understand how to manage ALG. Table 3.4 details participants’ strategies in learning about ALG. In embarking on these personal experiments, participants are guided by the responses of ALG and other nonhumans, which become vital in directing future management and building further knowledge about the plant.

**Table 3.4 Landholder observations and strategies in learning how to manage ALG**

<table>
<thead>
<tr>
<th>Practices of learning with ALG</th>
<th>N=</th>
<th>Example quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment: trialling new management regimes in order to learn how to use ALG for production.</td>
<td>9</td>
<td>I tried spraying it at first, and then I thought, ‘This is ridiculous. It’s all over the place. I can’t spray the entire property.’ And I found that slashing it in the house paddock seemed to keep it down to a reasonable extent, but really, it didn’t go until a) we got the sheep on, and then b) the drought disappeared. (Josie, Lifestyle agrarian: beef and sheep)</td>
</tr>
<tr>
<td>Personal research of plant biology: understanding the science behind ALG to then implement alternative management regimes.</td>
<td>3</td>
<td>We thought, ‘Well, we can’t find anything out there,’ so I just started reading just learning about soil. I learnt along the way that the species of plant that grows is determined by the conditions of the soil. (Bruce, Production farmer: beef)</td>
</tr>
<tr>
<td>Observation: identifying how ALG behaves in different environments and under different conditions.</td>
<td>5</td>
<td>ALG doesn’t like shading, it doesn’t like high nutrient [soil] and you’ll notice under some trees where stock camp, around stock troughs any area that’s highly fertilised and highly utilised or where ground cover is left, ALG is very sparse. (Adam, Production farmer: beef)</td>
</tr>
</tbody>
</table>

Learning how to manage ALG is a process of trial-and-error. For some, this involves personal research into the plant to develop new management techniques (e.g. reading peer reviewed texts and other publications relating to ALG). This personal research aims to limit ALG spreading, and to learn its potential use in property management. Subsequently, landholders—informed by their reading—conduct various experiments such as increasing soil fertility or increasing grazing
pressure in the hope of reducing ALG and promoting other grasses. These experiments then become meaningful through the responses of ALG and other nonhumans that validate or contradict research.

Many graziers undertake active experimentation informally in learning the mechanisms that promote and suppress ALG. These experiments reflect a process of trial-and-error, in which graziers determine the success or failure of a specific management practice through careful attention to the responses of ALG and livestock. For example, as graziers increase grazing pressure, or the frequency of slashing, the growth rate and palatability of ALG changes, becoming more productive. Informed by these new observations, graziers then attempt to maintain the colour and length of ALG—either through slashing or more intensive grazing—that corresponds with livestock eating the plant. In this context, graziers are modifying familiar management techniques as they become aware of how the materiality of ALG (how it looks, feels, and grows) influences livestock behaviours.

Contrasting active experimentation, landholders also observed how certain nonhuman relationships work to suppress ALG without direct human input. For example, landholders identified an absence of ALG under trees and in areas with higher fertility, such as around livestock camps. Observing these changes triggers more active management to replicate these functions, such as tree planting. This observe-to-manage process reveals the influence of nonhumans, which is not always directed by people. Ultimately, both active experimentation and passive observation depends on graziers’ careful attention to the physical properties of ALG (leaf colour, length, and texture, seed production) in relationship with livestock behaviour (grazing preferences), and in turn attempting to recreate more favourable conditions based on these ongoing observations.
3.6.4 Learning to live with

Living with ALG is a reality facing many landholders in the Bega Valley. Its invasiveness and spatial extent make eradication impossible. This is not to say landholders have a defeatist attitude, but that they need to make immediate and pragmatic decisions with or without the help of formal institutions. Table 3.5 highlights how landholders are changing their management practices, or attitudes about weeds more broadly, in response to ALG.

<table>
<thead>
<tr>
<th>Changing attitudes and practices to live with ALG</th>
<th>N=</th>
<th>Example quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pasture management: alternating grazing and pasture management to manage ALG for stock.</td>
<td>9</td>
<td>I've learnt to manage with the ALG and the main strategy is slashing, keeping it short. (Adam, Production farmer, beef and sheep)</td>
</tr>
<tr>
<td>Forced cohabitation: the extensiveness of ALG requires a shift in trying to learn to live with the species.</td>
<td>9</td>
<td>I see weeds as a succession thing, so we've damaged the landscape, so they're healing, but you're not going to eradicate them. We have to learn how to live with them through land management practices. (Tabatha, Lifestyle agrarian: mixed grazing)</td>
</tr>
<tr>
<td>Learning from ALG: graziers incorporate ALG into daily management practices.</td>
<td>3</td>
<td>I can look at the plant to tell me what the temperature's going to be for the day. If it doesn't roll its leaf up, then I know it's not going to go 35, and I don't have to be overly concerned about shade for the cattle. (Bruce, Production farmer: beef)</td>
</tr>
</tbody>
</table>

The inability to remove ALG presents significant challenges for landholders. At times, the task may be overwhelming, resulting in people leaving their property. Alternatively, it can lead to new management ideas and practices. Learning to live with ALG is partly achieved through treating the plant as another pasture species. Rather than inventing completely new management techniques, graziers rely on existing knowledge and skills of pasture management. Beef and sheep graziers depend on detailed knowledge of grass: they watch how grass responds to rain; they see what happens from overgrazing; they inspect paddocks routinely and notice new or odd things in relation to grass and weeds. They move stock to manage their grasses, as much as to manage the stock. This attentiveness to grass makes them keenly aware of the way small grassy
plants can change and respond. However, the fact that ALG cannot be managed the same as other pasture species highlights the diversity of plant life that also needs careful consideration. Learning ALG’s plantiness—the length at which it becomes unpalatable, how seeds are spread, how it competes with other grasses, how it reacts to certain herbicides—is necessary in order to live with the plant. While existing knowledge of pasture grasses is useful, differentiating ALG from other more ‘manageable’ plants provides the basis for learning how to live with this species, which is not completely novel, but nevertheless depends on learning its distinctive capacities.

The spatial and temporal variability of ALG, and the types of management interventions graziers’ employ, influences learning outcomes in distinct ways. In learning to live with ALG, graziers are drawing comparisons between the plant and other pasture grasses, but also attuning themselves to multiplicity of ALG. Observing how ALG grows and responds to different weather conditions, and in different locations, reveals new information about the plant. Instead of focusing primarily on individual plants (or indeed, leaves), during and after drought graziers observations were directed at ‘collectives’ of ALG. Swathes of brown ALG inform graziers of not only a lack of palatability, but also the extent to which pasture competition has been reduced. Since observing the collective response of ALG following drought, graziers are now more cautious, paying attention to grazing pressure, livestock rotation, and the vigour of other pasture grasses. Learning from ALG is not always predictable or replicable. The learning process is contingent on, and influenced by, whether graziers focus on individual plants or collectives, as well as their attention to other nonhumans, including livestock, and those less lively actors such as the soil.

In many ways, living-with ALG has seen a return to Leith and Davidson’s (1968) initial observation that maintaining the value of ALG in grazing systems, and avoiding the degradation of pastures and natural habitats, requires ‘intensive management and appropriate husbandry’. Moreover, learning to live-with ALG has required graziers learn how to cultivate the distinctive
capacities of the species that justified its initial introduction. However, learning to live-with ALG is not simply a matter of replicating past recommendations. ALG is not the same thing everywhere. The relational character ALG—in which the benefits and damages of the plant emerge through specific more-than-human relationships—requires forms of learning that can recognise the distinctive capacities of the plant. Attending to both the plant itself, and the wider relationships where its effects are coproduced, provides opportunities for learning how to cultivate ALG, while at the same time avoiding the properties of the plant that are least valued in grazing systems.

3.7 Conclusions

By forwarding a relational learning approach in NRM, we have simultaneously widened and focused the scope of research that invokes some level of agency to the environment. First, and most generally, we have sought to decentre the role of human-to-human networks in environmental learning research to explore the utility of extending agency to nonhumans. Second, and to advance the above point, we have considered how a specific invasive plant, in relation with human and other nonhumans, facilitates learning and guides management practices. This is a response to research in environmental learning and land management, which tends to focus on people and social networks or tends to lump the distinctive capacities of plants and animals under broad categories of nonhuman, environment, or landscape. Instead, by attending to the distinctive capacities of ALG—rapid growth, difficulty in control, unpalatability, and lack of crude protein—we reveal how this plant becomes a problem for land managers, and in turn how they learn to cope with and without social networks. For graziers, learning to live with ALG requires developing novel, and at times more familiar management techniques, which are learned by observing and experimenting with the plant in concert with other nonhumans. Watching grass grow alludes to a deceptively simple process; indeed both farmers and ALG are active in the learning process. ALG is not a passive object to be acted upon, but is an active subject within the
learning process. Unpacking what it means to watch the grass grow reveals the agencies of both people and plants that influence the learning process, and in turn the practices of graziers and the compositions of grasslands. Learning studies will benefit from paying closer attention to people’s interactions with the specificity of nonhumans, how this shapes knowledge and guides management practices, and the potential of this learning process to influence broader social networks.

We realise that in arguing for specificity, relational learning risks becoming immobile due to an apparent insistence on relativism. However, we have sought to demonstrate not only how greater attention to this specificity provides a more robust understanding of how people learn to manage different components of the environment, but also how this knowledge becomes mobilised. This is particularly relevant when there is an absence of effective institutional knowledge and where rapid change might unsettle longer held or more continuous place-based learning. As the case study identifies, in spaces of uncertainty formal and informal networks become increasingly reliant on the experiences of those on-ground. We have provided greater clarity to what is occurring on-ground, by not only documenting what people are doing, but also how a specific plant affects the learning process in distinct ways. It is precisely the lack of knowledge on how to manage ALG that necessitates a more meaningful engagement with the specificity of the plant. Moreover, the fact that uncertainty exists immediately distinguishes ALG from other more ‘predictable’ species, and as such requires further understanding into how this plant defies management and may become more manageable. A relational learning approach provides the epistemological tools (i.e. attention to spatial and temporal difference within a species and awareness of changing plant ‘signals’ through relations with other nonhumans) to examine the more-than-human agencies and relations that affect learning and management responses.

Understanding the learning process also requires reflecting on the social values that guide and influence landholders’ decision-making. The learning process does not occur outside of
landholders’ social, cultural and economic context, but is directed by a particular set of values and land use goals. For graziers in Bega Valley, managing ALG is motivated by the need to maintain livestock production. Consequently, and extending from ANT, both the learning process and the value placed on this emerging knowledge is contingent on the power of certain actors to define the problem, allocate the roles of other actors, and speak on behalf of all stakeholders (Callon 1986). For farmers and the Farmers Network the problem of ALG is primarily economic. As a result, the value of the learning process is contingent on the actors taking part (i.e. farmers), the methods used (i.e. applicability to existing grazing management), and the outcomes of this learning process (i.e. productivity). While it is valuable to understand how a specific epistemic community learns in spaces of uncertainty, the power inherent within this learning process runs the risk of excluding certain actors or other ways of living with ALG. Future research should pay particular attention to the role of power in opening or obstructing particular ways of learning and living with invasive plants.

Finally, relational learning offers a means to address Leith and Vanclay’s (2017: 167) claim that uncertainty requires ‘science and policy that effectively links technical information with local placed knowledge.’ As mentioned, the value of graziers’ knowledge is reflected in the Farmers Network, which collates the various experiments and experiences of graziers dealing with ALG in order to build knowledge and formulate management responses. The Farmers Network is a formal institution that is able to organise local placed-based knowledge with scientific information. In doing so, the group not only reveals the value of relational learning in assisting landholders to develop management techniques, but also strengthens local NRM organisations’ ability to coordinate cross-property management. Learning is just one aspect of the personal, social, and government responses needed to address future challenges, but knowing who we might learn from, as well as how we might learn are ongoing questions within NRM. Attending to human-nonhuman relations in learning suggests that people are already drawing upon a wide
frame of reference, as well as specific local and contextual information, in order to develop the knowledge and skills to live within uncertain conditions and environments. However, relational learning should not simply be considered within research as a last resort for management in the absence of institutional knowledge. Rather, it is an always ongoing process informing landholders’ management practices. Adapting to ecological change will require understanding the experiences of people like those in this study, and how they respond to and affect future ecological change, if landscapes like the Bega Valley are to continue to be both ecological diverse and economically productive.
4 Invasive plants, amenity migration and challenges for cross-property management: opening the black box of the property-centric landholder

This chapter is currently in preparation, as McKiernan S, and Gill N, ‘Invasive plants, amenity migration and challenges for cross-property management: opening the black box of the property-centric landholder’. This chapter moves the thesis focus from human-nonhuman relationships, to the social dimensions of invasive plant management. Further, the chapter also shifts attention from primarily graziers, to detail the values and practices of amenity migrants. In doing so, I begin to unpack the complexity of managing invasive plants across different social groups. Thus far I have set out how environments, and in particular invasive plants, can exceed control and complicate existing management strategies. In what follows, I begin to analyse how amenity migration is creating additional social challenges as well as opportunities for managing invasive plants.
Abstract

The movement of largely affluent urban or suburban populations to rural areas for specific lifestyle amenities is transforming the social and ecological compositions of rural landscapes. This transformation is evident in the biophysical changes to receiving landscapes, but also the increasing fragmentation of land use goals, skills and motivations among these amenity migrants. In the context of cross-property management, which requires landholders to cooperate and agree on management goals, the fragmentation of land uses and management values presents significant obstacles for protecting economic and natural resources. This paper focuses on invasive plants as one cross-property management issue that is complicated by amenity migration. Drawing on participant interviews with amenity migrants on the south coast of New South Wales, Australia, we detail the social and environmental relationships affecting the land use aspirations of amenity migrants’ and how this translates into individual management practices. In particular, we investigate the relationship between amenity migrants’ individual or ‘property-centric’ disposition and the outcomes for cross-property management. This is a response to the lack of critical reflection on the precise mechanisms and characteristics of property-centrism that impede cross-property management. We define property-centrism as a process, in which land use aspirations are negotiated within social and environmental contexts that reshape management goals and practices. In opening up the black box of property-centric management, we illuminate both the barriers and opportunities for addressing invasive plant management, and in doing so, provide recommendations for how land managers may be better equipped to respond to collective action problems in rural-amenity landscapes.

Key Words

Amenity migration, invasive plants, cross-property management, collective action, property-centrism
4.1 Introduction

Amenity migration is changing rural environments and the nature of environmental management in receiving areas. Defined broadly as the movement of largely affluent urban or suburban population to rural areas for specific lifestyle amenities, amenity migration carries substantial social and ecological implications for receiving landscapes (Abrams et al. 2012). In particular, amenity migration has resulted in the conversion of rural landscapes from productive farmland into more heterogeneous (or multifunctional) land uses, leading to the reordering of production, protection and consumption values (Argent 2002; Holmes 2006). The social, economic and environmental transformation of rural landscapes is also complicating attempts to coordinate NRM. While increasing land use diversity and landscape heterogeneity can lead to more beneficial environmental outcomes—for example increasing native biodiversity (Geddes et al. 2011; Klepeis et al. 2013)—more often research has illuminated the negative consequences of amenity migration on natural resources. This includes the cause-and-effect relationship between land subdivision and biodiversity loss (Kearney and MacLeod 2006), as well as the direct relationship between species introduction and ecosystem change (Maestas et al. 2003). However, more recently research has drawn attention to the role of individual stewardship values in recreating rural environments and complicating cross-property management (Cadieux 2011; Gill et al. 2010; Mendham et al. 2012). Following recent calls to move beyond the cause-and-effect outcomes of amenity migration on natural resources (Abrams et al. 2012), we draw attention to the complex interactions between individual actors, social processes and ecologies complicating cross-property management of natural resources.

Invasive plants provide a useful entry point to consider the relationship between amenity migration, land use change, and NRM. Invasive plants cause significant economic, social and ecological impacts. In Australia, more than 2770 exotic plant species have become naturalised, of which approximately 65% impact natural ecosystems and about 35% are a problem for
agriculture (Coleman et al. 2015). Of these 2700 exotic plants, 429 have been declared noxious or are under some form of legislative control (Hoffmann and Broadhurst 2016). The economic cost of invasive weeds to agriculture is estimated to be $4 billion annually (Sinden et al. 2004). This underscores the motivations for government officials and farmers to control invasive plants. Amenity migration is frequently positioned as enhancing the invasion of landscapes, as well as contributing to the breakdown of cross-property management that is needed to control invasive plants and limit these damages (Epanchin-Niell et al. 2010; Klepeis et al. 2009; Marshall et al. 2016). This is related to two primary factors. First, it is argued that the material changes associated with amenity migration, including land subdivision and residential development, increase the invadeability of landscapes as a result of habitat change and fragmentation (Bock and Bock 2009; Compas 2007; Dale et al. 2005; Hansen et al. 2011; Theobald 2003). Second, it is argued that amenity migrants lack the necessary skills, knowledge, and interest to effectively participate in invasive plant management (Marshall et al. 2016). This is partly an issue of human capital, but also reflects the fact that new owners can have various land use priorities other than agricultural or grazing activities. These non-production goals can include recreational or environmental priorities, leading to increased divergence in land management priorities and greater variability in approaches and attitudes regarding invasive plants in a given area. These issues represent impediments to cross-property management and can entrench the environmental and economic consequences of invasive plants (Abrams et al. 2012; Cooke and Lane 2015a; Klepeis et al. 2009; Klepeis and Gill 2016).

The increasing social heterogeneity of rural-amenity landscapes complicates attempts to develop shared understandings and then coordinate cross-property management for managing invasive plants (Epanchin-Niell et al. 2010; Epanchin-Niell and Wilen 2015; Marshall et al. 2016). As mentioned, this may be due to issues of human capital (such as lack of awareness, knowledge and skills), but also relates to the values and goals underpinning landholders’ management
decisions (Gill et al. 2010; Klepeis et al. 2009). In particular, amenity migrants’ individualised, or ‘property-centric’ approach to land management limits the ability to effectively coordinate management across properties (Cooke 2013; Cooke and Lane 2015a; Yung and Belsky 2007). Property-centric management is cited as creating particular consequences for invasive plant management, as well as other cross-property management issues that require a level of collaboration and uniformity in order to effectively address the problem (Haggerty and Travis 2006; Epanchin-Niell et al. 2010; Yung et al. 2015). This approach to land management is loosely characterised by amenity migrants importing land use aspirations onto their property, as well as seeking seclusion. However, despite frequent references to property-centrism, research seldom details the formation and manifestation of this management disposition and the precise impacts for cross-property management.

In this paper, we provide a more nuanced conceptualisation of property-centric management in order to better understand the sources that work against cross-property management in rural-amenity landscapes. Focusing on invasive plants, we examine the factors contributing to amenity migrants taking an individualistic approach to land management and the outcomes for collectively managing invasive plants. In doing so this paper has two aims. First, we aim to provide a more comprehensive framework for defining and understanding the characteristics and functions of property-centric management. Second, we consider how this understanding of property-centrism can inform more effective strategies for NRM organisations coordinating cross-property management. Drawing on collective action research, we detail the formation of property-centric management, how it complicates attempts to coordinate invasive plant management, and in turn offer recommendations for how land managers may better steer engagement strategies and organise collective action in rural-amenity landscapes.

We begin with an overview of amenity migration and cross-property management, with particular attention to invasive plant management. We then frame how property-centrism has
been positioned in the amenity migration literature, opening space for a more critical understanding of this disposition and the implications for collective action. After outlining the methodology, we then detail the experiences of two groups of NRLs (Gill et al. 2010) in pursuing their land use aspirations and undertaking invasive plant management in Bega Valley New South Wales, Australia. In particular, we detail the formation of property-centric management dispositions and the outcomes for land management. Rather than a linear progression, we argue that both social and environmental relationships influence and reshape these aspirations, triggering changes in land management practices and goals. In doing so, we conceive a more relational understanding of property-centrism, one that is not simply closed-off and isolated, but also responsive to social and environmental relations. We conclude with recommendations for how land managers may be better equipped to approach and coordinate invasive plant management across this group of landholders based on this understanding of property-centrism.

4.2 Amenity migration and shifting management priorities

Amenity migration and exurbanisation are changing how rural landscapes world-wide are used, transformed, and imagined (Cadieux and Hurley 2009; Abrams et al. 2012). The global expansion of urban-to-rural migration since the 1970’s has led to significant economic, social and ecological changes (Race et al. 2011). This migration is part of a broader transformation of rural landscapes from distinctly production landscapes to multifunctional rural landscapes (Holmes 2006). This transition is generally characterised by a shift from production goals to a more complex, contested and variable mix of production, consumption and protection (Holmes 2006: 143), resulting from a declining agricultural sector and the in-migration of largely affluent populations for urban centres for natural and cultural amenities (Argent 2002). The outcome is a socially and economically heterogeneous landscape where environmental values and management goals are often disputed (Argent 2011; Groth et al. 2014; Gosnell and Abrams 2011).
For those tasked with coordinating management across landholders, setting management priorities and generating action is increasingly complicated in rural-amenity landscapes (Abrams et al. 2012; Mendham et al. 2010). Characterised by limited, if any dependence on farm income, high interest in environmental stewardship, small-scale farming, sub-commercial landholdings and a focus on rural property ownership for lifestyle reasons, amenity migrants’ motivations for managing land can differ substantially from commercial property owners (Gill et al. 2010; Gosnell and Abrams 2011; Sorice et al. 2014). The increasing number of land parcels coupled with diversifying management values and goals is eroding management goals more singularly focused on primary production. This diversity in management goals and values is creating a complex environment for cross-property management (Cooke and Lane 2015b; Gill et al. 2010).

Cross-property management requires cooperation and coordination across individual land parcels to protect or manage natural resources. Cross-property research documents the role of power (Gosnell et al. 2006; Robbins et al. 2009), social and individual learning (Eriksen and Prior 2011; Larsen et al. 2011), property rights (Gosnell and Abrams 2011; Sayre et al. 2012), and environmental agency (Cooke and Lane 2015a; Haggerty and Travis 2006) in shaping individual management and collective management practices. When management issues extend beyond individual property boundaries, and require the participation of multiple landholders, the values underpinning individual decision-making can present barriers to addressing NRM. Such issues have been highlighted in wildfire mitigation (Edwards and Gill 2015), forest management (Meadows et al. 2013), wildlife conservation (Haggerty and Travis 2006), and invasive plant management (Klepeis et al. 2009; Epanchin-Niell et al. 2010), where inattention or inaction regarding these management activities compounds environmental problems.

One example of a cross-property management issue that is complicated by amenity-migration is invasive plant management. In invasive plant management, where individual decisions have consequences beyond their immediate property, the increasing number of land parcels and the
diversity of landholder types can mitigate against existing or new forms of cross-property management (Epanchin-Niell et al. 2010; Graham 2014; Niemiec et al. 2016). This can fragment management approaches if newer landholders are unaware, uninterested, or lack the ability to manage invasive plants, leaving isolated outbreaks to go unmanaged, with the potential to then spread across land parcels. This is particularly problematic in agricultural landscapes that are highly dependent on specific ecological conditions, and where invasive plants cause significant economic costs. The potential consequences of amenity migration for cross-property management require detailed examination into the relationships, practices and values of individual land managers.

4.2.1 Property-centrism and the implications for cross-property management

Amenity migrants are often cited as impeding or worsening cross-property management issues. This relates to specific land management practices or inattention to management issues, but also the values underpinning these management decisions. Implicit, and at times explicit within the criticisms of amenity migrants’ ability to contribute to cross-property management issues, is their individualised or ‘property-centric’ approach to land management (Cooke and Lane 2015a; Marshall et al. 2016). This individualised approach to land management, it is suggested, perpetuates cross-property management problems as amenity migrants do not identify with management concerns beyond individual property boundaries (Yung and Belsky 2007).

Within the literature, property-centrism is loosely defined by amenity migrants importing and practicing personal and autonomous representations of nature and management (Cooke 2013; Gill et al., 2010; Knoot et al., 2010; Urquhart and Courtney, 2011; Yung and Belsky, 2007). In particular, these behaviours are referred to as either ‘property-centric’ (Cooke and Lane 2015a) or ‘individualistic’ (Cadieux 2011; Creighton et al. 2002; Gill et al. 2010; Larsen and Hutton 2011; Pannell and Wilkinson 2009). Within these framings sit two universal characteristics that define this management disposition: amenity migrants import land use aspirations and desire seclusion.
Importing land use aspirations refers to amenity migrants transferring their motivations and aspirations for owning a rural property into individualised approaches to land management. This is commonly depicted through amenity migrants practicing conservation or regeneration management that align with their conservation values, and with a desire to recreate particular rural environments (Cadieux and Hurley 2009; Cooke and Lane 2015b; Gill et al. 2010; Mendham and Curtis 2010). For example, native enthusiasts (Gill et al. 2010) are driven by a commitment to improve areas of past mismanagement (commonly previous grazing lands) through reintroducing native species endemic to the area, and placing areas of their property under conservation schemes (e.g. conservation covenants). This approach to land management, generally speaking, results in positive outcomes for natural resources, and is encouraged by environmental management institutions (Meadows et al. 2014; Mendham et al. 2012).

Additionally, amenity migrants import recreational land use aspirations, for example through introducing and cultivating plant and animal species for aesthetic or practical reasons (Gill et al. 2010; Gosnell et al. 2007).

Seclusion refers to the independent, relatively isolated approach amenity migrants take in pursuing their management goals (Meadows et al. 2013; Urquhart and Courtney, 2011; Yung and Belsky, 2007). Similar to importing land use aspirations, this results in amenity migrants performing their land use aspirations in isolation from surrounding properties; seeking information and advice from specific sources that accord with existing values and further their land management goals (Cooke and Lane 2015a). Amenity migrants seeking seclusion have a desire to ‘get on with it’ independently from neighbours, particularly when there are disparities in land use goals and management practices (Gill et al. 2010; Yung and Belsky 2007).

Property-centrism, whether through importing land use aspirations or seclusion, presents an obstacle in addressing management issues that require collaboration and coordinated action across property boundaries. First, importing land use aspirations can lead to the narrowing of
management goals and practices, affecting management uptake and coordination across properties (Cooke and Lane 2015a). For example, importing a particular environmental aesthetic may involve introducing ornamental plants that become invasive, it can also lead to neglecting areas of the property that contain invasive plants if they are not used or valued aesthetically (Gill et al. 2010). Additionally, land use aspirations that favour less active management practices can be less effective in eradicating invasive plants, and unwittingly allow for them to spread across properties (Klepeis et al. 2009). Second, amenity migrants’ seclusion is another barrier to collective action. Landholders that become secluded in pursuit of land use aspirations are less likely to participate in management issues that do not affect them personally (e.g. weeds that affect grazing management), or are outside their immediate management priorities (Epanchin-Niell et al. 2010). Seeking seclusion can also limit social learning opportunities (Klepeis et al. 2009; Larsen et al. 2011). This can be problematic when management is difficult and requires knowledge exchange across landholders and land managers in order to build the necessary skills and to coordinate action.

However, despite the seemingly unambiguous claim in the literature that property-centrism impedes cross-property management, the precise characteristics and functions of this disposition remain largely absent. This gap requires further attention to the role of property-centrism in affecting the motivations and practices of management, the outcomes of these approaches, and the underlying stewardship values guiding this disposition. This is pertinent if the challenges to cross-property management, such as collective action, are to be better addressed.

4.2.2 Invasive plants and collective action

The challenges in addressing invasive plant management in rural-amenity landscapes can be partly characterised as a collective action problem, requiring the participation of individuals across large-scales in a manner that has some level of focus, cooperation, and planning (Epanchin-Niell et al. 2010; Graham 2013). In particular, invasive plant management across
private land requires a ‘diverse range of actors—individuals, governments, non-government organisations, and private businesses—to work together at a range of scales—local, regional, national, and international—for extended periods of time’ (Graham and Rogers 2017: 396).

Collective action research is often used to characterise existing cross-property management with greater clarity (Graham 2014; Graham and Rogers 2017), or frame issues of management breakdown (Epanchin-Neill et al. 2010; Niemiec et al. 2016). In this paper, we reference collective action as means to examine the challenges of cross-property management, but also to consider how land managers may better organise and steer landholders toward invasive plant management.

To do so, we extend Niemiec et al.’s (2016) collective interest variables to apprehend the factors contributing to amenity migrants’ property-centrism, as well as to better understand the fragmentation of cross-property management. Two collective interest variables are pertinent to this study. First is self-efficacy, defined by an individual’s assessment of their own capacity to contribute to the desired goals or objects (Niemiec et al. 2016). Second, collective efficacy is defined as the extent to which an individual believes others in the group have the ability or desire to contribute to a collective goal (Niemiec et al. 2016; Yau 2014). Both factors are useful tools in evaluating individual decisions to adopt a property-centric management approach, and to also consider the difficulties in coordinating collective action in rural-amenity landscapes.

Additionally, and expanding from these social determinants, we also examine how environmental conditions complicate land management, and reshape property-centric management (Cooke and Lane 2015a). Taken together, both factors provide the tools to examine the formation and characteristics of property-centrism, as well as the outcomes for cross-property management.

We adopt this framing in order to think more critically about the a priori factors that determine the likelihood of collective action in these landscapes. Given collective action is not occurring in
the case study area, it first requires better understanding the sources of tension and difficulties in dealing with cross-property management issues—such as invasive plants—in order to begin working toward collective action. We contend that a greater emphasis and elaboration of property-centrism not only provides further understanding into the issues of invasive plant management, and cross-property management more generally, but can also better assist collective action.

4.3 Methodology

The site of the research project is Bega Valley, New South Wales. Bega Valley is a LGA located on the far-south coast of New South Wales stretching to the Victorian border. Bega Valley is emblematic of the changing nature of rural communities and environments (Abrams and Bliss 2012; Cadieux and Hurley 2009; Gosnell and Abrams 2011). The region has a significant history of agricultural production, particularly beef dairy. However, the area has undergone considerable changes in land use, as decreasing farm numbers and size has coincided with an increase in smaller ‘lifestyle’ plots, resulting in significant social, economic and ecological changes to the region. Table 4.1 illustrates the changes in land area based on land use type. In particular, Bega Valley has experienced a steady decline in the area of land under dryland agriculture and production in relatively natural environments over a decade. The decline in agricultural land partly corresponds with the growing trend toward land subdivision (see Table 4.2), and the subsequent changes in land uses (e.g. from production to conservation). The result is a landscape comprising a heterogeneous mix of land uses and land managers, as the collective goals for agricultural production dilute and become mixed with greater concerns for conservation.

13 The next chapter details an example of collective action in Tindale Valley. However, Tindale Valley is an isolated area within the broader Bega Valley LGA. Hence, the examples within this chapter reflect the broader trends within Bega Valley, in which collective action largely absent.
Table 4.1 Area of land cover based on primary land uses, Bega Valley LGA

<table>
<thead>
<tr>
<th>Land use description</th>
<th>92-93</th>
<th>93-94</th>
<th>95-96</th>
<th>98-99</th>
<th>00-01</th>
<th>01-02</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conservation and Natural Environments</td>
<td>1996</td>
<td>1996</td>
<td>2348</td>
<td>3104</td>
<td>3130</td>
<td>3223</td>
</tr>
<tr>
<td>Production from dryland agriculture and plantations</td>
<td>232</td>
<td>201</td>
<td>140</td>
<td>137</td>
<td>230</td>
<td>128</td>
</tr>
<tr>
<td>Production from irrigated agriculture and plantations</td>
<td>101</td>
<td>86</td>
<td>93</td>
<td>116</td>
<td>106</td>
<td>179</td>
</tr>
<tr>
<td>Production from relatively natural environments</td>
<td>3923</td>
<td>3969</td>
<td>3672</td>
<td>2896</td>
<td>2785</td>
<td>2723</td>
</tr>
</tbody>
</table>


Table 4.2 Land parcel subdivision in Bega Valley LGA: 2001–2012

<table>
<thead>
<tr>
<th>Class</th>
<th>2001 cadastre</th>
<th>2012 cadastre</th>
<th>New parcels (2001-2012)</th>
<th>% new</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 0 (&lt;2ha)</td>
<td>16145</td>
<td>19611</td>
<td>3466</td>
<td>18</td>
</tr>
<tr>
<td>Class 1 (2-20ha)</td>
<td>5918</td>
<td>7453</td>
<td>1535</td>
<td>21</td>
</tr>
<tr>
<td>Class 2 (20-50ha)</td>
<td>1620</td>
<td>1970</td>
<td>35</td>
<td>18</td>
</tr>
<tr>
<td>Class 3 (50-200ha)</td>
<td>529</td>
<td>763</td>
<td>234</td>
<td>31</td>
</tr>
<tr>
<td>Class 4 (&gt;200ha)</td>
<td>11</td>
<td>23</td>
<td>12</td>
<td>52</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>24223</strong></td>
<td><strong>29820</strong></td>
<td><strong>5597</strong></td>
<td></td>
</tr>
</tbody>
</table>

Data sourced from Land and Property Information (2014)

Purposeful snowball sampling (Tashakkori and Teddlie 2003) was used to recruit a mix of amenity migrants and commercial farming properties. Research recruitment flyers were also distributed through Landcare and LLS email servers and newsletters. A total of 49 landholders and 5 NRM agency staff interviewed from April–June and follow-up interviews with 10 participants in November 2014. Semi-structured interviews with NRM staff were conducted to gain perspectives on how invasive plants are prioritised; the main challenges in recruiting new and existing landholders; and the abilities and attitudes of new and older residents for invasive plant management. Semi-structured interviews with landholders were directed at their prior knowledge of land management; their chosen information sources; and their history of management practices. In particular, research questions aimed to elicit stewardship dispositions
by asking what participants value about the land, and the overall goals steering management. Interviews lasted approximately one hour and were conducted with one interviewer and up to two participants.

Interviews were recorded and transcripts were imported into the qualitative software program NVivo. The interviews were coded using an open thematic approach (Bazeley 2007), whereby descriptive characteristics are grouped to build toward a theme (e.g. anti-chemical and lifestyle agrarian). Participants were sorted based on their land use characteristics, which were then tied into an overall stewardship type. From here stewardship values, land use goals and management techniques were positioned under a NRL category (Gill et al. 2010) to gain an overall understanding of how different landholder types value and practice invasive plant management (see Table 4.3)

We characterise participants based on Gill et al.’s (2010: 330) typology of NRL stewardship types. For the remainder of the paper we group together regenerative and conservationist stewardship. Additionally, following Gill et al. (2010) the reminder of the paper refers to specifically to NRLs, rather than amenity migrants in order to maintain consistency with the table below. These categories provide greater clarity into the kinds of practices and values that are often obscured under the homogenising label of ‘amenity migrant’. Additionally, we distinguish property-centric landholders from other NRLs based on the attributes of seclusion and the importation of land-use aspirations. It is important to note, and as will be demonstrated below, that seclusion and the importation of land-use aspirations vary considerably between NRLs. Such variability makes it difficult to position NRLs neatly within the property-centric category. However, this does not preclude the application of property-centrism, but instead invites a more rigorous conceptualisation and understanding of how property-centrism forms and manifests in land management decisions.
### Table 4.3 Participant typology: Bega Valley, New South Wales, Australia

<table>
<thead>
<tr>
<th>Types of landholders</th>
<th>Land use characteristics</th>
<th>Property Size (acres) *</th>
</tr>
</thead>
</table>
| **Production farmers (beef, sheep, dairy)** | - Focus is primarily on production. Farming methods are geared toward productivity. This includes pasture improvement through ploughing and resowing pastures with other pasture species, boom spraying invasive plants with herbicides, and a large number of livestock (up to 1000 total).  
- Grazing is generally extensive, with lower stocking numbers across larger areas, as opposed to cell grazing, which involves heavy stocking numbers in small paddocks and frequent stock rotation.  
- Besides dairy farmers, all have some form of off-farm employment, or use superannuation as a means of supporting their business. | 300+ |
| **Lifestyle Agrarian** | - Production is the primary goal; however the management techniques and attitudes about the environment often differ from commercial graziers. This is reflected in a greater commitment to merge environmental protection with grazing through lower stocking rates; fencing-off riparian areas; and destocking in order to preserve pastures.  
- In terms of methods, lifestyle agrarians present greater openness to alternative grazing techniques (e.g. cell grazing), as well as grazing a mix of livestock, such as goats with cattle.  
- They are generally financially independent from their land and while some make a profit, the majority admit their grazing enterprise ‘pays for the running of itself’ (e.g. fencing, stock treatment, equipment, general maintenance). | 50-300 |
| **Regenerative and Conservationist** | - Focus on native species reintroduction and protection.  
- Pastures are not managed for production, but for increasing biodiversity and cultivating native species.  
- Small number of livestock (no more than 5) as a hobby. This includes animals for recreation, such as horses and a small number of livestock (e.g. sheep and cattle) for self-sufficiency or to ‘keep pastures down’.  
- Similar to lifestyle agrarians, these landowners are financially independent from their land and are often interested in restoring the damage done from a history of production. | 5-100 |
| **Absentee** | - Similar to Regenerative and Conservationist landholders in stewardship values. Main difference is the time available to manage their property.  
- Main activities include weed removal, and at times native vegetation control (particularly black wattle and tea tree).  
- No livestock, unless agisted in order to keep down pastures.  
- Generally properties are visited fortnightly on weekends. | 0-5 |

Adapted from Gill et al. (2010); * Property size is represented in acres, rather than hectares to accord with how participants referred to their property.
4.3 Empirics

In what follows, we detail two forms of NRLs’ property-centric management and their outcomes for land management. As they are both characterised by on-property residence and are distinct from absentee owners who only visit their land periodically, we focus specifically on conservationist/regenerative and lifestyle agrarian NRLs, revealing how land use aspirations are imported, contested, and negotiated through social and ecological relationships. Taken together, both types of NRLs provide a means to apprehend the concept of property-centrism, but also how it varies across landholder types. In doing so, we aim to demonstrate that property-centrism is not simply the act of importing land use aspirations and becoming secluded, but is an ongoing process that is reified or transformed through specific social and environmental relations. Additionally, we trouble the representation of property-centrism as inherently problematic, by highlighting the potential benefits of this management disposition for invasive plant management. Opening the black box of property-centric management provides important insight into the formation of this disposition, the effects on cross-property management, and the barriers and opportunities for building collective action in rural-amenity landscapes.

4.3.1 Conservationist and regenerative NRLs

Land use aspirations

Conservationist and regenerative properties carry with them specific aspirations for land management that influence decision-making and learning networks. These NRLs bring with them certain ideas of nature and management that shape their decisions to purchase a particular property (based on size, aspect, location, environmental features), and their subsequent management practices. In Bega Valley, these aspirations reflect previous research that documents amenity migrants’ desires to cultivate a particular environmental aesthetic, often in contrast to larger farming properties (Cadieux 2011). This includes restoring native vegetation (both grasses and trees), repairing creeks and riparian areas, having a small number of livestock for self-
sufficiency or recreation, and gardening. Inherent within these aspirations is also a desire for seclusion, and embracing a rural lifestyle. This is captured in one regenerative NRL’s reflection on first moving to their property:

we were doing the same thing as everybody else, which was putting in a garden, and running animals. Basically managing the property for those things. So it was just a big backyard, and yeah, our, my primary aim was grass to feed the pets and the garden.

(Jackie, regenerative property)

These land management motivations coupled with a desire for seclusion and a retreat, form the template for property-centric management. However, this is not a linear process—from aspirations through to practice. As we will demonstrate, NRLs are in a continual process of negotiating their own aspirations against social expectations and relationships, as well as environmental conditions.

**Social and environmental relationships**

Initially, landholders’ land use aspirations were justified and strengthened through observing the existing diversity in Bega Valley. Acknowledging the social heterogeneity in Bega Valley, and the mixture of land uses provides examples and a rationale for developing and cultivating an individual management niche. The absence of a clear archetype of ‘best management’ then opens space to do things differently:

So I don't think there is any pressure to be like anyone, I think there's pressure to look after the place and not let it go crazy, but I don't think there is any pressure to do it the way other people are doing it. (Chris, conservationist property)

So there's lots of different ways of managing land out there, and I wouldn't comply with them all, I pick and choose what I think is the best and also what I'm prepared to do. (Pip, conservationist property)

Rather than a set of collective cultural and social values informing NRLs' decision-making, participants found comfort in acknowledging the diversity of land management in Bega Valley. This served as a means to develop an individual approach to land management that aligns with
land use aspirations. The first quote indicates how the freedom to practice individualised approaches to land management is also restrained by a sense of responsibility to neighbouring properties to not let weeds become ‘crazy’. In this context, a sense of freedom does not equate to reckless abandon, as Chris remains conscious of his responsibility within a broader landscape. Property-centrism then becomes a complex exchange between the freedoms to manage land in accordance with land use aspirations, while also acknowledging the need to meet certain expectations of being a rural landholder—in this case through controlling weeds.

In comparison, the second quote reveals how the existing diversity in Bega Valley provides an opportunity to not only develop individual approaches to land management, but also learn through a variety of sources. Ironically, this also echoes the approaches taken by farmers in adopting new management practices, particularly when working with groups such as Landcare. Rather than transforming management operations, research highlights how the probability of farmers implementing new practices is contingent on their management goals, stewardship values, and the expectations of peers (Cary and Wilkinson 1997; Pannell 1999). In this context, groups such as Landcare provide incremental changes to management practices, as farmers pick and choose new techniques that conform to existing goals.

In a similar vein, NRLs use the existing diversity in Bega Valley as an opportunity to learn and trial a range of management techniques. However, and similar to research on farmers, what management practices NRLs adopt remains contingent on their values and land use aspirations. For example, Figure 4.1 captures the efforts of one NRL, Steve, to manage blackberry bushes (*Rubus fruticosus agg.*) by using goats. This management project was inspired through Steve’s conversations with a range of landholders who have also experimented with goats to manage weeds, particularly blackberry. While blackberries are conventionally managed using the herbicides Grazon Extra or Brush-off, Steve’s objection to using chemicals (similar to other NRLs), requires more adaptive and experimental responses. In this context, Steve’s use of goats
to manage blackberries provides a method of weed control that is required legally and encouraged socially, while also aligning with personal land management values.

Figure 4.1 The before and after of Steve’s experiment to use goats for managing Blackberry (April-November 2014), Toothdale, Bega Valley
While the heterogeneity of land uses in Bega Valley provides NRLs with the sense of freedom to develop a property-centric approach, NRLs also became secluded from either being confronted by neighbours or witnessing an absence of weed management. Many of the aspirations of conservationist and regenerative properties conflict with commercial graziers, particularly herbicide and artificial fertiliser use. For most graziers, herbicides and fertilisers are essential components of land management for removing invasive plants and improving pastures for grazing. However, for NRLs these practices are largely unnecessary, or conflict with their values for restoration and less ‘impactful’ land management. This creates a schism between NRLs and graziers concerning what management is appropriate. One NRL describes the pressure applied by a grazier to perform certain management practices:

He keeps badgering me about putting superphosphate on the place which I won’t do, because it’s very bad for horses. But I get that about once a month. So a lot of them are still wedded to those very traditional farming, you know super phosphate, annual pasture that sort of thing. (Jen, regenerative property)

This is not a unique experience for NRLs, with many commenting on receiving unsolicited advice about their management practices by graziers. However, while this advice can be helpful, it can also lead to tensions when stewardship values clash. On one hand, this reveals the influence of land use aspirations in guiding decisions on what land management practices to accept. On the other hand, it also highlights this tension as a driver for NRLs to isolate their management practices. As another NRL describes:

I don't really care what they think, I try to do what I think is right and if somebody might have a different view on things, I just say well that's not what I think; it's not worth an argument. (Pip, conservationist property)

NRLs’ opposition to the management practices of graziers justifies the decision to isolate their management practices from surrounding properties. This is particularly the case when management advice counters their land use aspirations. In this context, property-centrism is
reified through social relationships. When NRLs feel at odds with the practices and advice given to them, they tend to focus more inward and reject advice that sits outside their aspirations.

The social influences of property centrisms extend beyond direct interactions with farmers, and are also shaped by observing a lack of weed management by neighbours and other land managers (see Figure 4.2). When asked whether they felt a certain pressure to manage weeds for the community, some commented that the absence of weed control from neighbours, as well as lack of enforcement from local council, has led them to simply prioritise management based on their own property goals:

if I don't see anybody else doing anything about their weeds, [it] make[s] me think ‘Well, why am I spending all this time and effort’ and if I even think that the council is not doing anything about their weeds I would eventually kind of think ‘If nobody else does anything why would I spend all my time doing it?’ (Walt, regenerative property)

Figure 4.2 A neighbouring property with heavy African lovegrass (golden area) and Blackberry infestations (black/dark green patches), Kameruka, Bega Valley
Observing the absence of weed control and enforcement is a significant influence in landholders becoming secluded and ‘getting on with it’ in pursuit of their own land use aspirations. Indeed, the response to witnessing the lack of weed control is to focus inward when deciding what weeds to manage, or how much time and energy to expend:

You do tend to get a little bit selfish in your outlook; you tend to look after your own property … you resign yourself to the fact that they’re never going to do anything. I think we’re appalled more with commercial properties who really have a bigger responsibility to the rest of the valley, the community and as well as themselves, and really can afford it, we think. (Brian, regenerative property)

In this context, property-centrism is, in part, an outcome of exiting cross-property management issues. It is a response to the lack of weed management from neighbours, as well as the perceived lack of enforcement from weed authorities. Therefore, property-centrism is not simply an outcome of land use aspirations that desire seclusion, but emerges through specific social relationships and observations. This may entrench individualised approaches to land management—resulting in a patchwork of management activities and interests—that impedes the ability of land managers to recruit NRLs to participate in collective weed management.

4.3.2 Lifestyle Agrarians

Land use aspirations

Lifestyle agrarians offer a different example into the motivations and practices of property-centric management. Lifestyle agrarians’ land use aspirations are primarily motivated by running a grazing operation; however they are often detached from the existing social and cultural norms of traditional graziers. In many ways, lifestyle agrarians aspire to perform similar goals and values to other NRLs, although the desire to run a grazing enterprise places their actions and attitudes in a different context. Lifestyle agrarians are generally motivated by developing farming systems that are less impactful on the land, often through eliminating or significantly reducing the amount of herbicides, no longer ploughing and resowing annual pastures, and trialling alterative
grazing management systems. Their land use aspirations also aim to repair the property, often through destocking and fencing-off creeks and riparian areas, re-introducing native pastures and trees, placing land under conservation schemes (e.g. conservation covenants). However, as opposed to conservation and regenerative properties, lifestyle agrarians are less motivated by seclusion, and as result their property-centrism varies considerably.

**Social and environmental relationships**

For lifestyle agrarians, attempts to perform their land use aspirations are significantly hindered by ecological conditions. Grazing management relies on specific pasture conditions in order to maintain carrying capacity and provide enough quality feed to raise healthy livestock. However, pastures are vulnerable to invasive plants. In Bega Valley, ALG presents a significant threat to agricultural production as well as endangered ecological communities (particularly lowland grassy woodlands). ALG is particularly problematic for agricultural production as it is often unpalatable to stock, low in crude protein and quickly dominates pastures if competition is reduced (Firn 2009).

For some lifestyle agrarians, achieving their land use aspirations has been significantly complicated by ALG. This was often an unexpected discovery that required an immediate refocusing of management goals:

> When I moved here I didn't know what ALG was, and we weren't told until after we bought it. Once we found out what it was we were a little bit horrified that we weren't going to move the way we wanted to until we got the lovegrass into a point where it was manageable. (Bob, lifestyle agrarian: beef)

In this example, Bob’s land use goal of being able to ‘run stock so they can pay for running to property’ is significantly set-back by ALG. However, the reaction is not to abandon his land use aspirations, but develop management responses that remain bound within existing stewardship values. This includes managing ALG in a way that does not compromise his aversion to heavy herbicide use. In response, Bob seeks information sources that align with his aspirations, while
rejecting advice that is counterintuitive. This filtering process led him into a Holistic Management program, as he explains:

We did a Holistic Management course through the Bega Tafe which is an Alan Savoury program, and that's all about using animals and that's what we are trying to do. But the old Cockie's they prefer chemicals and monocultures, whereas we are into as few chemicals as possible, we have to use them, and biodiversity.

Developed by Alan Savoury this farming method involves preferably no herbicide use, with heavy stocking rates in small paddocks that are frequently rotated. Participating in the program and implementing this management framework, not only assists in managing ALG, but also continues existing land use aspirations. Moreover, Bob's land use aspirations are not abandoned due to management uncertainty, but remain an important influence shaping the social networks he consults, and the management practices he is willing to undertake. While ALG disrupts the importation of land use aspirations, Bob's stewardship values still steer the information sources and management responses. Importantly, property-centrism is more than a linear manifestation of land use aspirations, but shapes and is also shaped by social and ecological contexts.

Lifestyle agrarians' aspirations to run a farming property, without herbicides and heavy inputs, not only challenges their ability to be productive (economically), but also leads to weighted expectations from other graziers. For lifestyle agrarians, the sense of expectation from commercial graziers is stronger than other NRLs. While not all commercial graziers are in favour of heavy herbicide use to manage invasives, interviews with both sets of landholders revealed that commercial graziers were less adverse to herbicides and pasture improvement than lifestyle agrarians. As a consequence, by adopting alternative management practices lifestyle agrarians feel a greater level of expectation from commercial graziers to demonstrate that it can be done differently. In recognising this expectation, participants did not retract from their aspirations, but rather embraced the scrutiny and aimed to demonstrate the potential value in their management practices:
So everyone has their ideas is what I'm trying to say. And if you don't go along with how other people think well you're considered to be a little different, but that's the way it is that's life isn't it? (Bob, Lifestyle agrarian: beef)

You don't know anything, you've come in … if you are going to implement something new you have to show it, just do it, but it's not going to happen overnight either, it's a long-term thing. And you've got to be prepared to stick it out. (Tabatha, Lifestyle agrarian: mixed grazing)

In these examples, both participants recognise their management practices sit outside the dominant management paradigm of commercial graziers. In feeling like ‘outsiders’, Tabatha and Bob focus their management practices inward. This is a form of property-centrism that remains committed to alternative management practices. Additionally, in feeling ‘a little different’ Bob acknowledges the scrutiny placed on his management practices, and subsequently the need to demonstrate that it can be done differently. Both participants refer specifically to ALG and their desire to demonstrate that alternative forms of weed management can be practiced without compromising productivity. Bob continues:

I want to be able to get it managed … to show the community that it can be done, that it doesn't have to be done with a particular method in mind, it can be done other ways. Most people it was always poison and resow, there are other ways, and I suppose what I'm trying to do is show it can be done.

Both Bob and Tabatha are committed to demonstrate alternative ways of managing ALG. For Bob, this involves working toward being able to control ALG solely through grazing management. His reluctance to use herbicides, and other more conventional weed control methods (e.g. ploughing and resowing), has led him to alter paddock sizes, stocking rates, and grazing durations, in an attempt to learn how to better manage ALG. While still needing to continually slash ALG in order to maintain feed for cattle as well as for fire prevention, Bob remains driven by his personal motivation to control ALG entirely through grazing management, as well as to demonstrate more broadly alternative ways of managing ALG. Importantly, rather than becoming secluded, both Bob and Tabatha aim to have these alternative methods witnessed
by commercial graziers with the hope of influencing others. In this sense, a property-centric approach is not simply isolationist. Indeed, the expectation of others’ graziers drives them to demonstrate other ways of managing weeds. This is a form of inward property management with an eye to the outside.

4.4 Discussion

The empirical material provides a more nuanced account of property-centrism. NRLs’ property-centric management is not simply driven by land use aspirations, but is also influenced by social relationships and environmental circumstances. In what follows, we propose a more relational account of property-centrism, in order to recognise the processes that reposition land use aspirations and direct individualised approaches to land management. In detailing how property-centric dispositions are formed and influence management decisions, we consider how land managers may better intervene in collective action strategies. In the context of rural-amenity landscapes, further research is needed to consider how social heterogeneity can present opportunities, rather than merely obstacles to collective action.

4.4.1 Property-centrism: a more critical framework

Property-centrism is a significant factor shaping NRLs’ management practices. This includes the types of management NRLs undertake, but also the information sources and advice that is accepted and acted on. Property-centrism can be problematic if NRLs are unwilling to contribute to collective management goals, or their pursuit of land use aspirations perpetuates environmental harms (Yung and Belsky 2007). Additionally, NRL’s desires for seclusion can entrench their land use aspirations, making it more difficult to persuade them to change management practices and participate in cross-property management (Cooke and Lane 2015a). It could thus be surmised that the increasing number of landholders that undertake property-centric management leads to the breakdown in cross-property management with significant
consequences for economic and ecological resources (Epanchin-Niell et al. 2010). However, the case study presents a more complex account of property-centrism.

While property-centrism influences the decision-making practices of NRLs, this disposition is not fixed and the management outcomes are not absolute. Instead, property-centrism is repositioned through social and environmental relations. First, NRLs’ land use aspirations are repositioned with the environment. Environmental conditions are a significant factor guiding land management decisions (Abrams et al. 2012; Cooke and Lane 2015a). This includes the soil, climate, ecology, and at times invasive plants. In Bega Valley, lifestyle agrarians’ attempts to import their land use aspirations onto their property were confronted by ALG, impelling them to rethink their management goals. This did not lead to the abandoning of land use aspirations, but instead required adapting these values and practices to novel conditions. These revised management practices remain property-centric, as NRLs’ land use aspirations frame the possible responses, as well as the goals directing land management. However, rather than a linear progression of importing these values onto a passive landscape, property-centrism is responsive to environmental conditions, which often requires reassessing management goals and reformulating management practices.

Second, land use aspirations are also influenced by social relationships. Similar to the responses to environmental conditions, both the networks NRLs consult and the information they accept are highly dependent on their management goals (what they want to do) as well as their values (how they want to do it). In this context, land use aspirations not only guide land management goals, but also direct how NRLs filter advice and observe the practices of other landholders. However, social relationships also have a significant bearing in NRLs becoming secluded. In particular, conservationist and regenerative NRLs justified getting on with it in isolation following conversations with landholders, as well as observing other landholders’ management practices. This is partly a rejection of advice that counters NRLs’ management values and goals.
However, it is also connected to the expectations and observations of other landholders in comparison to their personal dispositions. In this context, seclusion is not only an outcome of NRLs’ desire for a rural retreat (Meadows et al. 2013; Urquhart and Courtney, 2011), but is also reaffirmed or created through social relationships and expectations. Therefore, seclusion should not simply be regarded as an inherent quality of NRLs—although it can be—but rather it is important to uncover the relationships that lead them to focus inward, and the subsequent challenges for coordinating cross-property management.

Overall, the case study reveals property-centrism as processual, in which land management decisions emerge through the negotiation between NRLs’ land use aspirations and social and ecological contexts. This is not to suggest that all amenity migrants are property-centric. Indeed, participants in the broader study, as with amenity migrants elsewhere (Wilson 2008), are often eager to learn and develop new skills and knowledge without becoming secluded or resisting advice that counters land use aspirations. However, unpacking the concept of property-centrism provides a more detailed understanding of how land use aspirations shape and are shaped by social relationships and environmental relations. Importantly, NRLs’ pursuit of these aspirations, either through seclusion or with a desire to demonstrate alternative practices, reveals property-centrism as a diverse category that is neither predicable nor inherently problematic for invasive plant management.

4.4.2 Property-centrism and collective action: challenges and possibilities

As has been discussed in the literature, and is partly demonstrated in the case study, property-centrism can complicate cross-property management, presenting barriers to collective action (Epanchin-Niell et al. 2010; Marshall et al. 2016). Extending from our conceptualisation of property-centrism above, it is necessary to both understand these barriers to cross-property management, but also consider how land managers may better address these obstacles in order to develop collective action. Returning to Niemiec et al.’s (2016) collective interest variables, we
further elaborate on the social relationships influencing property-centrism, and in addition, consider how management may better approach cross-property management, particularly for developing collective action.

First, NRLs’ perceptions of collective efficacy are a significant factor in justifying the pursuit of individual management goals (Niemiec et al. 2016). This is similar to Graham’s (2013) findings, in which an individual’s sense of competence and goodwill trust among other land managers correlates with the likelihood of them participating in collective action projects. As NRLs witness the lack of management and disorganised approaches to weed management in the region, it leads them to focus inward and reify their land use aspirations as the primary goal for land management. The existing absence of collective efficacy then compounds cross-property management issues, as NRLs become isolated in their management approaches, leading to the increasing fragmentation of invasive plant priorities and management actions.

Second, NRLs’ pursuit of property-centric management is also tied to perceptions of self-efficacy (Niemiec et al. 2016). The absence of invasive plant control from neighbours, and in the area more broadly, not only led NRLs to focus inward, but also contributed to weed problems on their property. As a consequence, landholders, at times, no longer view invasive plant control as achievable given existing infestations are not being effectively managed. This compares and contrasts with research that documents how amenity migrants’ individual pursuit of personal management goals compounds invasive plant issues due to the lack of coordination across properties (Epanchin-Neill et al. 2010; Marshall et al. 2016). However, rather than simply being the cause of invasive plant problems, NRLs may no longer have the capacity or desire to contribute to cross-property management of specific invasive plants due to a prevailing lack of collective engagement. In this context, perceptions of self-efficacy are closely connected to existing collective-efficacy.
Understanding the role of collective interest variables in shaping property-centric management, and in turn impeding cross-property management, opens space to consider how land managers may be better equipped to develop collective action in rural-amenity landscapes. The first strategy is to avoid NRLs isolating their management practices based on their observations of others. This requires demonstrating collective-efficacy, gaining trust, and establishing the value in individual contributions to a collective good (Graham 2013; Niemiec et al. 2016). Achieving collective action requires land managers—for example weed authorities, neighbours or local NRM organisations—contact NRLs early, in order to establish the broader management issue, encourage participation, and respond to the immediate concerns that may lead them to become isolated. Although the absence of collective-efficacy may be a practical barrier in achieving collective action generally, this should not serve as a justification for amenity migrants to avoid weed control, which will only compound the problem.

The second challenge for achieving collective action in rural-amenity landscapes is the ability for land managers to establish collective action goals within the existing heterogeneity of Bega Valley. As noted by Abrams et al. (2012: 270), “amenity migration results in a redistribution of environmental harms and benefits at multiple scales, as rural landscapes are (partially and incompletely) re-created in line with the ideals and expectations of amenity migrant populations.” Hence, establishing collective management goals in rural-amenity landscapes is complicated by the diversity of land use aspirations that influence landholder perceptions and responses to environmental problems, such as invasive plants. Collective action then requires generating management goals that avoid ‘naturalising’ a specific type of land management. As evidenced in the case study, and demonstrated elsewhere (Klepeis et al. 2009; Yung and Belsky 2007), when NRLs are resistant to particular management practices, they are more likely to isolate their management goals in pursuit of their land use aspirations, regardless of the cross-property management issues. For those tasked with coordinating collective action, it is important that
management goals and practices are not enforced on these landholders, but rather built through consultation and collaboration (Graham and Rogers 2017). Rather than promoting management practices that may counter NRLs’ stewardship values, it is important to recognise how values come to affect the uptake of specific management practices, in order to formulate plans that can more effectively build social networks to deliver collective action.

Finally, land managers also need to recognise how environmental processes and relations, particularly the behaviours and properties of invasive plants, can challenge NRLs’ land use aspirations, as well as the efficacy of collective action. As highlighted throughout the case study, NRLs’ perception of self-efficacy is closely linked to their own ability to control invasive plants. When invasive plants (such as ALG) exceed control, land use aspirations often change.

Collective action requires management principles that not only recognise the social factors affecting NRLs’ willingness to participate, but also the material conditions that determine their perceptions of self-efficacy. Importantly, NRLs’ property-centrism—and the management attitudes and practices within this disposition—emerge through social encounters and observations, but also through their experiences within the environment. More specifically, the plants, animals, soil and other nonhumans within the environment influence NRLs’ land use aspirations and management decisions in diverse, unpredictable ways. Land managers thus need to better attune themselves to not only the social factors influencing property-centrism, but also the nonhuman actors that unsettle individual land use goals, redirect management priorities, and challenge attempts to build collective action.

4.5 Conclusion

In this paper, we have aimed to better conceptualise what property-centrism is, why participants approach land management in this way, and the outcomes for invasive plant management. NRLs’ land use aspirations form a central tenet in guiding decision-making, including what
management advice to take, from whom, and the direction they wish to steer their management goals and practices. However, rather than a static and linear process in which land use aspirations are imported onto the landscapes, property-centrism is repositioned through social and environmental relations. When landholders witness the absence of weed management from neighbours or lack of enforcement from government agencies they feel less compelled to participate in collective weed management, and instead focus their management goals inward. Additionally, environmental conditions can challenge NRLs’ existing land use aspirations, requiring adaptive strategies that both align and transform existing stewardship values and management goals. Opening the black box of property-centrism provides a more comprehensive understanding of the relationship between stewardship values and land use practices, moving beyond simplistic framings that render this disposition inherently problematic. Future research needs to not only consider how land use aspirations motivate property-centric approaches to land management, but also how these aspirations are repositioned in diverse social and ecological context, and the implications for cross-property management.

Understanding property-centrism as a relational construct—coproduced through social and ecological relationships—opens opportunities for land managers to develop more effective strategies to engage amenity migrants and overcome many of the cross-property issues that have come to characterise rural-amenity landscapes. In rural-amenity landscapes, collective action increasingly depends on the ability of land managers to negotiate between the diverse sets of management values and skills of landholders. This, in part, requires better appraisal of the diversity in NRLs’ land use aspirations, skills and stewardship values in guiding management decisions, but also remaining aware of their capacity to be reshaped. While self and collective efficacy variables present barriers to coordinate cross-property management, recognising the relationships (human and nonhuman) that contribute to property-centrism provides land managers with the opportunity to understand NRLs’ reluctance to participate in cross-property
management, and in turn develop more personalised and collaborative management goals that align with collective action goals. Importantly, these management goals cannot remain fixed, but also need to apprehend and respond to the shifting social and environmental dynamics of rural landscapes that unsettle individual and collective management goals and actions.
5 Managing invasive plants in a rural-amenity landscape: the role of social capital and Landcare


This chapter extends from the previous chapter’s examination of how social heterogeneity complicates cross-property management, through detailing how a Landcare group cooperates across a diverse range of landholders to maintain collective action toward invasive plant management. While the previous chapter discussed the barriers in establishing cross-property management, this chapter highlights the capacities of a key Landcare leader to overcome heterogeneous management values and effectively establish a strong social network to collaborate and coordinate invasive plant management across individual land parcels. This final chapter offers possibilities for how land managers may respond to and develop effective strategies for managing invasive plants in rural-amenity landscapes.

The text in this chapter has been reproduced from the original article. Table numbers have been altered to suit the structure of the thesis. The participants and locations within the chapter are also anonymised (see footnotes) to maintain consistency with the publication; I have made minor adjustment to landholder characteristics to match the categories used throughout the thesis. The referencing format has also been updated to maintain consistency.
Abstract

Rural-amenity migration is changing the social and ecological compositions of landscapes globally. The in-migration of new landholders is contributing to significant biophysical changes to rural landscapes, as well as the weakening of collective awareness, knowledge and skills needed to manage natural resources. This is leading to the proliferation of environmental harm. This paper focuses on invasive plants as one such harm, detailing how collective action is developed and challenged in a rural landscape undergoing increasing property turnover and diversifying management priorities. Focusing on the role of a Landcare group, located in southern New South Wales, Australia, I explore how social capital—with a particular focus on trust and social norms—is mobilised to recruit newly arrived residents and maintain commitment among landholders to manage invasive plants. This research provides insights into how policy can better steer management interventions, particularly how to develop and maintain collective action in diversifying rural landscapes.

Key Words

Social capital, collective action, trust, social norms, invasive plant management
5.1 Introduction

Invasive plants threaten natural ecosystems and grazing enterprises (Pyšek and Richardson 2010). Their fast growth, rapid reproduction, high dispersal ability, and tolerance of a range of environmental conditions allow them to quickly spread and dominate landscapes (Mack and Simberloff 2000). In this sense, invasive plant management can be partly characterised as a collective action issue, requiring the participation of individuals across large scales in a manner that has some level of focus, cooperation, and planning (Epanchin-Niell et al. 2010; Graham 2013). However, coordinating collective action is increasingly complicated in rural-amenity landscapes. First, the biophysical changes resulting from land subdivision and increased human presence and development can increase the vulnerability of landscapes to plant invasions (Klepeis et al. 2009; Epanchin-Niell et al. 2010). Second, coordinating invasive plant management is complicated by the melange of interests, motivations, and skills held by newly arrived residents (Epanchin-Niell and Wilen 2015; Marshall et al. 2016). As a result, collective action may be weakened as the increasing number of land parcels and the greater number and types of land management operations reduces management incentives, hinders cooperation, and increases the likelihood of reinfestation (Epanchin-Niell et al. 2010; Marshall et al. 2016).

In response to these challenges, existing research highlights the need for collaboration and cooperation across landholders in order to apply pressure, as well provide support to manage invasive plants (Graham 2013; Graham 2014; Marshall et al. 2016). There, however, remains considerable scope to consider the types of management interventions (bottom-up, middle-out, or top-down) (Epanchin-Niell et al. 2010; Marshall et al. 2016), as well as the factors influencing the uptake of management action (Graham 2013; Ikutegbe et al. 2015). This paper aims to strengthen understandings of collective action in rural-amenity landscapes by unpacking in greater detail how social capital—in the form of trust and social norms—is developed and mobilised across a range of landholders to effectively manage invasive plants.
In rural-amenity landscapes, community-based natural resource management (CBNRM) is an effective tool in coordinating and incentivising management amongst landholders (Graham 2013; Marshall et al. 2016). In the case of invasive plant management the relationship between landholders, and between landholders and government agencies, is critical in gaining cooperation and successful control of invasive plants (Graham 2013; Graham 2014; Klepeis et al. 2009; Marshall et al. 2016). Both trust and social norms are cited as key factors for CBNRM agencies attempting to develop collective action across private properties. For example, Graham (2013) identifies the need for weed authorities to establish trust among the public in order to gain participation and avoid resistance in managing invasive plants. In a cognate study, Minato et al. (2010) highlight the role of Landcare in extending social norms to new residents such that they tend to then participate in catchment-wide and local NRM issues. Both studies reveal how CBNRM, when delivered by appropriate individuals and members, can secure effective management outcomes. This paper contributes to this recent literature by illustrating how social norms and trust circulate interdependently—the success of one is relative to its relationship with the other—in order to recruit newly arrived residents as well as maintain the commitment of existing landholders to manage invasive plants. Rather than siloing each approach, with reference to social capital (Putnam 1993), I detail how a key Landcare leader gains trust and extends social norms to secure collective action.

Landcare, as an example of CBNRM, is credited as an active agent in the development of social capital in rural communities (Compton and Beeton 2012). Existing research focuses particularly on the role of trust and norms in facilitating the cooperation and coordination of NRM. However, despite references to trust and norms, less attention is given to the actual processes that facilitate trust and how social norms are mobilised and changed (Compton and Beeton 2012; Sobels et al. 2001; Webb and Cary 2005). In this context, I aim to advance collective action research by illuminating two key mechanisms involved in the development of social capital for
invasive plant management. Furthermore, responding to Klepeis et al. (2009: 390) appeal for further research to ‘uncover the extent, nature, makeup and operation of networks associated with Landcare in new rural landscapes’, I demonstrate how the makeup and operation of this Landcare group is central to recruiting new members and maintaining commitment across landholder types to manage invasive plants. Practically, this research offers important insights for how policy may be better geared to respond to and maintain management action in rural-amenity landscapes. This aligns with recent calls to understand the barriers to collective action for invasive plant management (Graham 2013; Marshall et al. 2016), by detailing the processes involved in developing and maintaining invasive plant management despite increasing property turnover and competing stewardship values. Additionally, I seek to move beyond the binary representation that amenity migration is inherently bad or good for invasive plant management, to instead focus on how land managers work with and across the diverse management interests and incentives of rural landholders to secure collective action.

I begin with an overview of rural-amenity migration and the consequences for invasive plant management, before detailing the theoretical framework. After outlining the methodology, I then turn to the empirical material to discuss the experiences of Tindale Valley Landcare (located in southern New South Wales, Australia) in coordinating invasive plant management across a diversifying rural area. Documenting the experiences of a Landcare project officer and members, I explore how social capital is developed through the interplay between social norms and trust, and its potential to secure collective action. In particular, I focus on the practices of this Landcare project officer in building and coordinating a local network, unpacking the possibilities and problems for collective action that hinges on a key leader.
5.2 Conceptual background

5.2.1 Rural-amenity migration and the changing nature of environmental management

Amenity migration (or exurbanisation) is changing how rural landscapes world-wide are used, transformed, and imagined (Abrams and Bliss 2012). Defined broadly as the movement of largely affluent urban or suburban population to rural areas for specific lifestyle amenities, amenity migration implies substantial social and ecological implications for receiving landscapes (Abrams et al. 2012). Specifically, amenity migration is leading to the transformation of rural landscapes that were once valued for production, to being valued for their consumptive amenity values (natural scenery; proximity to outdoor recreation) (Argent 2011). In developed countries this trend is witnessed in the increasing subdivision of commercial agriculture enterprises into smaller amenity holdings with heterogeneous values toward land management (Epanchin-Niell et al. 2010; Gill et al. 2010). The increasing heterogeneity of these landscapes is shifting management away from productivist goals toward amenity values that at times can conflict with traditional land management priorities (Holmes 2006). Cross-property management issues requiring collective action have been cited as creating conflict in relation to wildfire (Edwards and Gill 2015), forest management (Meadows et al. 2013), wildlife conservation (Haggerty and Travis 2006), and invasive plant management (Klepeis et al. 2009; Epanchin-Niell et al. 2010). This is partly an issue of human capital, whereby amenity migrants lack the required knowledge, skills, or interest to effectively manage natural resources. But there also exist disparities in stewardship values between amenity migrants and commercial farmers, which can impede the coordination of management across properties (Mendham et al. 2012).

Invasive plant management is one issue complicated by rural-amenity migration. Invasive plants require coordinated management across properties in order to reduce the spread of problematic species, as well as maintain control through suppressing isolated outbreaks (Epanchin-Niell and
Maintaining collective action in rural-amenity landscapes is not straightforward. Following Graham (2013), what distinguishes collective action research from other environmental research is its concern with the relationships between individuals. This is relevant in rural-amenity landscapes where the diversity of landholders creates particular challenges in maintaining collective interest and action for managing invasive plants. This is not simply about individuals taking responsibility for managing weeds but, as Graham (2013: 125) identifies, it ‘involves communities sharing information, providing support and applying pressure so that individuals have the capacity and motivation to act.’ This may be achieved through Graham’s (2013) reference to community-led collective action involving cooperation amongst landholders, or through polycentric governance (Marshall et al. 2016) whereby collective decision-making rights and responsibilities are assigned across government agencies and the public.

Coordinating management action is particularly difficult in rural-amenity landscapes. First, extending from critiques of amenity migration for NRM generally, amenity migrants are argued to lack the necessary skill, knowledge or incentives to control invasive plants (Epanchin-Niell et al. 2010; Klepeis et al. 2009). Second, the subdivision of properties increases the number of landholders needing to cooperate. There are an increasing number of people with diverse values and interests complicating collective action; concurrently the growing number of land parcels increases potential sources and vectors for weed infestations (Epanchin-Niell et al. 2010; Marshall et al. 2016). Third, some authors argue that amenity migrants are ‘property-centric’, making control decisions based on their perception of invasive plant issues and impact on their own land (Cooke and Lane 2015a; Yung and Belsky 2007). This disposition leads landholders to pursue their own interests, potentially in isolation from surrounding properties, leading to significant challenges for engaging them in cross-property action and awareness of invasive plant issues (Epanchin-Niell et al. 2010; Yung and Belsky 2007).
Clearly, the role of human capital in the form of awareness, knowledge, skills and resolving tensions with neighbours is crucial for effective collective action. However, measuring the effectiveness of collective action should not be restricted to the functions of human capital or vertical social capital (e.g. trust and reciprocity between landholders and weeds officers), but also requires consideration of horizontal social capital (e.g. mutual trust, local social networks, and social norms of reciprocity and community responsibility) (Marshall et al. 2016: 102). Finally, while research, at times, positions amenity migration as inherently problematic for invasive plant management, such a perspective is limiting. Promoting the attitude that amenity migration is inherently harmful for invasive plant management erects a binary between different landholder types, which often privileges agricultural productivity over other management goals.

Consequently, ‘naturalising’ a particular type of land management marginalises the abilities and enthusiasm of amenity migrants, and limits the range of possible management responses. To avoid problematising one type of management over another, I instead focus on the benefits of land managers working collaboratively, and avoiding management decisions being limited to a singular understanding of ‘best practice’.

5.2.2 Landcare and social capital

CBNRM, in the form of informal and formal networks, is one approach that can harness collective action (Pero and Smith 2008; Marshall et al. 2016). CBNRM marks the shift from government to governance responsibility for NRM, devolving government responsibility in favour of ‘grass-roots’ community action (Lockwood and Davidson 2010; Tennent and Lockie 2013). Landcare is an example of CBNRM (Tennent and Lockie 2013), in which local Landcare groups work together to address common problems based on shared understandings of important social, economic and ecological issues affecting the property-scale as well as the wider community (Sobels et al. 2001). Such strategies are employed to overcome the practical (continued decline in biodiversity and productivity) and moral (inattention to equity issues)
failures of centralised state-based control of NRM (Lockwood and Davidson 2010). Landcare is the flagship programme of CBNRM in Australia, as it continues to facilitate and promote sustainable environmental management (Tennent and Lockie 2013).

Landcare groups are funded federally through the ‘National Landcare Program’. Funding is distributed to local Landcare groups or regional Landcare associations to supply equipment, training, and often a project officer to assist in coordinating NRM projects. Additionally, Landcare project officers provide a link between state government agencies (in New South Wales, Local Land Services) and the public, assisting in grant applications and maintaining the cohesion of these networks. Aside from project officers, Landcare participation is voluntary; participants are not paid for their labour and often participate on public land and land owned by others (Curtis 2000). The dependence on voluntary labour is noted to significantly limit the effectiveness and longevity of Landcare groups (Byron et al. 2001; Curtis 2000). In particular, when Landcare groups come to depend on one or two individuals they are increasingly at risk of collapsing from individual ‘burn out’ (Byron et al. 2001).

However tenuous or well-founded these groups are, the role of leaders within Landcare, and CBNRM more broadly, remains crucial in securing collective action (Gray et al. 2005; Sharp and Curtis 2014; Sharp et al. 2012). Collective action requires key leaders to mobilise action, sustain interest, and negotiate conflict among private landholders (Pero and Smith 2008; Hatton MacDonald et al. 2013). Effective leadership is able to generate relationships between NRM agencies and the public, ensuring effective monitoring and evaluation of projects, and knowledge exchange across multiple scales (Gray et al. 2005; Pero and Smith 2008; Hatton MacDonald et al. 2013). Gray et al. (2005) also identify that leadership is capable of developing social capital and community capacity to manage natural resources.
Landcare has received significant attention in social capital research (Sobels et al. 2001; Compton and Beeton 2012; Webb and Cary 2005). Notwithstanding the debates over the effectiveness of Landcare in delivering sustainable outcomes (Compton and Beeton 2012; Gill 2004; Lockie 1996), the organisation is frequently cited as investing in the development of social capital in order to gain widespread participation (Compton and Beeton 2012). Here I borrow Putnam’s (1993: 35–36) definition of social capital as the ‘features of social organization, such as networks, norms, and trust, that facilitate coordination and cooperation for mutual benefit.’ While there is extensive debate concerning a precise definition (Onyx and Bullen 2000; Mohan and Mohan 2002), and a universal way to measure social capital (Woolcock 1998), it remains an important framework for policy and research in managing natural resources (Adger 2009; Sobels et al. 2001). In order to limit confusion over the definition and measurement of social capital, I focus on bonding social capital, which is inwardly looking and exclusive, characterised by strong ties of personalised trust between individuals that is based on shared norms (Compton and Beeton 2012). This is in contrast to bridging social capital, which is outward looking and refers to external networks. The focus on bonding social capital is a result of the ‘bottom-up’ approach to invasive plant management in the study site. In order to measure and assess instances of social capital, I borrow from Webb and Cary (2005: 127) who note ‘information about the norms of trust and reciprocity that govern behaviour through those networks will also be fundamental in assessing the level of social capital and its contribution to positive or negative consequences.’ The role of trust and social norms are thus instrumental in assessing both the effectiveness of social capital, and understanding how Landcare groups form and act collectively.

5.2.3 Framing social capital and collective action: trust and social norms

Given the breadth of research on trust and social norms, I will briefly set out how this paper applies these literatures. Trust is a key factor in generating collective action (Graham 2013; Stallman and James 2015). This is particularly relevant for NRM agencies aiming to gain
participation and encourage landholders to change or undertake new management practices.

Trust is defined as ‘a psychological state comprising the intention to accept vulnerability based upon positive expectations of the intentions or behaviours of another’ (Rousseau et al. 1998: 395). Trust involves dimensions of risk, vulnerability, uncertainty, expectations and interdependence for individuals (Sharp et al. 2012). The benefits of trust are linked to the cohesion it creates across individuals allowing acceptance of strangers, tolerance and reconciliation of diverse interests, and contributes to an individual’s sense of belonging and identity (Sharp et al. 2012). Two forms of trust are pertinent here. The first is competence trust that can be defined as the belief that others have the ability to contribute to the provision of the collective good, and it can be determined through past experience or reputation (Graham 2014; Purdue 2001). The second, goodwill trust, is the belief that other actors have not just the ability but also the motivation to contribute (Graham 2014). Similar to competence trust, goodwill trust also develops from experience and reputation, but involves an expressive commitment to shared values and goals (Purdue 2001).

Additionally, social norms are integral in both establishing and perpetuating specific management practices across individuals (Minato et al. 2010; Minato et al. 2012; Niemiec et al. 2016). Minato et al. (2012) distinguish between two types of norms: injunctive norms, indicating how individuals ought to act; and descriptive norms, demonstrating how people do act. Injunctive norms have a moral imperative attached to them, whereby people act in a certain way because it is understood as appropriate, irrespective of their personal beliefs. On the other hand, descriptive norms provide social proof that certain behaviours are acceptable (Minato et al. 2012). These latter set of norms create expectations without the same level of obligation seen with injunctive norms. As Minato et al. (2012: 865) describe, ‘people conform to descriptive norms because they want to fit in, or because it is easier to imitate the behaviour of other people in situations where they might be unsure of what to do’. Furthermore, when descriptive norms
are made visible, they can become injunctive. Thus, social norms compel land managers to do the right thing either because they acknowledge the utilitarian benefit of a new practice, recognise the need to collectively manage for the benefit of a catchment, want to be revered as a good steward, or are simply following the crowd on the assumption that the majority must be doing the right thing (Minato et al. 2010). While acknowledging that the dimensions of social norms may be underemphasised in social capital research (Minato et al. 2010), I aim to address this problem by examining how social norms and trust circulate interdependently to strengthen social capital.

5.3 Case study: Tindale Valley Landcare and invasive plants

The site of this research paper is Tindale\textsuperscript{14}, located in southern New South Wales. It is a small community of around 400 people (ABS 2011), approximately 4 hours’ drive from the nearest metropolitan area, Canberra. Tindale remains a largely agricultural region, consisting primarily of beef and sheep grazing. However, the region is emblematic of other rural-amenity landscapes in rural southeast Australia more generally, experiencing social and economic change with the in-migration of small amenity holdings (the 2011 census data indicates that 70 residents (17.5\% of total population) have moved into the area within 5 years). Table 5.1 further emphasises this rate of property turnover and in-migration through the increasing subdivision of land parcels in the broader LGA. The two classes represented (20–50 ha and 50–200 ha) are most prevalent in Tindale when compared across the entire LGA. This is largely the result of commercial farming properties being subdivided into smaller blocks, which are often occupied by tree changers, and hobby farmers. Additionally, as elsewhere (Abrams et al. 2012), many of these tree change properties in Tindale provide a weekend destination, with the owners’ primary residency remaining in metropolitan areas, leading to increasing rates of absentee ownership. The changing

\textsuperscript{14} Rural locations are given pseudonyms to protect participant identities.
social dynamics of Tindale is diversifying the motivations, skills and values of landowners with significant implications for invasive plant management.

**Table 5.1 Land parcel subdivision in the broader LGA: 2001–2012**

<table>
<thead>
<tr>
<th>Class</th>
<th>2001 cadastre</th>
<th>2012 cadastre</th>
<th>New parcels (2001-2012)</th>
<th>% new</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1 (20-50ha)</td>
<td>1620</td>
<td>1970</td>
<td>35</td>
<td>18</td>
</tr>
<tr>
<td>Class 2 (50-200ha)</td>
<td>529</td>
<td>763</td>
<td>234</td>
<td>31</td>
</tr>
</tbody>
</table>

Note: Data sourced from Land and Property Information 2014

The LGA of the study area comprises multiple CBNRM groups existing under the umbrella of Landcare, as well as the state funded LLS. These groups have emerged in response to the declining environmental health of local rivers, native pastures, and soils. The popularity of CBNRM in the broader LGA also stems from the increasing social diversity and changing land use patterns (Klepeis et al. 2009). In this paper, I focus on the practices of Tindale Valley Landcare (hereafter TVL) in recruiting and coordinating landholders to manage invasive plants. The Landcare group began with six key farmers driven by a commitment to address NRM issues threatening agricultural production, particularly invasive plants. Operating for over 24 years, TVL now has 75 active members with diverse backgrounds and land uses. The group continues to be driven by invasive plant issues, since these plants threaten agricultural production and endangered ecological communities, particularly Lowland Grassy Woodlands.

In Tindale, grazing management depends on specific pasture conditions, though invasive plants such as serrated tussock (*Nassella trichotoma*) and ALG threaten these economic and natural assets. Both plant species are highly adaptable to a range of environments, have high germination and seed success, tiny seeds that are easily spread by a range of common vectors, and have extremely low nutritional value and palatability (Michelmore 2003; Fim 2009). Managing both species requires early intervention. The NSW Department of Primary Industries recommends continuous monitoring of properties to ensure these plants can be controlled immediately. In
this respect, the most effective control strategy is to prevent establishment. However this is not always possible. For some, the inability to identify these species, a lack of time to scour the property, or in cases of absenteeism and property turnover, the lag time between infestation and monitoring/control allows these species to proliferate. Managing ALG or serrated tussock then requires an integrated programme of herbicide application, sowing new pasture species, and then pasture management. However, once established these species are increasingly difficult to eradicate, and often contingency plans are developed in order to contain and limit their spread, reduce seed reproduction, and ensure effective farm hygiene is practiced to prevent further distribution.

The issue of property turnover and weed control is at the forefront of TVL’s operations. In 2008, the Landcare group launched the Tindale Project to improve and increase contact with landholders. Anecdotal results indicate that in five years of the Tindale Project, 60% of landholders (including the majority of large holdings) have been engaged in noxious weed control, with general support from another 20%. The project achieved a significant reduction of the spread and density of serrated tussock, which once covered 20% of Tindale. This is despite the area experiencing a property turnover of 50% every 15 years.

5.4 Methodology

This research draws on a sub-sample of interview material with members of TVL. It is situated within a larger project on invasive plant management in southern New South Wales, Australia. Specifically, I draw on interviews with 9 rural landholders in Tindale, who are members of TVL. This includes 5 non-commercial properties with small-scale mixed grazing operations (50–200 acres), and three large-scale commercial beef and sheep farming properties (200–1000 acres), and 1 Landcare project officer. While the experiences of 9 participants frame this paper, the larger research project involved 49 landholder interviews, 29 of which are members of various NRM
groups. Further, interviews were conducted with agency staff from the LLS, other Landcare project officers, and Local Control Authority staff. TVL emerged as a case study during interviews across the study area, where the group is heralded as a successful example of CBNRM. The case study and sample size offer an opportunity to unpack the dynamics of bonding social capital in the development of bottom-up collective action. In particular, Tindale provides an appropriate scale to consider how a key leader transverses different landholder types; the experiences of those involved; and the effectiveness of these relationships for managing invasive plants.

Purposeful snowball sampling (Tashakkori and Teddlie 2003) was used to recruit a mix of amenity migrants and commercial farming properties. Research recruitment flyers were also distributed through TVL email server and newsletters. Semi-structured interviews were conducted with one interviewer and up to two participants, and lasted approximately 1 hour. Questions explored prior knowledge about land management, preferred information sources, and landholders’ history of management practices. Follow-up interviews were conducted with agency staff in response to initial themes from first-round interviews. These focused more specifically on landholder recruitment and engagement exercises as well as the strengths and weaknesses in delivering CBNRM.

Interviews were recorded and transcripts were imported into the qualitative software programme NVivo. The interviews were coded using an open thematic approach (Bazeley 2007), whereby descriptive characteristics are grouped to build toward a theme (e.g. recruitment and trust). Thematic coding ensured that individual codes remained situated in the wider themes of social norms and trust among all participants. The themes of trust and social norms surfaced during interviews and initial readings of interview transcripts. While interview questions were not specifically directed at these themes, they were implicit—and at times explicit—in participant accounts. As Minato et al. (2010) identifies, social norms are unwritten codes of behaviours and
are not directly talked about. Similarly, trust was a theme emerging throughout the coding process.

5.5 Results

In what follows, I trace the experiences of Landcare project officer Roger, in navigating the changing social dynamics of Tindale in order to recruit and sustain collective action for invasive plant management. Roger has lived in Tindale for over 30 years. While his position as project officer commenced 6 years ago, he previously worked in similar government agencies including the former Catchment Management Authority (now LLS) managing local rivers. From this, Roger was then offered the position of project officer on the proviso existing TVL members approve. Roger’s formal role involves writing grants and managing NRM projects; however, he is also informally tasked with enrolling new landholders and ensuring amicable relationships across members. Aside from Landcare, Roger also has a mixed grazing enterprise of cattle, sheep and an orchard. Given Roger’s background and the history of the Landcare group, TVL’s management projects are geared toward farming productivity.

5.5.1 Building trust, delivering action

Trust is a powerful tool in securing collective action. Organisations that are trustworthy gain increased participation (Sobels et al. 2001), and in turn build knowledge to be shared among members to better address management issues (Webb and Cary 2005). For TVL, Roger plays a significant role in not only gaining trust, but also nurturing trust among members. Gaining trust is a key first step in recruiting new landholders who lack experience in weed management and identification, or are unaware of the significance of weeds in Tindale. Participants reflected on

---

15 Note that the names used for the interview excerpts are pseudonyms to protect participants’ identities. Details of land use type and TVL membership remain accurate.
TVLs influence, particularly Roger, in establishing weed management as a priority and assisting in building management skills:

So my saviour was essentially Roger. He was a guy who said, ‘You have to watch this, you have to watch that.’ I couldn’t even recognise a single weed … so there was kind of an awareness training from him which was really good. (John, TVL member, Lifestyle agrarian: mixed grazing)

In this example, Roger gains trust by demonstrating his knowledge in weed identification and management. Building competence trust is integral for new residents to accept advice as well as develop their own management skills. Importantly, trust leads not only to the willingness of new landholders, but over time builds the necessary skills to control weeds. Roger demonstrates his skill and knowledge about weed management through face-to-face interactions (such as property walks), and also through public demonstrations. Roger deliberately engages in land management practices to earn the trust of the public:

We actually rent a farm which was thought of as the worst weed farm in the valley and it is now thought of as a very clean farm. So part of it was just actually walking the walk myself so that people know I have actually got on top of it. (Roger)

In renting a ‘demonstration block’, Roger makes himself accountable to the wider community, as they monitor his progress and observe the methods he uses to manage weeds. Furthermore, neighbouring properties also learn by observing his management on this demonstration block:

Roger’s used his sheep on the property next door [demonstration block] and has turned the Fireweed on that place around significantly. So, how did we learn? We watch what Roger’s doing. (Fiona, TVL member, Production farmer: beef)

Owning this property produces a number of positive effects. First, he demonstrates an ability to manage weeds, as he purchased a well-known patch of land easily visible to the public. Second, the high amount of weed infestations on the property ensures he demonstrates a high level of skill. Third, Roger’s effectiveness in reducing the amount of weed coverage allows him to promote his methods of weed control, making landholders more likely to accept his techniques.
and advice on property management. This resonates with the work of Burton (2004), who identifies the influence of existing social and cultural norms in shaping the practices of land managers, but also how farmers judge the practices of others.

Collective action is strengthened when competence trust circulates with goodwill trust. One challenge for TVL and Landcare groups more broadly, is overcoming the common view among farmers that Landcare is antithetical to agricultural production (Carr 2002). In the study area, Landcare is a common point of contact for amenity migrants seeking to learn and gain more information about land management. This often involves the conservation and regeneration of landscapes affected by grazing practices. As a result, these new land management practices promoted by Landcare are often understood by graziers to be inimical to their management goals. In Tindale this is germane given the area’s history and existing grazing enterprises. Thus, overcoming resistance from graziers requires establishing shared commitment and values toward land management. As a beef and sheep grazier, Roger is able to gain trust from graziers through demonstrating management skills, but also through sharing common values about land management. One management issue that builds goodwill trust is native vegetation management, as Roger explains:

Now you almost have to break the law yourself to make people trust you … that's a huge part of the trust because of the link with LLS, Landcare is envisaged as these people who plant trees, and our group … we're nearly anti-tree, it's very much a farming productivity and around here farming productivity is not made with too much scrub.

In this example Roger’s position as someone who spans social boundaries (Pero and Smith 2008) affords him a certain level of trust as he is able to communicate the laws restricting native vegetation management. However, to overcome the negative connotation attached to Landcare, he also needs to demonstrate staunch support for farming practices. In ‘almost breaking the law’ Roger establishes his commitment for production over protection, and gains the support of other farmers. In doing so, TVL is able to distance itself from negative associations with
Landcare among farmers and graziers, reaffirming shared values and goals toward land management. Such efforts are pertinent in rural-amenity landscapes such as Tindale; as the gradual changes in land use necessitate that Landcare leaders confront the evolving values of the region.

Competence and goodwill trust are also effective in securing the commitment of landholders who have ‘given up’. This is common for graziers and non-commercial properties who can no longer cope with the spatial extent of invasives, lack the motivation, or are physically unable to continue. Demonstrating both skill and motivation to manage weeds is a necessary component in building the confidence and willingness of these landholders. Building collective action in this scenario requires skill in assisting management, but also support and empathy for the challenges facing landholders. In contrast to enforcing management through financial penalties (as done by the Local Control Authorities), TVL provide support to assist management. This is evident in Roger’s attempts to motivate some graziers to manage ALG and serrated tussock:

we do have a couple of farmers who just believe it cannot be beaten [ALG] no matter what … and they are one of the ones I’m working strongly to try and win their trust and go in there with a crew and show them what we can achieve, because we can actually turn a place around. (Roger)

Roger is going to bring in his Landcare team. They're going to spend about three days. They reckon they can knock it [serrated tussock] over … To do it by yourself, it's really sort of you never see the end of it. But with a team and keeping at it for a couple of days, they reckon they'll break the back of it. (Kent, TVL member, NRL: absentee owner)

In these examples, competence trust serves to demonstrate the possibilities in managing these invasive plants, which in turn encourages landholders to maintain control. By volunteering their time and energy to assist landholders, TVL and Roger demonstrate the feasibility of removing invasives. Here, competence and goodwill trust work together to strengthen participation. In supporting landholders, TVL encourage participation through collaboration, rather than strict
enforcement. This strengthens collective action as landholders feel motivated and responsible enough to continue the management efforts set in motion by TVL.

**5.5.2 The social norms of invasive plant management**

Trust is significant in gaining the support of new and existing landholders. Importantly, once trust is established it allows for social norms to be extended. While gaining the support of new landholders requires trust, these relationships allow new landholders to become enrolled into TVL’s ethic of weed management. This is a deliberate strategy employed by TVL:

> It's not an official process, but it's sort of an unwritten law. They have to be contacted one by me, two by at least a couple of other neighbours, farmers … just sort of to say welcome, we care about this stuff, if we can help give us a ring. (Roger)

Weed management becomes embedded in the daily lives of new landholders; its importance reaffirmed through farmers stressing their personal commitment. As new landholders are contacted by neighbours, Landcare members and Roger, they become aware of the importance of weed management and the community’s commitment. In doing so, TVL actively mobilises injunctive norms, thereby perpetuating the moral imperative of suppressing invasive plants as something that ‘ought to’ be done.

> we don't have any stock, but we understand that certain species are bad for stock. And if we let them flourish here, we're doing a disservice to the other people in the valley who have stock. So that sort of social responsibility. (Kent, TVL member, NRL: absentee owner)

> I can be as diligent as I like here, but if my neighbour is not diligent I’m stuffed. Because I'll never win the battle. That’s why we as neighbours are so preoccupied with these matters and we work together in that. (Paul, TVL member, Production farmer: beef)

Instilling social norms is strengthened through the use of contracts. Contracts are a significant tool in gaining commitment and also steering management toward particular species deemed the biggest concern. This process involves TVL, particularly Roger, working closely with landholders assisting them with labour, chemicals, and funding to manage weeds. This assistance is
negotiated through the use of a contract, which is written by Roger in collaboration with the landholder to establish a weed management plan. As Roger explains:

Generally it’s me telling them they have a weed issue and suggesting this is a way of getting on top of them. The plans were seen as the only way of getting some sort of commitment … if you’re not doing it we will go in and do the control work because it actually stipulates that on the plan.

The plans serve as a contract ensuring landholders will make proper use of the funding and materials supplied. Participants value the support of Landcare and feel a greater sense of responsibility to engage in weed work:

But then we sign a contract that we’ll manage the weeds up to a certain point, certain time, and do certain things … then he signed off with that, and then the money comes through. (Kent, TVL member, NRL: absentee owner)

Rather than making landholders feel victimised in processes such as weed audits and notices, Roger’s weed plans are collaborative and tailored toward landholder abilities and goals, while also being couched within TVL’s interests. Such an approach has a two-pronged effect: (1) it ensures landholders will engage in management practices that benefit their own property and to an extent the broader community; and (2) it establishes the significance of weed management as a community issue requiring community effort. These injunctive norms are integral in the functioning of the Landcare group, which relies on personal commitment and shared responsibility.

Descriptive norms were also evident in strategies used to recruit new members. The injunctive norms established through face-to-face meeting with amenity migrants, were supplemented through TVL’s public demonstrations. Similar to Minato et al. (2012) findings of Indigo Landcare’s annual tree plantings, members of TVL participated in roadside weed removal to publicise the group. Roger explains the process:
We early on did a lot of working bees along roadsides and the farmers would get so angry because I would make them bring chip hoes because we would go past organic places, but it really worked because people saw people who were prepared to get out and do something for nothing.

This was also noted by other LLS staff outside of Tindale as an effective strategy to gain community interest and public awareness around weed issues:

[It] contributed a lot to people getting more involved in the group. So someone would see them coming past the road and go, ‘What are you doing? Who are you lot?’ They’d say, ‘We’re Tindale Valley Landcare, we’re making sure the weeds don’t get down this road,’ that was like a walking PR kind of scheme. (David, Landcare coordinator, southern NSW catchment area)

The road side sweeps led by Roger not only serve to establish a norm of community participation in weed management, but also promote the willingness of members to manage outside of their property. In doing so, Roger and other Landcare members promote the norm that weeds are a community concern, demonstrating the importance of community participation in limiting the spread of weeds (e.g. along roadsides), and the willingness and commitment of TVL members.

Collective action is not only strengthened through recruitment, but also by prioritising specific invasive plants. This is significant in targeting weeds with high seed production and germination success, and that spread easily by common vectors (Graham 2013). These species require frequent attention to ensure outbreaks are suppressed and there is adequate knowledge on how to effectively control their spread. TVL achieve this through making clear the biggest weed issues, and steering action among its members:

The way it works is that we [TVL] have this philosophy of we really want to keep it under control. Because if we each do our bit we’ll have a big result and we’ve done that … so how do I prioritise it? I’m led by the Landcare group who are concerned for the bigger area. (Paul, TVL member, Production farmer: beef)
Serrated tussock and ALG are primary concerns for TVL, prioritised in roadside management and in the management plans of Landcare members. These invasive plants require continued management efforts through large-scale removal of infestation sites, controlling isolated outbreaks and frequently returning to areas of past management. As mentioned, serrated tussock has been ostensibly controlled in Tindale through the work of TVL. ALG is yet to invade Tindale to the extent of surrounding areas. This is owing partly to the geography of Tindale; it is isolated, surrounded by National Parks and limited road access restricts the spread of weeds. More importantly, TVL reduce invasive plants by steering management toward the species they deem the most significant threats. These norms embodied in these activities not only have the ability to enrol people to participate in weed management, but allow for specific species to be managed.

5.6 Discussion

Understanding how social norms and trust operate interdependently is significant in addressing collective action issues. This process can better steer management activities, particularly strategies of recruitment and maintaining cohesion in socially diverse landscapes. The patchwork of landholder types spread across Tindale—from traditional commercial graziers to holistic managers—highlights an immediate issue in establishing shared goals that will manifest into private land management practices. This is a central challenge for collective action in multifunctional rural landscapes (Epanchin-Niell et al. 2010; Marshall et al. 2016). In what follows, I first reflect on how Roger develops a shared strategy for controlling weeds through building trust, establishing a norm of reciprocity, and overcoming other norms that present barriers to collective action (Graham 2013: 128). Second, I critically reflect on the limitations and potential challenges facing TVL’s bottom-up collective action.
5.6.1 Collective action in rural-amenity landscapes: the role of key leaders

TVL’s ability to recruit new members and sustain invasive plant control hinges on the work of Roger. In particular, it is Roger’s ability to develop and coordinate this form of bottom-up community-led collective action (Ostrom et al. 1999), which allows for the uptake of norms and ongoing participation in invasive plant management. TVL can be distinguished as a form of bottom-up collective action as the group develops and implements their own management goals outside of government mandates (i.e. legislation), and in doing so establishes the norms of community participation and monitoring needed to control invasive plants (Mead 2016; Yung et al. 2015). Previous research argues that bottom-up collective action is weakened by amenity migration as property turnover reduces ‘individuals’ connection to local communities, knowledge of natural systems and commitment to the problem’ (Epanchin-Niell et al. 2010: 214). However, TVL, and particularly Roger, exhibit how bottom-up collective action can be maintained through bonding social capital. This is witnessed in the strong social norms and reciprocity among neighbours in controlling invasive plants (Niemiec et al. 2016), as well as trust in agricultural extension agents (Stallman and James 2015).

In rural-amenity landscapes, a key question concerns whether some management norms are transferrable across landholder types. The social norms described above are largely tied to production goals. However, for amenity migrants this is less of a priority. In these circumstances, the norms of invasive plant management need to shift beyond the normal rhetoric of production, toward a more inclusive form of reciprocity (Graham 2013). While amenity migrants were aware that managing invasives is a necessary part of land management, contact with neighbours and Landcare emphasise the consequences of invasive plants personally, and beyond the individual property. This furthers Niemiec et al.’s (2016) and Sharp et al.’s (2011) findings that perceptions of risk, either personally or to public goods, are a significant motivator for action. Establishing the norms of invasive plant management is strengthened by TVL engaging
landholders promptly. This reflects Marshall et al.’s (2016) findings that lifestyle landholders’ willingness to participate is highest soon after moving to their new property. The readiness of new landholders suggests that norms are best adopted early, before landholders learn and develop their own personal sense of stewardship that may counter existing norms of best practice (Cooke and Lane 2015a). Therefore, NRM organisations in rural-amenity landscapes should prioritise contacting newly arrived migrants, and stress the consequences of invasive plants at the individual, but also the community scale.

Establishing social capital in rural-amenity landscapes is enhanced through a key leader. Roger’s ability to gain trust not only facilitates the uptake of management action, but also allows for landholders to gain knowledge and skills on how to manage invasive plants. This is where the norms of reciprocity are particularly important. In gaining the necessary knowledge, skills and funding from TVL, landholders feel compelled to reciprocate through managing invasive plants for the community. Rather than feeling pressured or even victimised when approached by TVL, participants describe the process as beneficial. Extending from Sharp et al. (2012), Roger is able to build trust by not only demonstrating competence, but also through expressing compassion, respect and reassurance and sharing community values and norms. These relationships then create the conditions for landholders to recognise that their own efforts will be reciprocated. This is not only about managing invasives, but land management generally (e.g. fencing, river and riparian management, soil health, pasture management). Establishing the norms of reciprocity is crucial in not only transferring the necessary skills to manage invasive plants, but also in creating the impetus, and then instilling the norms that invasive plants ought to be managed (Graham 2013).

Finally, establishing the norms of reciprocity also requires demonstrating respect for competing steward values. In rural-amenity landscapes, the processual changes in land uses and stewardship values require CBNRM groups, and in particular leaders, navigate across different landholder
types in order to secure collective action. In Tindale, the legacies of production still dominate management priorities. However, TVL need to foster other motivations and values in order to navigate the changing social makeup of the region. When landholders’ livelihoods are not threatened by invasive plants, or their values oppose orthodox management practices (e.g. the use of herbicides), engendering collective action can be a challenge. The role of key leaders is to help overcome these barriers. As mentioned, one way of achieving this is through reaffirming the collective risks of neglecting invasive plants (Niemiec et al. 2016). Additionally, gaining participation requires others to demonstrate their commitment to invasive plant management. Collective action research highlights the importance of people witnessing other community members participating in management efforts in order to further embed the norms of reciprocity (Epanchin-Niell and Wilen 2015; Niemiec et al. 2016). The example of using hoes to manage weeds outside of organic properties not only demonstrates collective commitment for weed management, but also TVL’s willingness to engage in management techniques outside of standard chemical applications. It is Roger’s ability to empathise with a range of landholders that ensures TVL members participate in alternative practices to further a collective goal (e.g. controlling weeds along roadsides), while also demonstrating that non-members can engage in weed management without compromising their values (i.e. aversion to herbicide). Such practices reflect the need for CBNRM groups to adapt to the gradual social changes of rural-amenity landscapes, and avoid privileging particular management types over others, if collective action is to be improved.

5.6.2 Contingencies for collective action

Despite the success of TVL in achieving collective action, there remain important caveats that need further consideration. The first relates to the issue of individual burnout. Previous research into Landcare leaders has identified that when people volunteer in leadership positions for long periods they may suffer burnout and leave (Byron et al. 2001). Compounding this, Tennent and
Lockie (2013) note when Landcare leaders suffer burnout that these groups then lack leadership, and often dissolve. TVL is highly dependent on the work of Roger. While they are developing contingency plans through increasing the level of member activity in recruitment and ‘working bees’, the ethic that TVL members have cultivated is indebted to Roger. As a result, the levels of trust that Roger has gained may not be easily transferred to a potential successor. Additionally, if a core group of farmers were to operate TVL in Roger’s absence, the level of rapport established across landholder types may also erode. However, it is also important to note that given Roger’s position is funded the risk of burnout may be lessened, or at least differ in some respects from the above studies. While previous research on volunteer burnout points to the need for social norms to become self-perpetuating and shared collectively outside of a key individual (Minato et al. 2012), the example of TVL highlights the significance of funding leaders to potentially reduce burnout and avoid these networks collapsing.

Second, the use of funds to encourage and assist landholders’ weed management, reveals both an important driver, but also a potential problem for collective action. As mentioned, TVL often use funding contracts as a means to recruit and gain long-term participation in weed management work. Although research documents the importance of funding schemes for gaining collective action among Landcare groups (Byron et al. 2001; Tennent and Lockie 2013), there is also the risk of ‘crowding out’ (Rode et al. 2015: 274) the intrinsic motivations of landholders to manage weeds. Research demonstrates that using incentives that appeal primarily to financial self-interest may undermine the fundamental values that lead landholders to act in altruistic or conservation-spirited ways (Greiner and Gregg 2011; Rode et al. 2015; Vatn 2010). In the case of TVL, the immediate success of the grants should be tempered with the understanding that such schemes may be at risk of crowding out the social norms that have embedded the values, and assisted in the uptake of invasive plant management. While the benefits of these grants indicate one area where government funding may be directed, such
schemes should be handled with care to avoid the norms of reciprocity and trust being eroded, or replaced by a dependence on financial incentives, which are ineffective in the long-term (Hajkowicz 2009).

Third, bottom-up collective action also presents some dilemmas in regard to the environmental outcomes of these networks. TVL is driven by a commitment to reduce the impacts of invasive plants, largely on the basis of agricultural goals (i.e. production). The norms that are bound-up within these management actions reflect a commitment to maintain the productivity of the land, as well as the social and cultural legacies of the region. The insular nature of bottom-up collective action and its extension of bonding social capital lead these values, at times, to become rigid and they are often imposed on new migrants, rather than modified through collaboration. Such inflexibility may cause negative environmental impacts (herbicide run-off; reduced biodiversity; land clearing), or fragment collective action if amenity migrants’ values are marginalised. This is indicative of other research into Landcare, which highlights how these groups tend to maintain the status quo, rather than encourage debate over their approaches and potential alternatives (Gill 2004; Lockie 1996). While perpetuating these norms and values for land management is detrimental to the groups’ success, it is important to note that this form of collective action may also impede the ability to adapt and promote alternative management practices outside traditional customs.

5.7 Conclusion

Understanding the role of social norms and trust is crucial in addressing collective action problems associated with rural-amenity landscapes. Following Putnam (1993), the interplay between social norms and trust are two key organising features and outcomes of social capital. I have aimed to detail in greater depth how these two components of social capital are mobilised and reproduced across landholders in order to secure collective action. Previous research
identifies how trust and norms of reciprocity are required to secure collective action (Graham 2013; Marshall et al. 2016). This paper has extended this research to identify how these two elements of social capital function interdependently through the work of a key Landcare leader. Roger’s role has proved instrumental in recruiting new landholders and strengthening management action across landholder types. As Minato et al. (2012: 875) state, ‘NRM practitioners need to identify both existing norms and key socialisation agents in the communities where these norms are established, reinforced and possibly reinterpreted.’ Further to this, and as I have demonstrated here, trust is also an important factor in ensuring the uptake of these social norms. Identifying and supporting the actors who are able to gain trust is crucial in not only increasing participation, but more importantly extending the injunctive norms that impel landholders to continue. CBNRM policies should endeavour to promote, support, and fund key leaders who can gain trust, extend norms of reciprocity, and in turn enrol a variety of landholders into a broader management ethic, if collective action issues such as invasive plants are to be better addressed in rural-amenity landscapes.
6 Conclusion

6.1 Amenity migration and the changing nature of invasive plant management

This thesis began by outlining how the in-migration of new rural landholders is in part contributing to the distribution and spread of invasive plants. Amenity migration is changing the nature of invasive plant management through both the biophysical changes to rural landscapes that is driven by the in-migration of new landholders, as well as the values and land use goals these landholders bring with them. The former, I have argued, is concerned with the cause-and-effect relationship between amenity migration and invasive plant management, in which social processes have direct and quantifiable environmental impacts. The latter, and the focus of this thesis, emphasises the situated and ongoing social and environmental processes and relationships that shape landholders’ management knowledge and practices. Instead of drawing lines of responsibility to what is causing invasive plant problems, I have sought to detail how the social and environmental changes occurring within Bega Valley are influencing landholders’, and to some extent, land managers’ responses to invasive plant management.

The chapters of the thesis have detailed the complex histories and unfolding relations that unsettle the linear framings between invasive plant management and amenity migration. In a landscape that already contains invasive plants, there is an increasing need for research to move past locating invasive plant management in cause-and-effect terms, to instead grapple with the everyday management practices of landholders and land managers. In focusing on the everyday experiences of rural landholders I have aimed, in part, to contribute to a growing body of literature that is concerned with the implications of amenity migration for collective action. In particular, I have examined the role of individual values and management dispositions in guiding management decisions, but also the social and environmental relationships that influence individual and collective responses to invasive plant management.
Attending to these everyday experiences yielded important insights into the social relationships that influence invasive plant management, but also the environmental processes that challenge existing management practices and with which landholders must contend. In Bega Valley, invasive plant management is not only complicated by increasing social heterogeneity, but also the uncertainty facing landholders and managers when environmental changes confront the feasibility of management goals and exhausts existing management knowledge. To understand how social and environmental change is affecting invasive plant management the thesis has been guided by the overall aim: ‘to critically interrogate how rural landholders come to define, manage and at times, live with invasive plants against a backdrop of social and environmental change’. To fulfil the aim I addressed the following objectives:

1. Document and analyse how landholders learn about the invasiveness of particular plants, and in turn develop the skills necessary to manage, and, at times, live with these species;

2. Examine how landholders interpret and navigate environmental legislation in the context of personal land use goals and ecological change;

3. Assess whether the diversifying management values and goals of landholders—associated with amenity migration—impede collective action for invasive plant management.

Both the aim and objectives provided the direction to open up the possible range of actors affecting invasive plant management, and reveal the everyday human and nonhuman relations that assist or impede the collective action of invasive plants. In what follows, I detail the theoretical and practical contributions of the thesis. First, I highlight the value in combining the epistemological insights from cultural geography with NRM in order to conceptualise and articulate the challenges and opportunities for invasive plant management. Second, I illustrate the practical implications of this theoretical framework for improving collection action in rural-amenity landscapes, as well developing management responses in spaces of uncertainty.
6.2 Theoretical contribution: combining cultural geography with natural resource management

This thesis has endeavoured to combine cultural geography perspectives on nature and the environment with those from the field of NRM. The motivation for combining these perspectives is two-fold: (1) the epistemologies of relationality and social constructionism provide important insights into the actors and relations affecting invasive plant management; and (2) existing NRM research provides a valuable framework for thinking through how these epistemological insights can be developed into practical responses. In integrating both perspectives, I have critically examined the co-construction of Nature to not only identify how invasive plant discourses are formed, practiced and contested, but also how these discourses can unify or divide collective management action.

The theoretical ambitions of this thesis are a response to the seeming polarisation between the multiplicity championed in relational and social construction epistemologies, and the uniformity of management goals that is called for in NRM research. This thesis has grappled with the issue of multiplicity in the context of landholders’ management values and decision-making. In particular, I have adopted the idea of multiplicity—as evidenced in relational learning—to illuminate how individual and collective management values do not adhere to a universal conception of Nature, but emerge within specific social and environmental contexts.

Alternatively, the thesis has also detailed how collective action relies on developing and maintaining a shared management goal across landholders, often in response to the increasing social and ecological heterogeneity occurring in rural-amenity landscapes. There is thus a tension between recognising and embracing the multiplicity of management values and goals that emerge through human and more-than-human relationships, while also needing to develop and sustain shared management goals across individual landholders.
In this thesis, I have addressed this tension by incorporating relational and social construction epistemologies with practice-based approaches from the field of NRM. In doing so, I have offered a theoretical framework that supports the need for management discourses to become operational in order to engender collective action, while also acknowledging the potential fallibility of such goals through on-going human and more-than-human relations. This theoretical framework is a response to the criticisms that the pluralism—or multiplicity—championed by relationality runs the risk of lapsing into an indecisive form of relativism (Light and Katz 1996). Such critiques challenge relational approaches to move from general statements and declarations of intent to become operationalised in more specific engagements with the world (Jones 2008; Mansfield and Doyle 2017). Indeed, relational and social constructionism epistemologies need to provide more than just an increasingly long and complicated list of actors and processes affecting invasive plant management. Multiplicity needs to be mobilised into practical responses. Additionally, the theoretical framework is driven by a commitment to problematise invasive plant discourses, as well as unsettle the human-centred approaches of NRM research. The chapters of this thesis demonstrate how both perspectives, when integrated, can address their individual limitations, and provide direction for those tasked with managing natural resources, particularly in changing social and environmental landscapes.

Chapters 2 and 3 employ relational and social construction epistemologies in order to critically examine the discourses and practices of invasive plant management. In particular, both chapters take the topic of uncertainty to evaluate the relevance of current management discourses and the vulnerability of existing management practices in a landscape undergoing social and environmental change. Chapter 2 applies a relational framework to critique the durability of management discourses in a complex and changing social and ecological landscape. Chapter 3 extends a relational epistemology to learning frameworks in order to apprehend how landholders develop ways of living with ALG outside of legislative framings and effective institutional
management advice. Importantly, combining the epistemological tools afforded by relational and social construction perspectives, with NEG and learning frameworks, provides a more robust understanding of the relationships that unsettle and challenge collective management discourses. Additionally, the knowledge gained from incorporating these perspectives opens space to consider the types of learning processes that can assist capacity-building and adaptive responses in times of management uncertainty.

While a relational approach to invasive plant management illuminates the assemblages of human and nonhuman actors complicating management decisions, it remains necessary to consider how this insistence on multiplicity can be mobilised into practice. Rather than focusing primarily on the more-than-human relationships, Chapters 4 and 5 draw attention to the intersection between collective and individual management goals that influence the effectiveness of collective action. Chapter 4 highlights the social and environmental relationships that reshape amenity migrants’ management goals and practices, with particular implications for coordinating cross-property management. Chapter 5 demonstrates the importance of key NRM leaders in building social networks for collective action through gaining trust and extending social norms. Both chapters illuminate how individual management values and social relationships work for and against developing collective action. However, and in line with relational epistemologies, these social relationships are never divorced from their environmental context. Bringing a relational perspective to bear on collective action affords NRM research, and land managers, with the ability to recognise the relational co-construction of landholders’ management values, and how they can challenge or conform to collective action goals.

Overall, in combining cultural geography perspectives on nature the environment with those from the field of NRM, I have sought to not only de-centre human actors and social networks in NRM research, but also consider how relational and social construction epistemologies can improve invasive plant management. Collective action and NEG both provide useful
frameworks to mobilise relational and social construction perspectives. Such an approach facilitates a more robust understanding of invasive plant management, beyond the human-centred approaches that are prioritised in the field of NRM, while also extending relational thinking into the realm of practice.

6.3 Practical contribution: future directions for invasive plant management in rural-amenity landscapes

The theoretical gains from combining cultural geography and NRM perspectives provide an opportunity to contribute more practical suggestions for addressing invasive plant management, particularly in rural-amenity landscapes. Uncovering the relations where invasive plants are defined, managed and at times lived with provides a comprehensive account of the values underpinning invasive plant management. Importantly, understanding how landholders’ management values are reformed and practiced can improve collective action, minimise vernacular disjunctures, and enhance management responses in times of environmental uncertainty. In order to advance these insights into practice, I have also provided recommendations for how local NRM institutions in Bega Valley (particularly LLS) can improve on existing management programs and practices (see Tables 6.1 and 6.2).

Returning to objective 1, documenting how landholders learn about the invasiveness of particular plants and develop management responses provides valuable insights for managing in times of uncertainty. As Chapter 3 demonstrates, in times of management uncertainty attending to the specificity of plant agency and ongoing more-than-human relationships provides novel insights for how landholders may live with, and better manage ALG in the absence of effective institutional management knowledge. When invasive plants exceed control, managers need to engage with the complex interdependencies between people and plants that unsettle existing management knowledge and practices. Drawing from the experiences of rural landholders can equip managers with important insights for adapting to changing environments and living with
invasive plants. While a relational learning approach provides the epistemological tools to examine the more-than-human relations that affect learning, there also remains the need to open space for a range of actors—human and nonhuman—to contribute in the development of management responses in times of uncertainty.

Developing management responses in times of environmental uncertainty also requires revising the discourses used to guide management practices. Following from objective 2, landholders interpret and navigate environmental legislation based on their own personal land use goals, but also in response to changing ecological conditions. When competing goals for environmental management arise between the public and policymakers, the effectiveness of legislation is placed under considerable scrutiny and may hinder the public and land managers’ ability to work collaboratively to address management issues. In Bega Valley, vernacular disjunctures are caused, in part, by a lack of communication and arising disagreements between landholders and policymakers over the priorities and outcomes of environmental legislation. In particular, when legislation is unable to recognise the socio-ecological relations that unsettle environmental legislation, or when landholders management goals are moving against or beyond existing legislation, vernacular disjunctures ensue.

In line with growing acceptance toward adaptive governance in NRM (Cook et al. 2010; Holley et al. 2012; Plummer et al. 2013), those tasked with regulating and enforcing invasive plant management need to recognise the fallibility of existing management discourses and practices when confronted with changing environments. Table 6.1 provides recommendations for how the Farmers Network and the LLS may better respond to the management uncertainty caused by ALG, and ecological change more generally. In particular, these management groups will benefit from further reflection and deliberation on the power of social norms in influencing the information that group members are willing to accept and the range of management responses considered appropriate. NEG offers a useful framework to examine the role of power and social
norms in securing environmental management outcomes across different epistemic communities. However, the focus on social relationships within NEG can be improved by also including the insights from cultural geography perspectives on nature and the environment. Importantly, NEG’s principles of learning and collaboration need to be expanded to incorporate nonhuman agency and relational epistemologies in order to recognise the potential fallibility of management discourse, while also tuning attention to the more-than-human actors and relations that influence the learning process.

Table 6.1 Recommendations for policymakers and practitioners responding to management uncertainty in Bega Valley

<table>
<thead>
<tr>
<th>Management Uncertainty</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Responses</td>
<td>Addressing social norms in learning networks:</td>
</tr>
<tr>
<td>- Farmers Network:</td>
<td>- LLS should consider establishing or supporting additional organisations that encourage a range of perspectives that are not tied to traditional land uses and farming productivity.</td>
</tr>
<tr>
<td></td>
<td>- NRM organisations should also maintain space for experimenting with alternative management practices, as well as sharing the failures and successes of new or existing management practices across different learning networks.</td>
</tr>
<tr>
<td></td>
<td>Decentring human-human learning networks:</td>
</tr>
<tr>
<td></td>
<td>- Social learning networks need to treat plants as actors in the learning process, rather than just objects to be acted upon. This requires creating an environment that encourages conversations about plant agencies, or more specifically the distinctive capacities of plants in terms understood by landholders. Drawing out such experiences may require promoting different methods for documenting the learning process, such as photo and video diaries.</td>
</tr>
<tr>
<td></td>
<td>Addressing vernacular disjunctures during management uncertainty:</td>
</tr>
<tr>
<td></td>
<td>- Managers need to develop clear understandings of species’ impact that can guide management action. This includes the types of species’ behaviours that are problematic (e.g. invasiveness), as well as the environmental conditions that people want to protect. Ideas of species’ impact should not remain fixed, but should be deliberated across landholders, managers, and policymakers in response to ecological change.</td>
</tr>
</tbody>
</table>
In rural-amenity landscapes invasive plant management is also contingent on the ability of managers to coordinate the diverse values, interest, and abilities of landholders toward a shared goal. However, coordinating management is not a straightforward process. Following objective 3, improving invasive plant management requires managers to apprehend the diversity of values and discourses inherent within landholders’ decision-making that can fragment collective action. In this context, coordinating invasive plant management should not operate entirely on a knowledge-deficit model—as some would propose (Simberloff et al. 2013). While amenity migrants and graziers may at times require information about new invasive plants, or in developing management skills, more attention is also required to analyse the discourses of managers as well as the public in order to overcome vernacular disjunctures and develop collective action in rural-amenity landscapes. As Barry and Proops (1999: 338) state:

Until we know the ‘discourses’ people use about the environment, it will be very hard to judge what, and whether, environmental policies will be socially acceptable, and therefore capable, of being implemented.

Collective action in rural-amenity landscapes needs to encompass processes and procedures that allow all relevant perspectives to be taken seriously in developing management goals. Taking a collaborative, rather than coercive approach to collective action improves the ability of landholders to reach agreements and minimise tension (Holley et al. 2012). A relational approach to NEG and collective action more broadly, resonates with Healy’s (2003) epistemological pluralism, which takes into account not only the diversity of management values, but also the co-construction of such values and goals through human and more-than-human relations. As demonstrated in Chapter 4, amenity migrants’ property-centrism emerges through their social and environmental relationships that influence their management goals and practices. In this context, developing collective action in rural-amenity landscapes requires recognising the diversity in amenity migrants’ land use goals, but also the ability of these management goals and
values to change or solidify through social and environmental relationships. Table 6.2 provides recommendations for how collection action can be improved in Bega Valley through broadening the methods of participation, and encouraging greater deliberation of the values and goals underpinning invasive plant management.

**Table 6.2 Recommendations for practitioners to improve collection action in Bega Valley**

<table>
<thead>
<tr>
<th>Collective Action</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Current Responses</strong></td>
<td><strong>Recommendations</strong></td>
</tr>
<tr>
<td>- LLS and Landcare: organise field days and working bees to provide an opportunity for new and existing landholders to meet and learn about weed issues affecting the region.</td>
<td>Reflecting on the values and goals underpinning invasive plant management:</td>
</tr>
<tr>
<td>- Local Control Authorities: applies pressure on landholders to manage weeds through financial penalties.</td>
<td>- Managers need to critically reflect on the values underpinning their own management decisions, and how these values are conveyed to landholders.</td>
</tr>
<tr>
<td>- TVL: establish trusting relationships between government agency staff and landholders and in turn develops social norms for controlling invasive plants.</td>
<td>Reflecting and deliberating on the values within NRM organisations can better address sources of disagreement between land managers and landholders, particularly when different management backgrounds, values and goals need to be worked with.</td>
</tr>
<tr>
<td></td>
<td>Broadening methods of participation:</td>
</tr>
<tr>
<td></td>
<td>- In apprehending the range of management values NRM organisations, particularly Landcare, can avoid opposition to specific weed management practices (e.g. herbicides), or the broader goals underpinning weed management (e.g. grazing production). Collaborating with a range of landholders will improve the ability of NRM groups to align personal motivations with collective management goals. Such an approach can instil injunctive norms around weed management that are not dependent on specific methods of control.</td>
</tr>
</tbody>
</table>

Despite the need for managers to recognise and respond to the diversity and reformation of management values across landholders, invasive plant management still requires some form of collective action that can only be mobilised through establishing, and at times enforcing, a single management priority. Advocating for greater reflexivity and epistemological pluralism in prioritising invasive plant management is not to suggest giving *carte blanche* to all landholders. Rather, collective action requires developing shared management goals that can be applied across landholders in order to achieve a level of coordination and cooperation necessary for controlling
invasive species. Combining cultural geography and NRM perspectives provides the mechanisms to apprehend the relationships and practices that compliment or confront existing management discourses and affect the development of collective action. Taken together, collective action research will benefit from opening up the range of actors that unsettle and challenge management values and priorities in changing social and ecological landscapes. At the same time, cultural geography perspectives—particularly those employing relationality and social constructionism epistemologies—can help resolve issues of vernacular disjunctures and better steer collective action through articulating the coproduction of management values.

6.4 Research limitations

Although this study has contributed critical insights into the nature of invasive plant management in rural-amenity landscapes, the theoretical framework and methodology of the thesis have provided a particular way of understanding of the broader issue. As a result, there remain some aspects of invasive plant distribution and management in rural-amenity landscapes that has received less attention in this thesis, which requires further reflection. First, the in-depth analysis of landholder practices, and more-than-human relations, cannot fully account for the wider social and environmental processes and relations driving the ecological changes in rural-amenity landscapes (Abrams et al. 2012). While I have spent considerable time arguing for research to move beyond cause-and-effect analyses, there is still important information to be gained from such studies. In particular, I was unable to quantify the biophysical changes in land cover resulting from landholders’ management practices. Instead, determining the effectiveness of landholders’ management practices was contingent on my personal observations, interviewee experiences, as well as the discussions that took place with local land managers and research scientists in Bega Valley. Although this provided valuable insights into the outcomes and specific management practices, it is still important to consider the absence of biophysical data when making claims about the effectiveness of specific management practices.
Second, the thesis does not discuss in specific detail the economic factors of invasive plant management. Such an analysis is germane in agricultural landscapes, where graziers’ decision-making is often bound within economic circumstances. Beef farmers in particular spoke of the economic pressures to maintain grazing pressure despite knowing the potential ecological consequences. This aligns with research more generally that illuminates how the economics of agriculture constrains land management decisions, and often as a consequence, leads to environmental degradation (Lawrence 2005). Indeed, there is a troubling paradox that arises when the economic pressures on farmers’ leads them to manage the land in such a way that facilitates the spread of invasive plants, and in turn perpetuates the economic pressures they are seeking to relieve. However, this narrative was marginalised in the thesis, partly through the theoretical framework, but also the methodology and its reliance on interviews. It is difficult to discuss their economic status with farmers. While some farmers mentioned the tight profit margins in beef grazing and the need for off-farm employment, the precise figures on production costs (including weed management) is confidential. Most commonly this information is gathered through surveys, such as ABARES, but this data only establishes broader trends (as set out in the earlier chapters), and is often only available at broader spatial scales. Therefore, while it is necessary to consider the economic pressures on graziers to manage weeds, a detailed consideration of the economics in invasive plant management was beyond the scope of this study, and indeed the methods used.

A second limitation of the methodology is the range of participants included within the study. Because the recruitment flyers and the overall framing of the research project were geared toward invasive plants and invasive plant management, the research tended to recruit landholders who are already eager and proactive in managing weeds. However, given research and government documents often place fault on ‘uninterested’ amenity migrants or absentee landholders, not being able to interview these landholders limits the total understanding of the
factors impeding issues such as collective action. Recruiting uninterested participants is a perennial problem for research more generally. Additionally, the legal implications of invasive plants may also make landholders who have weed problems less eager to participate, particularly if they are receiving a recruitment flyer through a government agency. Despite this absence, the number of participants in the study provided a considerable range of land uses as well as abilities and interests of landholders. Adding to this, interviews with government agency staff also provided knowledge into the practices and behaviours of other landholders that I was unable to interview.

While it facilitated greater depth, another methodological limitation was having only one study area. As mentioned, the initial aim of the thesis was to include a comparative site; however the success of early recruitment and the significant number of participants impelled me to focus on Bega Valley. Nevertheless, an additional study area may have provided important information about differences in weed species, as well as the types of amenity migrants. Given my focus on the distinctive capacities of plants, having a wider range of weed species and different weed priorities could have yielded interesting insights into learning processes and management techniques. Further, the distance of Bega Valley from major urban centres in comparison to other rural-amenity migration ‘hot-spots’, may have provided a more diverse range of amenity migrants and ownership types. A wider range of amenity migrants would also improve understandings of the diversity and similarities in values as well as their abilities in managing invasive plants.

In terms of my positionality as a researcher, one limitation was my lack of botanical knowledge, specifically of invasive plants. This limited the range of questions I was able to ask, as well as my ability to identify weeds on participant properties. At times, this restricted the level of dialogue during properties walk, and there was also a sense of confusion from participants in regard to my intentions of doing weed research. However, my lack of botanical knowledge also provided
opportunities to ask more general questions, and potentially gave participants a greater sense of freedom to discuss their knowledge, without feeling overly scrutinized.

6.5 Future research

The limitations of this research project open opportunities to discuss directions for future research on this topic. Extending from my recommendation for invasive plant management to embrace a form of epistemological pluralism, researchers—potentially in collaboration with management agencies—should set into practice deliberative forms of invasive plant management and governance. Epistemological pluralism extends, in part, from adaptive management frameworks that collaborate with multiple stakeholders across different governance levels. Such an approach requires apprehending the range of existing values and how they can be reconciled in order to establish a shared management focus. However, as has been the criticism of adaptive management, there is still a need for managers to consider the role of power when there is no collective agreement about what the goals should be. People will not always agree. The question then becomes, how will these goals be decided, and by whom. Traditionally management disagreements are settled with a turn to science to guide management decisions. It is this role of power in deciding the direction of invasive plant management that research needs to consider.

Finally, holistic management provides another interesting research trajectory. Some of the participant quotes within this thesis are from landholders who have participated in a holistic management workshop, or consider themselves to be holistic managers. These landholders provided novel interpretations into how invasive species are valued and also lived with. Indeed, holistic managers tended to be the most responsive and willing to learn about how to live with ALG. This is partly an outcome of the restrictions placed on the types of management they are able to do (e.g. no herbicides), but more significantly it is attached to their philosophy of land management. Future research will benefit from exploring the relationships between holistic
management and invasive plants. This will be beneficial in not only considering less
environmentally impactful ways of managing invasive plants, but also how to develop ways of
living with species in spaces of management uncertainty. I am not claiming it as a panacea for
invasive plant management, but instead I encourage research to pay closer attention to how this
disposition can open future possibilities for thinking about and living with invasive plants.
References


Appendix A: Participant Recruitment Flyer

Local Residents Needed For Study

Land, People and Weeds: Natural Resource Management in Changing Rural Communities

This is an invitation to participate in a study conducted by researchers of the Australian Centre for Cultural Environmental Research (AUSCCER) at the University of Wollongong with project funding from the Australian Research Council.

Changes in communities, land use, and land ownership have made weed management more complex. The new mix of landowners means that what motivates weed management, and what people actually do about weeds can vary. Some argue this has the potential to improve weed management. Others worry that weed management has worsened. To understand how landholders’ perceive weeds and gather knowledge is vital to effective weed management. Participation in this study will assist in understanding landholder issues with weeds and weed management over the Bega Valley.

The overall purpose of this study is threefold:

- To understand what you are doing in relation to weed management and why?
- To assess what you perceive as the largest weed threats in your property and region?
- To examine how you have learnt to identify and manage weeds?

This research will help the wider community by:

- Developing insights regarding how landholder’s prioritise what species to manage, the limitations to effective management, and whether weed management is worsening or improving with changing rural communities.
- Assisting local community, farmer based and government organisations (e.g. Landcare, South East Local Land Services, Farmers Network, Bega Valley Shire Council) identify the types of assistance programs most needed and how best to deliver them.

We are interested in interviewing adult members of households located:
In the Bega Valley including but not limited to: Candelo; Cobargo; Wolumla; Wyndham.

If you agree to participate in the study, it will involve:

- An interview with you at your property at a time of your convenience, and
- A property-walk to further discuss and show your weed concerns and management.

If you are interested in participating in this study, we will be in Bega Valley throughout June to conduct the research. Please contact the project researcher, Shaun McKiernan, via email (sm065@uowmail.edu.au) or telephone (0402 428 023) indicating your interest or to obtain further information.

Information about AUSCCER and this project is available at:

Appendix B: Participant Information Sheet for Landholders

TITLE: Land, People and Weeds: Natural Resource Management in Changing Rural Communities

PURPOSE OF THE RESEARCH

This project aims to investigate the effects of population and land-use changes on invasive plant species distribution and management in rural Australia. Amenity migration (aka “Tree change”) – the movement of people to rural areas for lifestyle reasons – is changing rural landscapes and the social and environmental conditions within which invasive plants grow and are managed. The project involves social science researchers from the Australian Centre for Cultural Environmental Research (AUSCCER) and the School of Earth and Environmental Science based at the University of Wollongong.

Project researchers will investigate the extent to which farm sales and subdivision, landholder diversity, weed and natural resource management organisations and groups, and the character of plants themselves affect invasive plant management. These issues will be explored in study areas on the New South Wales south coast that encompass a diverse set of land-use types and invasive plant species.

INVESTIGATORS

Dr Nicholas Gill
Associate Professor
Australian Centre for Cultural Environmental Research
University of Wollongong
Tel: (02) 4221 4165
Email: ngill@uow.edu.au

Shaun McKiernan
PhD Candidate
Australian Centre for Cultural Environmental Research
University of Wollongong
Tel: 0402 428 023
Email: sm065@uowmail.edu.au

Natalia Adan
Research Assistant
Australian Centre for Cultural Environmental Research
University of Wollongong
Tel: 0412651221
Email: nataliaa@uow.edu.au

Dr Laurie Chisholm
Associate Professor
School of Earth and Environmental Sciences
University of Wollongong
Tel: (02) 4221 3765
Email: lauriec@uow.edu.au

Chris Owers
Spatial Data Officer and Research Assistant
School of Earth and Environmental Sciences
Faculty of Science, Medicine and Health
METHOD AND DEMANDS ON PARTICIPANTS

The research involves exploratory interviews with landholders in the Bega, Shoalhaven, and Eurobodalla areas. Interviews are likely to take 1-2 hours of your time. It will involve an interview with up to two researchers at your location of preference. This interview will include a discussion about the decisions, choices, and actions of landowners with respect to weed management and associated activities. The interview may also involve a walk around your property to better understand where on your property you are concerned about weeds and where weed management has occurred.

The project also includes a weed survey of the property which will be done by a weed ecologist who will walk through the property and measuring the presence, density, abundance and diversity of weeds. This will help us understand the results of what different landowners are doing and the findings may be of interest to you.

We will ask a smaller number of landholders to complete a participant diary, with no more than 5 simple questions about their weed management on their property. This will also include participant mapping of weed management with a GPS tracker.

BEFORE THE INTERVIEW

1. Indicate to us that you agree to participate by completing and signing the ‘Participant Consent Form for Residents’.

2. If you have not already been provided with a ‘Participant Consent Form’ please call or send an email to Shaun McKiernan (if you live in Bega) or Natalia Adan (if you live in Shoalhaven or Eurobodalla) so they can provide them by email or in hard copy depending on your preference (Contact details above).

3. Once you have completed the ‘Participant Consent Form’, keep it and return it to us at the time of the interview.

4. We will confirm a suitable time for our researchers to come to your preferred location and conduct an interview with you.

RESEARCH STAGES

If you agree to participate in the study, it will involve all or some of the following steps depending on which stages of the research you are part of and agree to:
Stage 1 Interview: We will ask you some questions about weeds, how they may impact you, your personal experiences in weed management, and how you have learned about weeds and weed management. This may also include a property walk to show where weeds are on your property and areas you have managed weeds.

Stage 2 Weed Survey: With your consent a weed ecologist will do a survey of the presence, density, abundance and diversity of weeds in your property. To facilitate the survey, part of this stage will involve the researcher discussing where you have weeds and/or where you manage weeds. The results will be treated confidentially.

Stage 3 Second interview: A selection of interviewees from stage one will be asked to participate in a follow-up interview to discuss in greater depth themes around weeds and weed management from the first interview. This stage may also involve further property walks to show potential changes to the property since the initial visits and/or further management work you have conducted.

Stage 4 Diary and participatory mapping: A further selection of participants from Stage 2 will be asked to keep a written diary for up to 4 weeks over two different seasons. This will involve recording what weeds you have managed, how you conducted management, and why. Further, you will also be asked to use a GPS tracker when conducting weed work as a way to record where on your property you have managed weeds.

Stage 5 Follow-up interviews: With selected participants from Stage 3 we will explore themes developed in previous interviews, mapping, and diary entries. This final stage will aim to bring together these different sources of information to gain a comprehensive account of landholder attitudes and actions toward weeds.

Please note that no stage is compulsory. We appreciate any level of involvement that you are able to provide. You are able to opt out of the research at any time.

AUDIO DOCUMENTARY

Recorded interview materials may also be used to produce an audio documentary or web podcasts to explore and illustrate the experiences of landholders with weeds. Participating in an interview does not oblige you to agree to this. You will be given a separate opportunity to indicate whether you consent to having audio-recordings of your interviews used in an audio documentary or podcast. If we want to use your interview, we will provide you with an opportunity to review our proposed use of your interview material to ensure that you feel comfortable with the information.

POSSIBLE RISKS, INCONVENIENCES AND DISCOMFORTS

Apart from your time for the interviews, the property walks, participatory mapping and the diary responses we can foresee no risks for you. Your involvement in the study is voluntary, and you may withdraw your participation from the study at any time and withdraw any data that you have provided to that point. If you request it, your participation will be anonymous. Refusal to participate in the study will not affect your relationship with the University of Wollongong.
FUNDING AND BENEFITS OF THE RESEARCH

This research is being funded by a grant from the Australian Research Council (ARC). The ARC aims to deliver policy and programs that advance Australian research and innovation globally and benefit the community. This research will enhance knowledge about how people are managing weeds on the ground and provide a basis for future decisions on weed management strategies. Findings from the study will be published in a PhD thesis, possibly published in outputs such as journal articles, a book, and other publications. Results may be publicised in the media and in fora such as University blogs.

ETHICS REVIEW AND COMPLAINTS

This study has been reviewed by the Human Research Ethics Committee (Social Science, Humanities and Behavioural Science) of the University of Wollongong. If you have any concerns or complaints regarding the way this research has been conducted, you can contact the UoW Ethics Officer on (02) 4221 3386 or email rso-ethics@uow.edu.au.

Thank you for your interest in this study
Appendix C: Consent Form for Landholders

‘Land, People and Weeds: Natural Resource Management in Changing Rural Communities’

Researchers: Dr Nicholas Gill, Mr Shaun McKiernan, Mrs Natalia Adan, Dr Laurie Chisholm, Mr Chris Owers

I have been given information about the project ‘Land, People and Weeds: Natural Resource Management in Changing Rural Communities’ and would like to participate in the study. I have had the opportunity to ask the research team any questions I may have about the research and my participation.

I have been advised that any information that I provide will be treated confidentially in any publications or other communications arising from the research. I understand that I will not be personally identified as the source of information such as quotes or opinions, unless I indicate below in this Consent Form.

I understand that my participation in this research is voluntary, I am free to refuse to participate and I am free to withdraw consent from the research at any time. My refusal to participate or withdrawal of consent will not affect my relationship with the University of Wollongong.

If I have any enquiries or concerns about the research, I can contact Shaun McKiernan 0402 428 023 and/or Nicholas Gill (02) 4221 4165 or if I have any concerns or complaints regarding the way the research is or has been conducted, I can contact the Ethics Officer, Human Research Ethics Committee, Office of Research, University of Wollongong on 4221 3386 or email rso-ethics@uow.edu.au.

By signing below I am indicating my consent to:

☐ Participate in an interview
☐ Have the interview audio recorded
☐ Being quoted directly in the research
☐ Be identified by name in relation to any quotes or opinions emerging from this research
☐ Complete a weed management diary.

I understand that the data collected from my participation will be used for a PhD thesis and will also be used in journal articles and other publications, and in presentations such as at conferences and I consent for it to be used in that manner.

Signed: ____________________________ Date: __/__/____

Print name: ____________________________
Appendix D: Indicative interview schedule (for landholders)

First-round interview schedule

General

1. How long have you lived in area [X]?
2. What influenced you to live in area [x]?  
3. Do you undertake agricultural and/or grazing activities on your land?  
4. (If yes) what does this involve?
5. For what reasons do you undertake these activities (primary income, hobby, part-time etc.)?
6. What other key things do you want to achieve and/or maintain on your land (amenity values, biodiversity, production, recreation, nice home etc.)?
7. What do you do on your land in order to work towards these goals? (where do weeds feature in this)

Weeds

1. Does your property contain weeds (if so, what species)?
2. Did you know about weeds at the time of purchase?
3. Can you tell me about what you thought about them/how you found out about them/how you reacted?
4. What weeds are of most concern to you? Why?
5. Are there weeds that you don’t worry much about? Why not?
6. Do you do any management for the ones you don’t worry much about? Why is that?
7. Have your weed priorities changed since you came here?
8. What do you view as the main cause of weed infestations on your property?
9. To what extent have weeds changed the way you live on and work on your land? To what extent have they changed your everyday practices or routines on your property? To what extent do weeds affect the values you mentioned earlier?

Weed management

1. How do you find out about weeds and how to deal with them?
2. How do you decide which weeds you focus your management efforts on?
3. To what extent would you say you are successful in managing weeds? What facilitates this?
4. To what extent is your ability to manage weeds constrained or limited? What causes this?
5. Which method or methods of weeds control do you mainly use? Why do you choose this method(s). Have you changed what you do? Why?
6. What have been the key influences on your weed management? (This is where you may get into a conversation about the sources, who they talk to, what they read, what they get from these sources etc)
7. Are there any weed management actions that you wish to undertake but cannot? What is the reason(s)?
8. To what extent have you been compelled to undertake weed management work that you have seen as not so important?
Follow-up interview schedule

1. How did you imagine the property to look before you bought it?
2. What were your intentions in managing the property to achieve this? How have they changed? What are the trade-offs, if any?
3. To what extent is there a sense of how a property should be managed / how it should look / what tasks are most important to do and be seen to do?
4. To what extent do you think there is an idea of a ‘good’ landholder, a good property manager around here?
5. Does the tradition of the Valley have any influence on how you use your land?
6. How would you describe what you want the property to look like and be used for?
7. What are the main influences in your decision-making about property management?
8. Do you see yourself as a good landholder or as doing things the way people around here think they should be done / as having a property that looks right?
9. What are your long-term goals with your property?
10. What motivates you to manage your property?
11. What do you value on your property, and why?
12. What do you feel to be the most important work on your property? (Personally, socially, legally?)
13. Are there any limitations to conducting this work?
14. Do you feel a responsibility to the community to do weed work? Where does this come from? (Within? Social pressure somehow?)
15. Are there certain weeds that you feel the greatest pressure to manage?
16. Are these weeds your greatest concern?
Appendix E: Indicative Interview Schedule (for managers)

History/Job Description

1. What is the role of your organisation?
2. How long the group is established in the area?
3. What have been the main objectives in the area (Bega/Shoalhaven)?
4. What the key things (law/policy, funding availability and criteria, council politics, concepts/ frameworks/ideas/’common sense) that influence what you focus on?
5. What are the things that influence the strategies in how you approach your role?
6. What are the things that occupy most of your time and resources available to you?
7. To what extent are you satisfied at this allocation of your time and resources?

Description of the region/landscape

1. How do you describe the region (landscape type, socially)?
2. How has the landscape changed over time?
3. Does the physical structure of the landscape lead to becoming more inveable to certain species (soil types, topography, wind breakers)?

Weeds/management

1. What weeds are you most worried about?
2. What is it about these weeds that make them your key concern?
3. Has the status of certain weeds changed over time?
4. What are the main criterions that determine what weeds to prioritise?
5. What are the most difficult species to manage?
6. What do you see as the main limitations in conducting weed management?
7. How would you overcome these challenges?

Landowners

1. What are your methods to engage landowner’s about weed management?
2. What are the main categories of landowner do you work with?
3. What are the main hindrances to engage with landowners?
4. Has your approach to working with landowners changed over time?
5. How would you describe the influences or impact on landowners that you would ideally have?
6. Do you have adequate skills, resources, tools available to you to get landholders to do what they need to do/ should do?
7. If no, what it’s missing? What would you like?
Appendix F: Participant Weed Diary

In addition to follow-up interviews with 10 research participants, I also asked participants to complete a ‘weed diary’ (see below). The weed diaries were intended to collect insights into the practices, ideas, experiences, and meanings of ‘weed management’. Participants were asked to complete the diary over a four week period in summer 2014, and winter 2015. Participants were emailed the template of the weed diary and asked to return the completed entry via email. Inviting participants to keep a written journal of their weeding experiences was an attempt to gain access to the everyday experiences of weeding, how management decisions are made, and if/why they manifest and change. In total three participants agreed to complete the diary entries. However, after receiving the entries it became clear that this data served more as a complement and extension of the interviews, rather than providing a novel insight. Perhaps this was an outcome of the questions asked in the diary; the time participants could invest in these entries; or even the perceived banality of compiling these entries. Either way, after reviewing the first four entries I decided to disband the follow-up. While the data was useful it was not drawn on in the subsequent chapters.

Land, people, and weeds participant diary

Date/time:

What weed management have you done in the past week?

How did you manage these weed(s)?

Why did you conduct this management?
Appendix G: Using NVivo Interview Analysis Framework

Interviews were coded and analysed using the qualitative data analysis software NVivo 10, and later NVivo 11. ‘A code is an abstract representation of an object or phenomenon … ranging from purely descriptive … through labels for topics or themes … the more interpretive or analytical concepts’ (Bazeley 2007: 66). Codes are stored under ‘nodes’, which refer to named categories or themes. Open, axial, and selective coding was used in order to identify and then build themes from interview data (Neuman 2006). During the first round of interview coding, an open approach was undertaken, whereby transcripts are read over several times and tentative nodes are created for that summarise emerging themes. This open approach provided ‘dropping-off’ points that refined the data, identified relevant parts, and then developed broad themes.

Following open coding, axial coding was performed to identify relationships across the interview transcripts. This involved organising the tentative nodes into trees – hierarchical, branching structures in which parent nodes serve as the main theme and contain within them subcategories. Sorting nodes into trees provided greater organisation, conceptual clarity, and a prompt to code richly and identify patterns (Bazeley and Jackson 2013). This was then further entrenched through selective coding. Once initial codes were compiled and themes emerged, I then reread transcripts and selectively coded any material that relates to the core variable that was identified.

The ‘Tree Nodes’ figure below illustrates all hierarchical layers and the categories developed from interview transcripts. These categories were amended and at times deleted as the analysis developed and certain nodes proliferated as others wilted. While not all nodes were used in the chapters of this thesis, they nonetheless provided an important means to organise data, as well as provide an objective account of the prevalence of certain categories in order to avoid overemphasis and misrepresentation. Toward the end of the thesis nodes were also created
specifically for papers. This often involved relabelling nodes for organisation, but also coding specifically for the themes of the paper (i.e. selective coding). However all themes emerged from the initial open coding approach, as well as during the interviews. Overall, the appeal of NVivo is that the coding process and organisation of data allows for less subjective and, by implication, more accurate interpretations (Crang et al. 1997).