National Environmental Research Program

LANDSCAPES & POLICY hub

Mapping community values for regional sustainability in the Lower Hunter Region

Final Report

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Purpose of Report

The purpose of this report is to present a robust, replicable method for mapping community values for regional sustainability and to present on the key findings from the application of this method in the Lower Hunter Region of New South Wales.

The research was commissioned by the Department of Sustainability, Environment, Water, Population and Communities. A research team from the Charles Sturt University was engaged to undertake the study through the Landscape and Policy Research Hub at the University of Tasmania. The report is an output of the Landscapes and Policy Research Hub.

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Frequently Used Abbreviations

DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities
GIS	Geographical Information System
LEP	Local Environmental Plan
LGA	Local Government Area
LHRS	Lower Hunter Regional Strategy
NERP	National Environmental Research Program
NGO	Non-Government Organisation
MNES	Matters of National Environmental Significance
OEH	Office of Environment and Heritage (NSW)
PPGIS	Public participation geographic information systems
PSMA Australia	Formerly Public Sector Mapping Agencies

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Executive Summary

The mapping of community values for regional sustainability in the Lower Hunter Region was funded by the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC). The project is part of the National Environmental Research Program (NERP). A research team from the Charles Sturt University was engaged through the Landscape and Policy Research Hub (based at the University of Tasmania) to assess community values for regional sustainability in the Lower Hunter Region of NSW. Community values broadly refer to the social values that individuals assign to places on the landscape (for example, aesthetic, recreation, biodiversity), as well as the development preferences that individuals assign to places on the landscape (for example, residential, industrial, tourism). Our focus was on urban and rural residents who were adults, rather than the wider population in the Lower Hunter Region.

The project aimed to address three key objectives:

1. Identify and map the values assigned by multiple community types to natural and built features in the Lower Hunter Region;
2. Develop a robust methodology for eliciting community values for natural and built features, which can be applied in multiple regional planning contexts; and
3. Provide information and a series of policy recommendations that can be used to inform the Lower Hunter Regional Sustainability Plan, including a reliability check of sites tagged for conservation and regional development.

The community values mapping method comprised of two key phases of a community appraisal and a mail-based survey. The aim of the community appraisal was to identify key issues and opportunities with respect to regional sustainability planning in the Lower Hunter. The community appraisal involved one hour semi-structured interviews with 15 regional planning practitioners identified as key stakeholders by the Department of Sustainability, Environment, Water, Population and Communities and their contractors. The themes which emerged through these interviews informed the topics and items included in the mail-based survey. Key issues of potential interest to the department included the ongoing threats posed to biodiversity conservation by urban development in greenfield areas, the lack of a co-ordinated approach to land-use planning and the tensions related to biodiversity offset policy. Key opportunities included the development of new tools to justify the conservation of natural areas at the place-specific scale, the potential for the new Lower Hunter Regional Strategy to act as an umbrella document, which provides the pathway for different agencies responsible for land-use planning (for example, infrastructure, roads and land allocation) to work together to achieve common goals and outcomes, and pathways to reducing so called 'green tape' with respect to biodiversity offset policies at national and state scales of governance.

During the community appraisal, we noticed that communities of place (rural and urban landholders) and practice (planning practitioners employed in land-use, conservation or infrastructure planning fields) have a key stake in planning for regional sustainability. We therefore stratified our survey sample into rural landholder (n = 500), urban landholder (n = 500) and planning practitioner (n = 80) cohorts. The community of place cohort was obtained by undertaking a stratified random sample of the regional cadastre database provided on licence by PSMA Australia. The community of practice cohort was obtained by snowball sampling (that is, asking key planning practitioners to identify the names of up to 10 practitioners who they believed had an important voice on regional sustainability planning issues in the Lower Hunter and then seeking these candidates to pass on a further 10 names and contact details).

A survey response rate of 39.3% (393 completed surveys returned from the sample of 1,001) was achieved. To test for non-response bias, we compared survey respondents with a sample of non-respondents using data gathered during follow-up telephone surveys with non-respondents; and survey data on a limited number of variables with similar data collected from the wider population through the 2011 ABS Census. Those comparisons established that survey respondents were of similar age to non-respondents, but respondents had attained higher levels of formal qualification.

The mail-based survey comprised seven parts:

1. Community views on regional sustainability issues;
2. Knowledge of regional sustainability issues;
3. Beliefs about the future of the Lower Hunter region;
4. Values and preferences for the low hunter region;
5. Attitudes toward biodiversity offsets;
6. Respondent background (for example, socio-demographics); and
7. Open comment about the threats and opportunities facing regional sustainability planning in the Lower Hunter Region.

Part 4 was the unique aspect of the survey. Survey participants were asked to assign aesthetic, recreation, biodiversity, natural significance, cultural significance, food, water, natural materials, science, health and intrinsic values to places in the Lower Hunter Region using sticker dots. Additionally, they were asked to identify places on the map of the Lower Hunter Region that they believed were acceptable or inappropriate for residential, industrial, transport, agriculture and tourism development, in addition to areas acceptable and inappropriate for conservation outside existing national parks and conservation reserves. Survey participants could place up to six dots for each value and preference type on to the map of the region. They could place as many or as few dots as they liked on the map.

Subsequent sections of the Executive Summary provide a brief overview of key findings for each survey topic. There is also a summary of the conclusions section of the final report where we directly respond to each key research objective.

Level of Concern about Regional Sustainability Planning Issues

Of the 25 issues listed in the survey, those of concern to the highest proportions of survey respondents were:

1. Insufficient coordination between land-use, conservation, transport and infrastructure planning;
2. Lack of accessible public transport in regional centres;
3. Lack of integrated transport planning; and
4. Biodiversity (the variety of native plants and animals) decline as a result of development.

The issues of least concern out of those listed were:

1. Negative impacts from the construction of new roads such as the Hunter Expressway;
2. Establishment of new corridors for biodiversity conservation;
3. Rezoning of private land for biodiversity conservation; and
4. Laws that exist to limit native vegetation clearance.

All community types rated biodiversity decline as an issue of concern above infrastructure issues such as the lack of cycling paths, the increased frequency of trains to transport coal to the port of Newcastle and the availability of basic services (for example, water, electricity) to support residential development. Coal seam gas exploration was a medium-ranked issue; however, for rural landholders it was ranked in the top seven issues.

There are significant differences in the issues of concern between rural and urban landholders and planning practitioners. Both landholder cohorts were more concerned than planning practitioners about the lack of opportunities to express their views on regional planning issues that affect their community, the high rate of population growth of some regional centres; and development along main roads. The lack of full-time employment opportunities was of concern to a higher proportion of urban landholders than rural landholders or planning practitioners. The establishment of new corridors for biodiversity conservation was of greater concern to urban landholders than planning practitioners.

Knowledge of Regional Sustainability Planning Issues

It is important to highlight that most rural and urban landholders self-reported very little to some knowledge on most items included in this survey topic. For example, most rural landholders reported less than some knowledge for 17 out of the 18 aspects of regional sustainability (> 80% reported less than some knowledge) and most urban landholders reported less than some knowledge for 16 out of the 18 aspects (> 78% reported less than some knowledge). These results suggest there is a case for improving public knowledge of regional sustainability planning. Respondents self-reported most knowledge about the advantages and disadvantages of coal mining and coal seam gas mining, and the threats posed to biodiversity by residential and industrial development in the Lower Hunter Region. These results suggest there is a case for improving public knowledge about regional sustainability issues in the Lower Hunter.

Beliefs about Regional Sustainability Planning Issues

Respondents were generally very supportive of a diversified regional economy, including investment into renewable energy options such as wind and solar power generation (78% supported versus 13% opposed), increased tourism development to improve the economic viability of the region (86% supported versus 5% opposed) and building a more efficient public transport system (91% supported versus 4% opposed). The recent establishment of 20,000 ha of conservation reserves or flora reserves in the Lower Hunter Region was also supported by a large majority of respondents (80% supported versus 7% opposed).

A high proportion of respondents disagreed with belief statements about the openness and fairness of regional planning in the Lower Hunter. For example, 49% disagreed that regional planning organisations are open and honest when explaining plans for future development (versus 11% agreed); and 30% disagreed that the process used to develop land use plans in the Lower Hunter Region is fair and equitable (versus 12% agreed). There was general uncertainty about the desirability of the changes proposed to the NSW planning system under the '*A New Planning System for NSW*' (78% unsure).

Overall, the majority of respondents agreed that the economic prosperity of the Lower Hunter Region is too dependent on the coal mining industry (75% agreed versus 14% disagreed) and the majority disagreed that coal-seam-gas mining is an acceptable land-use in the Lower Hunter Region (61% disagreed versus 17% agreed). Rural and urban landholders agreed significantly more than planning practitioners that coal seam gas mining presents an unacceptable risk to the health of residents in the

Lower Hunter Region ($F = 7.08$, p[1] < 0.01). Proportionally, 62% of rural and urban landholders versus 39% of planning practitioners agreed that coal seam gas mining presents an unacceptable risk.

Compared to planning practitioners, landholders were less supportive of high-density residential development in urban areas (34% rural and urban landholders versus 2% planning practitioners opposed). This is an important finding given that urban infill is often promoted as a way to better manage urban sprawl impacts on the environment (and perhaps improve urban amenity and lower infrastructure costs). Nevertheless, 52% of rural and urban landholders and 90% of planning practitioners supported higher density residential development in urban areas.

Further to this topic, during the community appraisal a number of planning practitioners believed that the cheap price of quarter acre blocks on the urban-rural fringe was a key driver of greenfield development and thus biodiversity decline. We included a question on these price signals in the mail-based survey. It seems that rural and urban landholders are not convinced that price is the principal driver of the trend towards the purchase of quarter acre blocks in the region. Indeed, rural and urban landholders were more likely than planning practitioners to believe that price was a weaker driver of this trend (58% rural and urban landholders versus 33% planning practitioners agreed). This result suggests that the 'suburban dream' of living on larger blocks of land is still alive in the Lower Hunter.

The majority of respondents (60%) were generally supportive of the restoration of brownfield (for example, old coal mining sites) for residential development ahead of the expansion of greenfield (previously undeveloped) area (versus 19% opposed). Restoration of brownfield areas may be a socially acceptable and practical means of providing for the rural lifestyle preferences of a substantial proportion of the Hunter population while minimising the impact of rural subdivision for urban development on biodiversity.

Social Values and Development Preferences for the Lower Hunter

Spatial pattern and overlap analyses

We generated a series of density surfaces (maps) to show the distribution and intensity of social values and development preferences assigned by all respondents across the Lower Hunter Region. A variety of patterns were identified, but those likely to be of greatest interest to the Department of Sustainability, Environment, Water, Population and Communities relate to the spatial arrangement of respondents' values for biodiversity and natural significance, and their development preferences near areas of national environmental significance (Matters of National Environmental Significance - MNES) identified under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth).

Respondents identified existing national parks, state forests and conservation reserves across the region as areas with high conservation value, particularly Tomoree National Park, Watagans National Park, Yengo National Park and Heaton and Awaba State Forests (Figure i). When asked to identify areas that should be conserved outside of national parks and conservation reserves, respondents

[1] The ***p* value** is a statistical term that indicates how significant a result may be. Scientists use the *p* value to understand how likely the result is to be real and not just by statistical chance. There is a possibility that the results obtained by statistical methods might have happened purely by statistical chance. *P* is an estimate of the probability that the results have occurred by statistical chance. The smaller the value for *p* (for example, $p < 0.01$), the less chance a result is by chance, rather it is a reliable result. The threshold for *p* value significance is different for different survey design. In this report, the smaller the *p* value, the more confident we are in the result being a true indication of people's preferences.

assigned 70% of their conservation preference dots to the Lower Hunter coastal strip, particularly between Nelson Bay and Newcastle. Proportionately more social values compatible with conservation (that is, biodiversity, natural significance and intrinsic values) were found in areas containing medium and high Matters of National Environmental Significance than low areas. For example, biodiversity and natural significance values were significantly over-represented in medium (14% and 14% of all value dots) and high (16% and 15%) Matters of National Environmental Significance frequency areas compared with what may be expected by chance ($p < 0.05$), and significantly under-represented in low Matters of National Environmental Significance areas frequency areas (8% and 7%). The community values mapping method therefore provides empirical evidence that there is widespread community support for the conservation of MNES in the Lower Hunter Region.

Overall, areas identified by respondents as highly acceptable for development were typically found outside areas of medium or high Matters of National Environmental Significance areas frequency areas (Figure ii). For example, areas perceived to be inappropriate for residential and agricultural development were significantly over-represented in areas of medium (16% and 6%) and high (17% and 8%) Matters of National Environmental Significance areas frequency compared with what may be expected by chance ($p < 0.05$). These results suggest that survey respondents are broadly aware that areas of environmental significance are unsuitable for development.

Nevertheless, in some cases areas of medium-high frequency of Matters of National Environmental Significance were identified by respondents as having medium-high acceptability for development. Those cases include Sugarloaf State Conservation Area, Cooragang Island, Williamstown Airport, Toronto West and an area south of Watagans National Park.

We then generated a separate 'potential-for-conflict' index based on the differences between acceptable and inappropriate residential and industrial development points found within a 2 km grid cell, then multiplied by the number of social value points found in that grid cell. Catherine Hill Bay, Branxton-Huntlee, Thornton North, Cooranbong, Lochinvar and Anambah were all identified as high conflict potential for both residential and industrial development. North Raymond Terrace, Bellbird and Newcastle Airport Employment Zone were identified as areas of high potential conflict for residential development, whereas the Hunter Economic Development Zone (Kurri Kurri) and Togago Employment Zone were identified as areas of high potential conflict for industrial development. The consistency of the results suggests that the method is a reliable way of identifying potential for land-use conflict.

In the main, it seems that respondents' preferred areas for residential and industrial development were closely aligned with the areas identified for development in the 2006 Lower Hunter Strategy. For example, acceptable residential (23.0%) and industrial development (16%) were significantly over-represented within the proposed urban lands compared with what may be expected by chance ($p < 0.05$). Those areas tended to be in close proximity to existing transport infrastructure such as the Hunter Expressway and its junction with the Sydney to Newcastle Freeway near Minmi. On the other hand, the Catherine Hill Bay area provided an example of potential conflict between the preferences of respondents and the direction of the strategy. The strategy nominated the Catherine Hill Bay area as acceptable for urban development but respondents indicated they thought high residential and industrial development was inappropriate here and placed a high conservation preference (non-reserves) on the area.

Figure i Overlay of hotspots of Matters of National Environmental Significance and acceptable development preferences

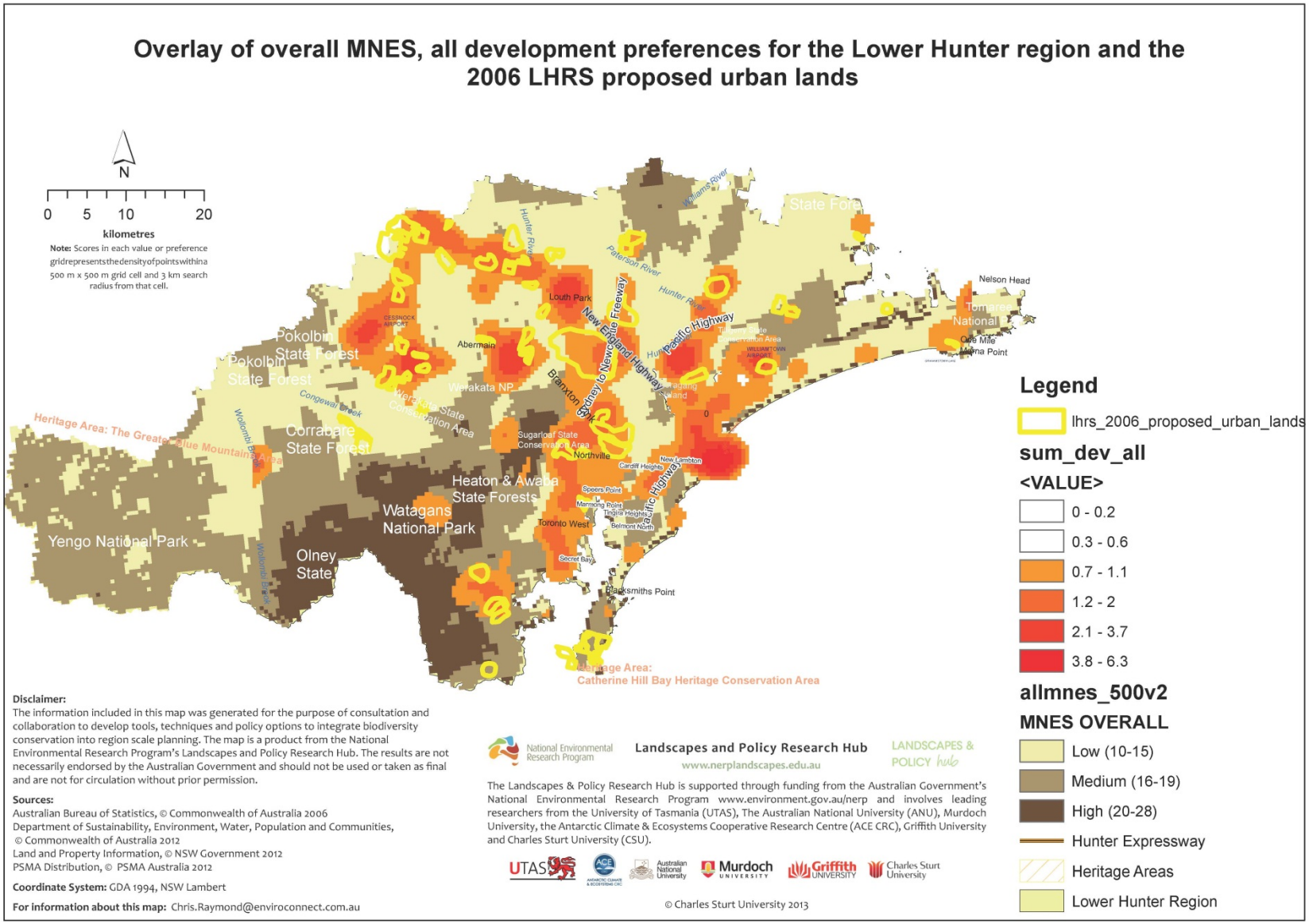
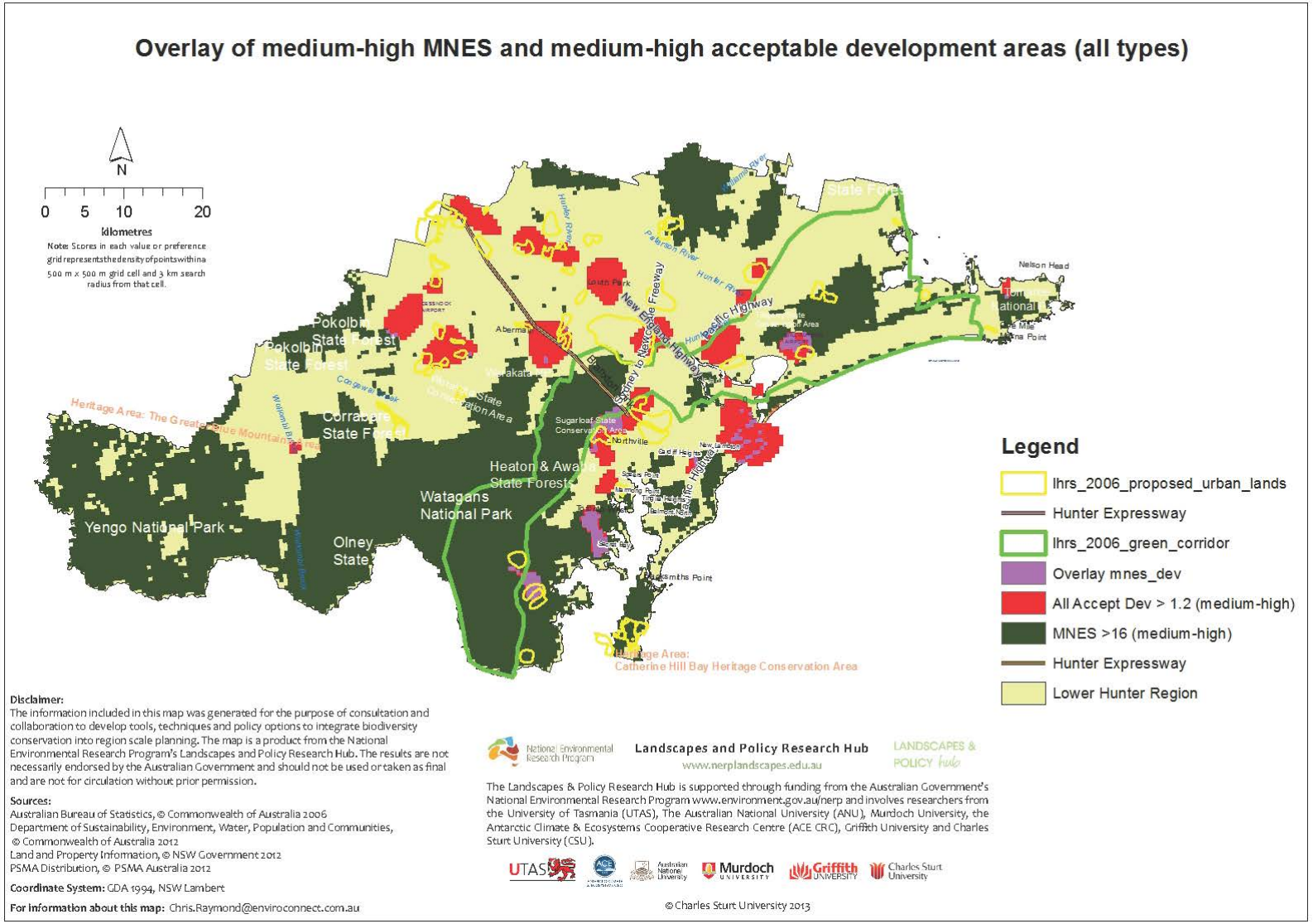


Figure ii Overlay of areas of moderate to high Matters of National Environmental Significance and moderate-high acceptable development.

(Purple areas highlight the potential for land-use conflicts.)



Effect of landholder type and local government area of residence on the assignment of values and preferences

In total, 14,357 value and preference dots were assigned to the map by respondents. Newcastle local government area (LGA) was assigned the most number of dots (3,305) and Maitland local government area was assigned the least number of dots (2,083). The proportion of total dots assigned by each community type was closely associated with their local government area of residence. For example, 35.4% of rural landholders lived in Cessnock local government area and 35.7% of their value and preference dots were assigned to this local government area. Conversely, only 0.7% of rural landholders lived in the Newcastle local government area and they only assigned 0.1% of their value and preference dots to this local government area. Similar patterns were found across the other respondent cohorts. These associations suggest the presence of a form of geographic discounting whereby environmental valuation is discounted from the home perspective across space. A greater proportion of values were assigned closer to one's place (for example, local government area) of residence, and fewer values to places further away, highlighting the need to engage a random and representative group of landholders from all local government areas in the study region.

To examine the influence of proximity on the mapping exercise we examined the mean distance at which each value and preference type was placed from respondent's place of residence. We also undertook that analysis based on landholder type. The LGA of residence generally had a stronger effect on the distance of value assignment than landholder type, with the exception of the assignment of recreation value. This finding suggests that overall respondents tend to assign social values within their own local government area of residence, with a key exception being recreation values for rural landholders. In community values mapping, it is therefore important to elicit values from residents who live across all the local government areas contained within a study region to ensure the values mapped are representative of that region.

Attitudes toward Biodiversity Offsets

We used feedback from the community appraisal to ask survey participants to rate the extent they agree or disagree with 16 statements related to biodiversity offsets. For ease of interpretation, we grouped responses into: 1) assessments of effectiveness/social acceptability; 2) type of approach preferred; 3) management of levy; 4) accountability; 5) application; and 6) longevity/duration.

Almost half of the respondents (48%) agreed that biodiversity offsets are an effective approach to maintaining or improving biodiversity in the Lower Hunter Region; however, there was a lot of uncertainty about their effectiveness (33% unsure). Two of the survey items explored respondent's views about the way that biodiversity offsets should be implemented. Overall, 49% of respondents agreed that a standardised approach to biodiversity offsets is needed in the Lower Hunter Region (versus 21% disagreed); and a majority (82%) agreed that the Australian Government should play a leadership role in the establishment of a consistent approach to biodiversity offsets in the Lower Hunter Region (versus 6% disagreed).

There were four survey items exploring respondent's views about ways to ensure the accountability of those involved in the administration of an offsets levy. Nearly all (93%) respondents agreed that a publicly available record needs to be established and updated so that governments, developers and the public can check where offsets have been established. Half (51%) of all respondents agreed that developers who do not plan to remove native vegetation should not have to pay the offset levy (versus 27% disagreed); and half (51%) of all respondents disagreed (versus 30% agreed) that developers

should be able to negotiate the amount of revegetation required as part of an offset rather than have to follow rules that apply to all cases. There were significant differences across the community types about the extent developers should be responsible for identifying and acquiring areas of similar ecological characteristics for offsets. A high proportion of rural and urban landholders (67%) agreed that developers should be responsible (mean > 3.65), whereas a high proportion of planning practitioners (47%) disagreed (mean = 2.85, $F = 10.64$, $p < 0.001$).

Two items explored the way in which the biodiversity offset levy should be managed. A majority of respondents agreed (71% agreed versus 10.4% disagreed) that a board of trustees independent of government and developer interests should be established in order to manage the levy. There was a lot of uncertainty as to whether the NSW Government could be relied on to effectively manage an offset levy in order to maintain biodiversity in the Lower Hunter Region. Overall, 52% of respondents disagreed that the NSW Government could be relied on to manage an offset levy, and 33% were unsure.

Future Delivery of the Community Values Mapping Method

We conclude that the community values mapping method presented here is useful for regional sustainability planning because the approach:

1. Systematically identified regional sustainability issues of concern to residents and other community types and is able to identify the spatial expression of values and preferences. That is vital information for planners making decisions about whether to engage and how to engage different community types, such as community consultation, conflict resolution and social acceptability assessments;
2. Provided a conceptual framework and technology for integrating the natural and social sciences to enhance regional sustainability planning. That is, spatially referenced ecological data layers can be linked to spatially referenced social data layers to enhance the capacity of planners to develop scientifically defensible and socially acceptable recommendations/decisions; and
3. Provided a way of capturing the values and preferences of a substantial sample of the public (segmented by community types) in a way that has scientific credibility. Such an approach is likely to enhance public trust in regional sustainability planning which often relies on input through public meetings/workshops and written submissions. Planning practitioners are often left with the unenviable task of subjectively sorting through and then prioritising community values and preferences.

Further:

1. The provision of an up-to-date database of the names and addresses of residents is a key to the success of the community values method. We encourage the department to consider the inclusion of a clause in a future bilateral agreement that requires the provision of cadastral databases containing the longitude and latitude coordinates and property identity number of each parcel and the names and address of each parcel/property owner (in accordance with provisions under the *Privacy Act 1988);*
2. The community values mapping method has not been applied to the consideration of Indigenous values and the values of specific interest groups such as mining interest. The Department of Sustainability, Environment, Water, Population and Communities could consider contracting researchers to expand the method to engage these wider stakeholders in regional sustainability planning in other areas of Australia;

3. Alternative approaches for eliciting community values are available to researchers, including online-mapping and workshop platforms. The department could fund projects to experiment with the use of multiple mapping platforms in order to engage a wider range of rural and urban landholders in regional sustainability planning; and
4. Current collaborations between research hubs highlight the potential for spatially integrating the community values presented here with ecological value assessments. The department could consider encouraging integrated assessments in other areas in order to understand the trade-offs associated with the integration of social values and preferences into conservation priority assessments. For example, the proportion of the landscape or species distributions which may be lost (or gained) as a result of the consideration of social values or development preferences.

Policy Recommendations and Future Directions

Conservation of Matters of National Environment Significance (MNES)

Areas of high and medium Matters of National Environment Significance (MNES) frequency in the Lower Hunter were also highly valued by survey respondents for conservation and considered highly inappropriate for residential or industrial development. These finding suggest the priorities and actions of environment/conservation agencies are likely to enjoy widespread community support in the Lower Hunter and that development proposals that threaten those values will be contested. At the same time, there are areas in the Lower Hunter where there is potential conflict between conservation and development. The Catherine Hill Bay area was one of those areas identified as acceptable for urban development by the NSW Government, as proposed under the 2006 Lower Hunter Strategy, but the majority of survey respondents identified this as an area where residential and industrial development was inappropriate. To address these potential conflicts, the Department of Sustainability, Environment, Water, Population and Communities and the NSW Department of Planning and Infrastructure should consider:

1. Identifying in relevant planning documents those areas this study suggests are areas of potential conflict if residential or industrial development is proposed for areas currently conserved;
2. Developing and publicising a policy which enables areas of identified potential conflict to be systematically considered at multiple stages of the strategic assessment process, including referral, assessment and decision phases; and
3. Further understand the nature of the land-use conflicts in the Catherine Hill Bay area to ensure areas of Matters of National Environmental Significance are appropriately conserved.

Integrated regional sustainability planning

Respondents appear to be supporting a more co-ordinated approach to regional sustainability planning in the Lower Hunter. As part of a more co-ordinated approach, the Department of Sustainability, Environment, Water, Population and Communities should:

1. Liaise with local and state government bodies to identify instances where areas in close proximity to MNES are proposed to be developed and then consider developing tools and processes to identify and evaluate the impacts, including cumulative impacts, of those potential developments on MNES;

2. Work with local and state governments to fund research to forecast demand for residential development in the Lower Hunter over the next 20 years and to explore the extent that demand can be met with a combination of increased density in existing urban areas, development of rehabilitated coal mining areas and new greenfield areas that can be developed consistent with MNES;
3. Fund research (including a literature review and specific case studies) investigating the apparent preference for larger (for example, quarter acre) suburban and peri-urban residential land amongst those living in regional Australia. That research should consider the economic and social factors at work and the opportunities to alter existing preferences through a suite of instruments, including marketing;
4. Investigate the need and utility of potential approaches for undertaking catchment-based assessments of the impacts of development proposals. This would entail understanding the socio-economic and environmental impact of development proposals on the Hunter Valley Catchment, not just the Lower Hunter Region; and
5. Further understand the social drivers of the 'suburban dream' of owning larger blocks in the Lower Hunter, and identify effective policies to manage this preference into the future.

Mining and energy

A majority of respondents across all community types expressed views suggesting they believe that coal seam gas is an unacceptable land-use in the Lower Hunter Region, which suggests that proposals to explore and mine coal seam gas in the Lower Hunter Region will generate widespread opposition. These community concerns need to be acknowledged and addressed by the mining industry and governments if those stakeholders remain committed to coal seam gas mining in the Lower Hunter Region.

Transport and other infrastructure

The Lower Hunter Region is a high residential development growth region and the need to provide an integrated transport network and other infrastructure to cope with those pressures was a concern to a majority of respondents. Given the likelihood of major infrastructure development in the region in the immediate future, including to service coal seam gas development, and of the potential for infrastructure development to negatively impact on Matters of National Environmental Significance, we recommend that the Department of Sustainability, Environment, Water, Population and Communities work with the Department of Planning and Infrastructure (NSW), Hunter Development Corporation (NSW), and Department of Roads and Maritime (NSW) to consider ways to:

1. Integrate transport planning into the 2013 revision of the Lower Hunter Regional Strategy; and
2. Provide infrastructure such as water, sewerage and power to areas proposed for new developments in a way that minimises the impact on areas Matters of National Environmental Significance.

Biodiversity offsets

Biodiversity offset policy is complex; however, our findings present some clear signals with respect to the direction of offset approaches and we recommend that:

1. The Department of Sustainability, Environment, Water, Population and Communities consider mechanisms for supporting a standardised, coordinated and transparent approach to biodiversity offsets delivery and accounting in the Lower Hunter that includes some/all of the following elements:
   a) Funds from offsets should only be available for work to improve biodiversity outcomes;
   b) Allow for offsets to occur on public land if the offset would improve biodiversity conservation;
   c) The amount of revegetation required as part of an offset be fixed rather than negotiated with developers;
   d) Land used for biodiversity offsets should not be available for future development unless all biodiversity losses are offset elsewhere;
   e) Biodiversity offsets should not be applied on land previously set aside for conservation;
   f) Provide offset revenue which should only be available for use in the region funds were sourced from and for projects that support biodiversity conservation; and
   g) Allow offsets to be listed on the land title held by the NSW Government.
2. The Department of Sustainability, Environment, Water, Population and Communities and the Office for Environment and Heritage (OEH) NSW to consider communication/engagement programs to inform rural and urban landholders of the benefits of offsets, including the ways consolidated funds are spent in the Lower Hunter; and to listen to and address where possible, widely or strongly held views that are at odds with current offset policy/management. Engagement programs should focus on issues of conflict between landholders and planning practitioners regarding biodiversity offsets. That is:
   a) Whether developers should be responsible for identifying and acquiring areas of similar ecological characteristics for offsets. Both rural and urban landholders agreed that developers should be responsible whereas the planning practitioners disagreed; and
   b) Whether biodiversity offsets on specific parcels of land should only be erased by a separate NSW Act of Parliament. There was only moderate agreement among all respondents for this view.

Community consultation should also focus on elements listed in Section 8.6.5 (part 1) of the final report. However, these elements are at odds with the strategic directions outlined in the *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy*[2]. Specific attention to be directed at whether offsets should be fixed rather than negotiated with developers (element c), the long-term security of environmental offsets (element d), the appropriate siting of offsets (element e) and the listing of offsets (element g).

[2] DSEWPaC (2012) *The Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy*, Department of Sustainability, Environment, Water, Population and Communities, Australian Government, Canberra.

1 Introduction

1.1 Report Context

This report describes and explains the results of a research project funded by the Department of Sustainability, Environment, Water, Populations and Communities (DSEWPaC). The department invited Professor Allan Curtis and Dr Christopher Raymond from Charles Sturt University to undertake research in the Lower Hunter (NSW) to develop a robust, replicable method for understanding community values for regional sustainability. This project is part of the National Environmental Research Program (NERP), and the researchers were engaged through the Landscape and Policy Research Hub from the University of Tasmania.

In consultation with departmental staff, the researchers adopted a mixed-methods research design. That approach included a community appraisal (qualitative phase) to understand the issues and opportunities facing regional planning practitioners in the Lower Hunter Region, followed by a survey (quantitative phase) to understand community values for regional sustainability and attitudes toward conservation and development planning issues facing the Lower Hunter. This report provides a short background and rationale for the research; a description of the methods, including the development and administration of the mail survey instrument; a summary of results by survey topic; and a report on findings, including interpretation of the data and the significance of findings in relation to other research.

The research approach is based on a widely accepted Public Participation Geographic Information System (PPGIS) methodology for mapping community values for natural and built landscape features (Brown 2005). The system was developed and refined through a substantial body of research, including in Kangaroo Island, SA (Brown 2006), the Otways region of Victoria (Raymond & Brown 2006; Raymond & Brown 2007), the South Australian Murray-Darling Basin region (Raymond et al. 2009) and more recently the Alpine National Park (Brown & Weber 2011). Over 15 studies internationally have now been applied using this methodology (Brown 2012).

Despite significant attention on assessment of biophysical priorities for management, comparatively few GIS tools exist for understanding and mapping community values for regional sustainability planning. However, mapping community values is useful because it provides a spatial understanding of community values to ensure that regional sustainability plans are both scientifically defensible and socially acceptable.

1.2 Research Objectives

This project has three key objectives

1. Identify and map the values assigned by multiple community types to natural and built features in the Lower Hunter Region;
2. Develop a robust methodology for eliciting community values for natural and built features which can be applied in multiple regional planning contexts; and
3. Provide information and a series of policy recommendations that can be used to inform the Lower Hunter Regional Sustainability Plan, including a reliability check of sites tagged for conservation and regional development.

1.3 Report Structure

In Section 2, we provide background of the Lower Hunter Region. We then present a short literature review that describes the different types of values and critiques the theory and empirical research for identifying and mapping values assigned by communities to places on the landscape. We conclude the literature review by introducing what we believe is a useful and sound framework for researchers to identify different types of communities. We then present an overview of the research approach, a description of the survey methods and results by survey topic, followed by a detailed report on findings with respect to key research questions. We conclude with a discussion of the implications of the methods and results for regional sustainability policy and planning.

2 Background

2.1 The Lower Hunter Region

The Lower Hunter Region (defined as the area covered by the Cessnock, Lake Macquarie, Maitland, Newcastle and Port Stephens local government areas) is located in eastern NSW and covers approximately 430,000 hectares, 60% of which is covered in native vegetation (DECCW 2009). The Lower Hunter includes the Port of Newcastle and the wide flood plain of the Hunter River (see Figure 1). The alluvial flats of the major rivers and creeks in the region are used for intensive farming such as dairying and vegetable growing, graduating to viticulture, cereal crops, beef cattle, horses and sheep production further inland (Mcdonald et al. 2008). The population of the Lower Hunter was 552,776 in 2011, an increase of 12% since 2006 (ABS 2012). The most populous LGAs were Lake Macquarie (202,347) and Newcastle (157,663). During the 10 years between 1996 and 2006, the population of the region grew at an average annual rate of 0.9%, equivalent to the average rate of growth for the state of NSW. The fastest growing LGAs were Maitland and Port Stephens, increasing at an average annual rate of 2.1% and 1.7% respectively (Mcdonald et al. 2008).

The Lower Hunter is a region of high biodiversity value. It provides a transition between northern and southern ecological communities as well as an east-west migratory pathway for inland species (DECCW 2009). The region also contains significant wetland areas including estuaries that are of significance for migratory shorebirds, and one of the largest coastal saltwater lakes in the southern hemisphere. The region supports one of the three largest river valley systems in eastern NSW and includes wetlands of international and national significance, including Ramsar-listed wetlands.

2.2 Land Use Planning Challenges

Demand for residential dwellings is a major challenge in the Lower Hunter Region considering existing land-use constraints. In 2006, the Lower Hunter had approximately 205,000 dwellings. It was estimated that an additional 115,000 dwellings will be required to house the region's growing population over the next 25 years. Of this number, 80,000 dwellings will be needed to house the additional population (160,000 people), while an extra 35,000 dwellings will be needed to meet changing housing demands (NSW Department of Planning 2006). Population growth and the demand for new housing in urban release (greenfield areas), is leading to:

1. Increasing pressure on the region's natural environment;
2. Lack of utilities infrastructure in new release areas;
3. Increasing congestion on key connecting roads;
4. Underutilised infrastructure capacity in some existing urban areas; and
5. Inadequate public transport (NSW Department of Planning 2006).

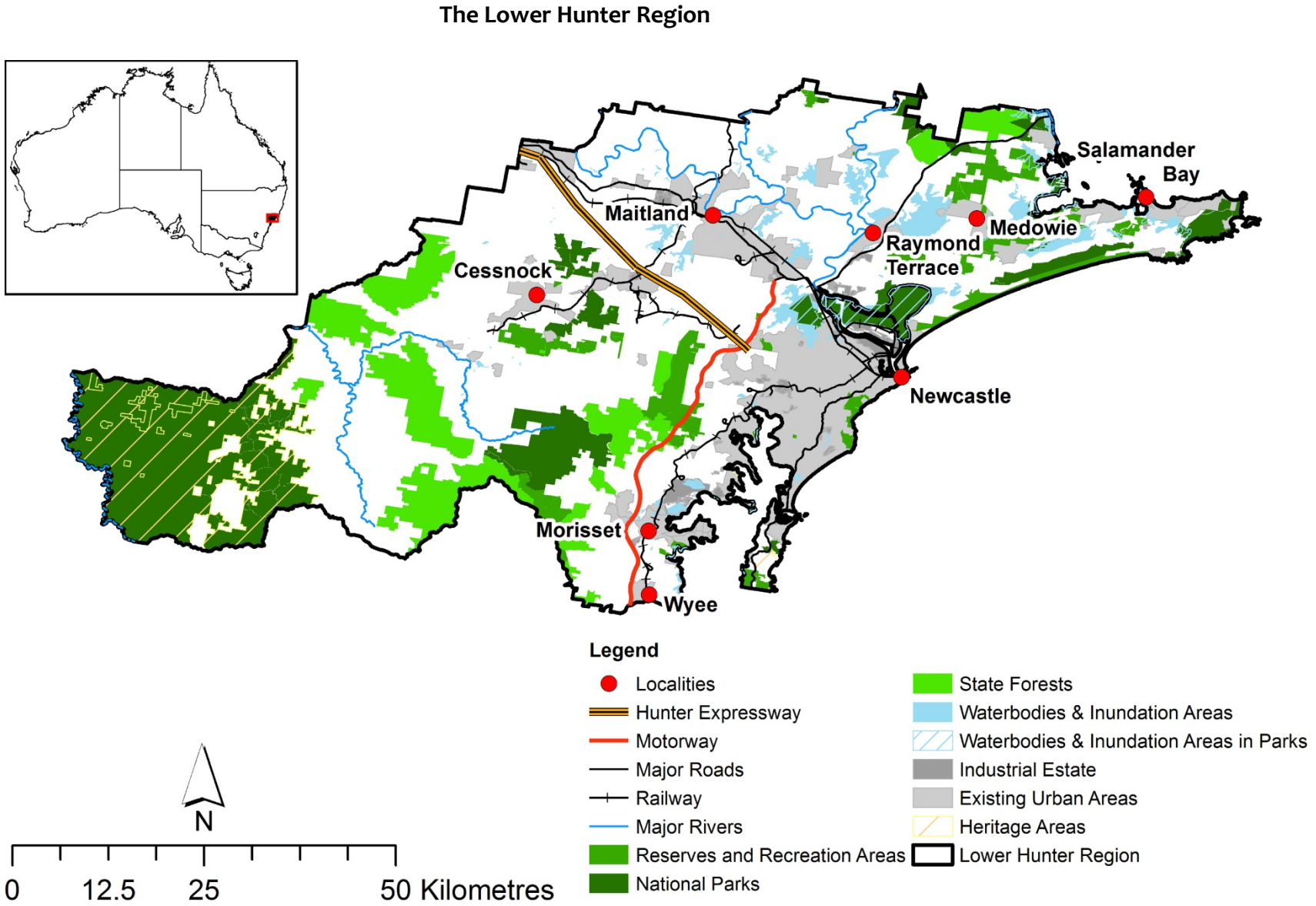


Figure 1 The Lower Hunter Region

2.3 Land Use Planning Programs or Strategies

In response to these land-use planning challenges, the Australian and NSW government have developed, or are developing, a variety of land-use planning strategies. The aims and objectives of these strategies are summarised below.

2.3.1 *Sustainable regional development program*

The Australian Government is investing $29.2 million over four years to promote sustainable development in high growth regions across Australia through the Sustainable Regional Development program (DSEWPaC 2012a). This program is one of the measures under *Sustainable Australia - Sustainable Communities: A Population Strategy for Australia.* The program will help deliver effective and responsive planning to address the challenges of population and economic growth. The program aims to protect Matters of National Environmental Significance (MNES) whilst helping to streamline the environmental approvals process (DSEWPaC 2012b).

Strategic assessments are a key component of the Sustainable Regional Development program. Strategic assessments are regional scale assessment that consider a broad set of issues related to regional sustainability. They can include a strategic assessment of regional-scale urban development plans and policies. When entering into a strategic assessment, the Australian Government seeks to maximise the conservation of MNES that occur in the area in the most pragmatic way. This includes an understanding of ways to avoid impacts, mitigate potential impacts, offsets to compensate for the impacts to MNES that can be avoided or mitigated, and ongoing adaptive management (DSEWPaC 2011).

2.3.2 *Lower Hunter Strategy (2006-31)*

To address land-use pressures, the NSW Government prepared the Lower Hunter Strategy (2006-31). This original strategy had four main objectives (NSW Department of Planning 2006):

1. Ensure that adequate land is available to accommodate projected housing;
2. Protect and manage the biodiversity and conservation values of the key green corridors of the region;
3. Protect the rural character and viable agricultural lands of the region; and
4. Protect the mineral and coal resources of the region.

Key actions of the strategy include:

1. Provide for up to 115,000 new dwellings by 2031 in line with changing housing demands, smaller households and reduced occupancy rates of the existing population, as well as meeting the housing demands for an additional 160,000 people;
2. Identify and protect new green corridors between the Watagan Ranges and the Stockton Peninsula, across the Wallarah Peninsula and along the riverine environments of the Karuah River and the foreshores of Port Stephens; and
3. Enable the release of up to 69,000 new greenfield lots in a coordinated way, with improved neighbourhood design and more efficient use of infrastructure.

2.3.3 *Lower Hunter Conservation Plan*

In 2009, the NSW Government released the Lower Hunter Conservation Plan (DECCW 2009). The plan has the following key objectives:

1. Describe the conservation values of the Lower Hunter Region;
2. Analyse the current status of biodiversity within the region and the likely impacts of development on biodiversity; and
3. Assess the biodiversity values of the region.

Key actions of the strategy include:

1. The transfer of 20,000 ha of high conservation value land to conservation corridors, including:
   a) A Green Corridor stretching from the Watagan Ranges, through Hexham Swamp to Port Stephens (14,600 ha);
   b) Port Stephens in the Karuah area (3,000 ha);
   c) Addition to Warakata National Park near Cessnock (2,200 ha);
   d) Implement mechanisms to contribute to offsetting the biodiversity impacts resulting from development in the Lower Hunter including biodiversity banking and offsets schemes, statutory planning agreements, voluntary conservation agreements and covenants; and
   e) Applying the 'improve or maintain' principle to guide the adequacy of conservation outcomes.

2.3.4 *Local Environmental Plans*

Local Environmental Plans (LEPs) guide planning decisions for local government areas. Through zoning and development controls, they allow councils and other consent authorities to manage the ways in which land is used. Each of the five local governments in the Lower Hunter Region is responsible for developing and managing a LEP in accordance with the provisions under the *Environmental Planning and Assessment Act 1979* and the directions provided by the Minister (NSW Department of Planning and Infrastructure 2013a). The directions cover the following broad categories:

1. Employment and resources;
2. Environment and heritage;
3. Housing, infrastructure and urban development;
4. Hazard and risk;
5. Regional planning; and
6. Local plan making.

2.4 Revised Planning Strategies

The Lower Hunter Regional Strategy and Lower Hunter Conservation Plan are currently being revised by regional planning authorities.

Two additional initiatives are also underway. Firstly, the Australian Government is developing a Regional Sustainability Plan for the Lower Hunter, which will bring together all levels of government and the community to share information and encourage an integrated and targeted approach to sustainability. Secondly, planning agencies and developers have recognised the need to develop a systematic approach to infrastructure prioritisation in new greenfield developments identified in the existing

Lower Hunter strategy. The Hunter Development Corporation is charged with preparing a Lower Hunter Infrastructure Plan. This plan will use a stop light (red, amber, green) assessment framework to identify priorities for infrastructure development. Priorities will principally be based on a spatial overlay of economic and biophysical assessments. No attempts will be made to engage Lower Hunter residents in the selection of preferred infrastructure or development areas. To ensure a coordinated approach to regional sustainability planning, all plans are being developed in unison.

In this context, there is an opportunity to gather spatially-referenced community values that can be integrated with expert knowledge and better inform regional planning. These values can be used to provide a reliability check of sites tagged for both conservation, under the revised Lower Hunter Conservation Plan (in preparation), residential and industrial development under the revised Lower Hunter Regional Strategy (in preparation) and for infrastructure planning, under the new Lower Hunter Infrastructure Plan(in preparation).

The next section of this report reviews the different types of values, the linkage between values and development preferences, different approaches for mapping values and development preferences, as well different ways of categorising 'community'.

3 Literature Review

3.1 Different Types of Values

Significant research attention has been paid to the structure and content of values over the past century. In this section, we briefly describe the way in which values have been structured and measured in the social psychology and geography literatures, broadly referred to as human values. We do not consider the role of economic values and associated valuation metrics.

Two broad types of human values exist, namely held and assigned values. Held values are the most basic or underlying of human values which reflect ideas or principles that people hold as important to them (Rescher 1969; Najder 1975; Brown 1984; Lockwood 1999). Social psychologists have largely employed Rokeach's (1973) concept of human value, which is an expression of held value. He defines value as 'enduring belief that a specific mode of conduct or end-state of existence is personally or socially preferable to an opposite or converse mode of conduct or end-state of existence.' (p. 5). Schwartz and Bilsky (1987) extended Rokeach's definition of value to encompass much of the previous work on values typologies and instruments (for example, Feather & Peay 1975; Hofstede 1980; Braithwaite & Law 1985; Crosby et al. 1990). They state: 'According to the literature, values are a) concepts or beliefs, b) about desirable end states or behaviours, c) that transcend specific situations, d) guide selection or evaluation of behaviour and events, and e) are ordered by relative importance' (p. 551).

In contrast, assigned values are those values that people attach to things such as goods, activities, services and places (Brown 1984; Lockwood 1999). They reflect a person's perception of the thing under valuation, their held values and associated preferences, and the context of the valuation (Brown 1984). Assigned values have been categorised in a variety of ways. In the Human Geography literature, they have been operationalised as 'landscape values' (Brown 2005; Raymond & Brown 2006), place-based values (McIntyre et al. 2008) and social values (Bryan et al. 2011). The concept of assigned value has been well developed in the 'sense of place' literature. In his seminal writings, Tuan (1976) suggests that the human mind organises phenomena into both segments and opposite pairs, such as land and water, mountain and valley. The spatial characteristics of these contrasts excite emotions which in-turn leads

to the ascription of values to places (p. 29). The term 'topophilia' has been used to include all of the human being's affective ties to the natural environment. Responses may be aesthetic (the pleasure associated with a view), tactile (a delight in the feel of air and water) and connections associated with home (p. 93).

However, other researchers contend that these assigned values are not just sensory in nature. Norton and Hannon (1997) provide a place-based theory of environmental valuation which suggests that 'some form of territoriality is universal to all human cultures, particularly those aspects of culture that relate people and communities to their ecological, social and cultural context' (p. 229). Two people who live in the same place may value that place very differently. The culturally determined values are shaped by the connections that develop between people and place. Assigned values from this perspective are socially constructed from a given perspective in space and time.

The previous definitions encapsulate the affective and social dimensions to assigned value, but they omit the activity dimension. Zube (1987) provides a more comprehensive view – he discusses three concepts of human-landscape relationships: 'the human as an agent of biological and physical impacts on the landscape; the human as a static receiver and processor of information from the landscape; and the human as an active participant in the landscape – thinking, feeling and acting' (p. 37). Landscape perceptions and values are tied to patterns of land use activities and are influenced by needs and desires, social and cultural contexts. For example, an individual could value a place at the beach for aesthetics (a sensory connection), for the recreational activities pursued there (activity-based value), or the values associated with reshaping the landscape to meet needs (an economic value).

In contrast to assigned values, preferences are judgements that are open to critical evaluation. These judgements are usually underpinned by a combination of held and assigned values. Numerous studies have demonstrated preference for environments with natural elements over those that are predominantly built. However, three decades of research concerning human response to different types of largely natural landscapes (Kaplan & Kaplan 1989) raises the possibility that the most natural environments may not be the most preferred. Those that are relatively open and smooth are generally more preferable (Kaplan et al. 1989). The theoretical underpinning of development preferences is less clear. Previous studies have shown moderate to strong spatial associations between development preferences and intended uses for given areas of land, with some important outliers (Brown 2006; Brown & Weber in press).

To be consistent with contemporary Public participation geographic information systems (PPGIS) literature, hereafter we refer to values which individuals assign to places on the landscape as 'social values' and the preferences which individuals assign to place-based development activities on the landscape as 'development preferences.' We refer to social values and development preferences collectively as 'community values.

3.2 The Mapping of Social Values and Development Preferences

Public participation GIS techniques are techniques that engage multiple stakeholders through a GIS platform, and have been used to identify a variety of spatial attributes. Table 1 presents a partial list of spatial attributes identified using PPGIS including landscape value, development preferences, national park experiences and perceived environmental impacts, climate change risks, highway qualities, urban park and open space values, knowledge of landscape conditions, recreation resources and ecosystem services. This study focuses on social values and development preferences. In the section below, we describe how these values and preferences have been categorised.

Table 1 Examples of PPGIS studies which have mapped a variety of spatial attributes for conservation or development planning

Spatial Attribute	Examples of PPGIS Studies
Landscape values/social values	(Brown et al. 2004; Brown 2005; Brown & Raymond 2007; Tyrvainen et al. 2007; Alessa et al. 2008; Beverly et al. 2008; Clement & Cheng 2011; Nielsen-Pincus 2011; Sherrouse et al. 2011).
Development preferences	(Brown 2006; Raymond & Brown 2007; Nielsen-Pincus 2011; Brown & Weber in press)
National park experiences and perceived environmental impacts	(Brown & Weber 2011)
Climate change risks	(Raymond & Brown 2011)
Highway qualities	(Brown 2003)
Urban parks and open space values	(Brown 2008)
Recreation resources	(McIntyre et al. 2008)
Ecosystem services	(Raymond et al. 2009; Bryan et al. 2011; Brown et al. 2012)

3.2.1 The Categorisation of Social Values and Development Preferences

To better integrate community values into land use planning processes, Brown (2005) developed a quantitative and systematic approach to soliciting expressed social values and development preferences in survey research. The values typology was validated in a US national forest planning application (Brown & Reed 2000) with the majority of survey participants having little difficulty understanding and responding to the typology of values. Table 2 shows how this typology has been modified to include additional values as well as development preferences over time.

Table 2 The evolution of the categorisation of social values and development preferences

Original Values Typology (Reed & Brown 2000)	**Expanded Values Typology to Include Values for Ecosystem Services** (Brown et al. 2012)	**Addition of Development Preferences** (Brown 2006; Raymond & Brown 2007; Brown & Weber in press)
Aesthetic value—I value these places for the attractive scenery, sights, smells, or sounds.	**Water**—I value these places because they provide fresh water for households, for irrigating farmland, or for industry.	**No development**—Use these dots to identify areas where any future development should be permanently prohibited.
Economic value—I value these places for the economic benefits such as agriculture, tourism or commercial activity.	**Food**—I value these places because they provide plants or animals to eat, including meat, fish, fruits or vegetables, or mushrooms.	**Tourism development**—Use these dots to identify areas where tourism development could conditionally occur with a good plan.
Recreation value—I value these places because they provide outdoor recreation activities opportunities.	**Natural materials**—I value these places because they provide, or could provide for, coal, wood products, animal feed, firewood, or other useful natural materials.	**Residential development** —Use these dots to identify areas where residential development could conditionally occur with a good plan.
Life Sustaining value—I value these places because they help produce, preserve and renew air, soil and water.	**Science/education**—I value these places because they provide opportunities to understand and learn about the natural world.	**Wind energy development** —this area is acceptable for the installation of commercial wind turbines.
Learning value (knowledge)—I value these places because we can use them to learn about the environment.		**Natural resource development**—this area is acceptable for natural resource development such as gravel extraction, grazing or forestry.
Biological diversity value—I value these places because they provide for a variety of wildlife, marine life or other living organisms.		**Energy development**—this area is acceptable for energy development such as hydroelectric dams or wind turbines.
Spiritual value—I value these places because they are spiritually special to me.		
Intrinsic value—These places are valuable for their own sake, no matter what I or others think about them or whether they are actually used.		
Heritage value—I value these places because they have natural and human history.		
Future value—I value these places because they allow future generations to know and experience them as they are now.		
Therapeutic value—I value these places because they make people feel better, physically, and/or mentally.		
Wilderness value—I value these places because they are wild.		

3.3 Different Types of Communities

The concept of community can be problematic. The heterogeneity of a 'community' can result in planners engaging privileged groups and in the long-term, undermining the integrity and social acceptability of plans. This research will draw on the framework developed by Harrington et al. (2008) to identify key community types. According to that framework, these types may include: 1) communities of place (for example, residents in the countryside, towns, cities); 2) communities of interest (for example, conservation groups, land developers; 3) communities of practice (for example, regional planning staff, engineers, ecologists), and; 4) communities of identity (for example, Indigenous groups).

After consultation with Department of Sustainability, Environment, Water, Population and Communities staff, mail survey samples included examples of two of the four community types, excluding communities of interest and identity. Communities of place in this research include rural landholders (individuals who own more than 10 ha of land), urban landholders (individuals who own or rent less than 10 ha of land and live within an urban or regional centre). Communities of practice are represented by planning practitioners involved in sustainability planning in the Lower Hunter Region (including a range of state agency officers, land developers and various people who they engage on development projects).

4 Methods

4.1 Introduction

One of the key objectives of this research is to identify a relatively straightforward, robust and replicable approach to identify and map community values. We therefore explain our approach in sufficient depth for others to be able to replicate our approach. We adopted a mixed-methods research design comprising of a qualitative community appraisal followed by a mail-based survey (Figure 2).

The aims of the community appraisal were to:

1. Engage regional stakeholders in the project (explain the rationale and methods) to build regional support for the project and understanding of expected outcomes; and
2. Inform survey development by gathering information related to the land-use history of the region; key social and ecological components of the Lower Hunter; and regional sustainability planning issues and opportunities in the region.

In Section 4.2, we report on the community appraisal methods and key findings. Community appraisal findings informed the selection of topics and development of items included in the mail-based survey.

The aims of the mail-based survey were to gather spatially-referenced information about values and preferences to enable us to quantify or map:

1. The relative importance of regional sustainability issues facing the Lower Hunter Region;
2. The level of knowledge about existing planning protocols in the Lower Hunter Region;
3. The strength of beliefs concerning regional sustainability planning;
4. The distribution and intensity of community values (social values and development preferences) for specific places in the Lower Hunter Region; and
5. Attitudes toward biodiversity offset policies in the Lower Hunter Region.

Social values and development preferences can be mapped online, in workshop environments and via mail-based surveys. We selected a mail survey because this approach would allow us to gather information from a large sample of Lower Hunter residents at a reasonable cost.

We have achieved high survey response rates (typically around 50%) using mail-based surveys administered through a modified Tailored Design Method (Dillman 2007) (for example, Curtis et al. 2008; Raymond et al. 2010). Survey administration involves three mailings: (1) introductory letter informing of the purpose of the research; (2) complete survey packet; and (3) a second complete survey packet to non-respondents from the first round. Accompanying steps 2 and 3, reminder postcards were sent to mail package recipients to encourage a response.

The survey for this research underwent three levels of review: 1) practitioner review whereby Department of Sustainability, Environment, Water, Population and Communities staff and five regional planning practitioners reviewed the survey; 2) landholder review whereby five urban or rural landholders provided feedback through a facilitated workshop in the Lower Hunter, and; 3) expert review whereby five social scientists from Charles Sturt University with experience in mail-based survey development and administration provided expert review of the instrument.

Research Methodology

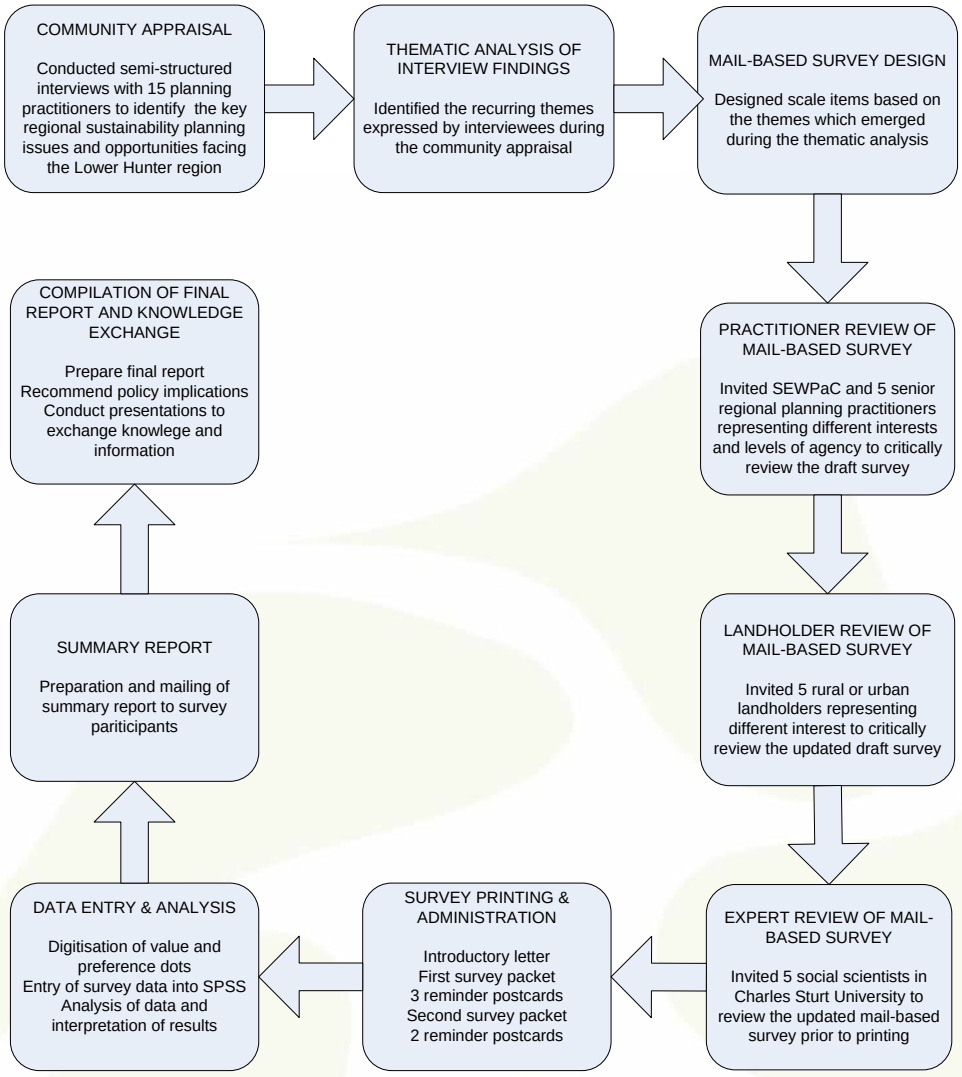


Figure 2 Overview of the methodology underpinning this research

4.2 Community Appraisal Methods and Key Findings

4.2.1 *Sample*

The Department of Sustainability, Environment, Water, Population and Communities assisted in identifying 10 key informants in the Lower Hunter Region who have a major interest in or influence on regional sustainability issues, for Dr Raymond to interview during the community appraisal. These were:

1. Senior state agency land use planning representative;
2. Senior state agency NRM/conservation planning representative;
3. Senior Local Government Association representative;
4. Conservation NGO representative;
5. Lower Hunter agriculture representative;
6. Lower Hunter tourism representative;
7. Lower Hunter regional planning specialist;
8. Lower Hunter coal seam gas exploration representative;
9. Lower Hunter transport (including rail) planning representative; and
10. Lower Hunter economic development/commerce representative (for example, regional development board representative).

As part of the appraisal, Dr Raymond spent 10 days travelling across the region and interviewing these key informants. With their input, he identified an additional five key informants whom he thought would offer different perspectives on regional sustainability planning. Table 3 presents the representation and interests of these key informants. For ethical reasons, we are unable to name individuals.

Table 3 The representation and interest of key informants who participated in the semi-structured interviews (N = 15)

Representation	Interest	n
Australian Government	Regional development	1
NSW Government	Conservation planning	1
NSW Government	Land-use planning	1
NSW Government	Infrastructure planning	1
NSW Government	Transport planning	1
Local government	Tourism planning	1
Local government	Land-use planning	2
Local government	Conservation planning	2
Non-government organisations	Agriculture	1
Non-government organisations	Catchment management	1
Non-government organisations	Conservation planning	1
Private enterprise	Land-use planning	1
Research institutions	Catchment management	1

4.2.2 *Interview technique*

Each interview occurred at the practitioner's office and lasted approximately one hour. For consistency, the interviewer followed a script (Appendix A) containing questions designed to elicit information about:

1. The nature of their work;
2. Issues facing conservation and development planning in the Lower Hunter Region; and
3. Opportunities for addressing these issues as part of future planning frameworks.

Each interview was recorded and transcribed verbatim. Interview transcriptions were then imported into NVivo8 qualitative text analysis software. NVivo8 was used to identify, analyse, and report patterns (themes) within the interview data in accordance with thematic analysis procedures (Braun & Clarke 2006), a widely applied qualitative analytic method within psychology. The goal of thematic analysis is to search for themes that emerge as being important to the description of the phenomenon, rather than to represent all possible variations of that concept or to quantify relationships between themes. Working directly from the raw information rather than a theory enhances appreciation of the easily evident and difficult to discern aspects of the information.

4.3 Survey Methods

4.3.1 *Stratifying the sample into multiple community types*

We used a stratified random sampling technique to identify potential respondents as being part of a 'community of place'. Using lists of property owners provided under licence by the NSW Government, we generated a randomised list of approximately 500 rural landholders who owned more than 10 ha of land in the Lower Hunter Region and a list of approximately 500 urban landholders who live in urban or regional centres and own less than 10 ha of land. We engaged a sub-consultant specialising in marketing research to identify a list of 75 renters in the Lower Hunter Region.

The community of practice sample was generated using a snowball sampling technique. During the community appraisal, Dr Raymond asked each interviewee to identify up to 10 planning practitioners who may be interested in completing the survey. Approximately 75 contact details were provided and became the mailing list for the community of practice.

We collated a sample of 1,150 individuals using these sampling techniques. Based on previous experience, rural property owner lists have a 5% inaccuracy in mailing addresses (for example, invalid addresses). To account for this inaccuracy, we randomly selected an additional 25 rural landholders and 25 urban landholders to be involved in the survey. This oversampling resulted in a total initial sampling frame of 1,230 survey participants, divided into approximately 1,155 individuals representing communities of place and 75 individuals representing communities of practice.

4.3.2 *Survey content*

The Lower Hunter survey consisted of seven parts (refer to Appendix B):

1. Views on regional sustainability issues;
2. Knowledge of regional sustainability issues;
3. Beliefs about the future of the Lower Hunter Region;
4. Values and preferences for the Lower Hunter Region;
5. Attitudes toward biodiversity offsets;
6. Socio-demographics (their background); and
7. Other threats or opportunities facing regional sustainability planning in the Lower Hunter (other comments).

Part 1 asked survey participants to rate the extent that particular issues were a threat to their quality of life. Respondents were asked to select one of five response options on a 5-point Likert Scale, ranging from '1 = Strongly Disagree' through to '5 = Strongly Agree'. These issues embraced the threats identified during the semi-structured interviews, such as the high rate of population growth of some regional centres.

Part 2 asked survey participants about their knowledge of regional sustainability issues such as the development approval process used to assess the merits of residential development in the Lower Hunter Region. Again, respondents were asked to select one of five response options, ranging from a '1 = No Knowledge' through to '5 = Very Sound Knowledge'.

Part 3 asked survey participants to rate a series of belief statements using a 5-point scale where '1 = Strongly Disagree' through to '5 = Strongly Agree'. These beliefs included 'the process used to develop land use plans in the Lower Hunter Region is fair and equitable' (see Appendix B for further details).

In Part 4 of the Lower Hunter survey, we directed participants to a 1:125,000 colour map of the Lower Hunter Region and accompanying map legend (Table 4 and Table 5). The map legend contained 11 rows of sticker dots for each of 11 social values, ranging from aesthetic value to intrinsic value. An operational definition for each value appeared adjacent to the respective row of sticker dots. Each social value was assigned six dots weighted from 5 to 50, with the larger numbers reflecting more of the landscape attribute (for example, more scenic or more recreation value). Participants were requested to place their sticker dots on the map locations that held the 11 social values (Table 4). They could place as many or as few dots on the map as they liked. The values were based on previous empirical work (Table 1), with the exception of natural significance and cultural significance. We added these values to be able to compare the Matters of National Environmental Significance generated by Department of Sustainability, Environment, Water, Population and Communities with areas of perceived significance. On return, the social value and development preference locations marked on the survey were digitised using GIS software. The hotspot maps presented in this report reflect the total number of points assigned to a 2 km grid cell (for a given value or preference type) rather than the weightings assigned to each dot.

The map legend also included six types of development preferences. Two development preferences (that is, residential and tourism development) were included in previous research. We elected to add industrial, transport and agricultural uses because these development themes emerged consistently during the community appraisal. A number of interviewees also supported or advocated for increased formal protection of biodiversity in the Lower Hunter, whereas other participants did not want any further formal protection. In response, we included a development preference related to areas that should and should not be reserved for conservation. Following on from recent research, we elected to ask survey participants to identify and map areas of acceptable and inappropriate development using positive and negative dots, respectively (see Brown & Weber 2012). For each preference, survey participants could place up to three acceptable development and three inappropriate development dots on the map. The numbers on each dot were included for digitising purposes only and, unlike the values, do not representing weightings. Respondents were instructed to place as many or few dots on the map as they desire.

Table 4 The social values included in the map legend

Aesthetic – I value these places because they have attractive or pleasing landscapes.
Recreation – I value these places because they provide recreation opportunities.
Biodiversity – I value these places because they provide for a variety of plants, wildlife, marine life, or other living organisms.
Natural significance - I value these places because of the significance of the native animals, native plants, ecosystems or geological features found there.
Cultural significance – I value these places because they provide opportunities to express and appreciate culture or cultural practices such as art, music, history and Indigenous tradition.
Food – I value these places because they provide plants or animals to eat, including meat, fish, fruits or vegetables, or mushrooms.
Water – I value these places because they provide fresh water for households, for irrigating farmland, or for industry.
Natural materials – I value these places because they provide, or could provide for, coal, wood products, animal feed, firewood, or other useful natural materials.
Science/education – I value these places because they provide opportunities to understand and learn about the natural world.
Health/therapeutic – I value these places because they make me feel better, physically and/or mentally.
Intrinsic – I value these places for their own sake, regardless of human needs and/or wants.

Table 5 The development preferences included in the map legend

Residential Development – Use **rd +** dots to identify areas where residential development could occur with a good plan and **rd-** dots to identify areas where residential development should not occur.
Industrial Development – Use **id+** dots to identify areas where industrial development (for example, shopping centres, electricity and water services) could occur with a good plan and **id-** dots to identify areas where industrial development should not occur.
Transport Development – Use **ti +** dots to identify areas where transport infrastructure nodes (for example, railway stations and bus interchanges) could occur with a good plan and **ti –** dots to identify areas where these nodes should not occur.
Agricultural Development – Use **ad +** dots to identify areas where agricultural development (for example, vineyards) could occur with a good plan and **ad -** dots to identify areas where agricultural development should not occur.
Tourism Development – Use **td+** dots to identify where tourism development could occur with a good plan and **td-** dots to identify areas where tourism development should not occur.
Conservation – Use **c+** dots to identify areas (excluding national parks and conservation reserves) where conservation or restoration could occur with a good plan and **c-** dots to identify areas where conservation or restoration should not occur.

Part 5 of the survey asked landholders to express their attitudes toward two main approaches to biodiversity offsets.

Approach 1 This is where developers are required to identify and acquire 'like areas' (areas of similar ecological characteristics) to offset their impact on biodiversity.

Approach 2 Each developer pays a standard levy (cost per hectare) for the right to develop an area of land, irrespective of whether the area contains native vegetation. The levy is then paid into a trust account administered by an external body. This body is then responsible for identifying and acquiring 'like areas' for the biodiversity offset.

Attitudes were presented as statements and respondents were asked to choose one of five responses using a Likert Scale, where '1 = Strongly Disagree' and '5 = Strongly Agree'.

Part 6 asked participants about their socio-demographics and basic property characteristics such as the size of their property and whether they rent or own the property.

Part 7 invited participants to list any other potential threats and opportunities facing regional sustainability in the Lower Hunter Region over the next 5-10 years.

4.3.3 Survey administration

We initially selected 1,200 individual households to receive a mail questionnaire and then commenced the process for the three rounds of mailing from October to early December 2012. As explained above, our approach is based on a Dillman's (2007) Tailored Design Method. Survey administration could involve a total of nine separate mailings:

1. An introductory letter informing of the purpose of the research;
2. Complete survey packet;
3. Three reminder postcards to non-respondents from the first complete survey packet;
4. A second complete survey packet to non-respondents from the first round; and
5. Two reminder postcards to non-respondents from the second complete survey packet.

To encourage response, we provided a small gift of two postage stamps which was included in the first complete survey packet. We also provided a 1800-number, which enables participants to phone the research team and ask any questions they have about the survey. Based on previous applications of the Dillman (2007) method, we have achieved survey response rates of greater than 50% and up to 65%. Mail-based surveys involving a value mapping component have achieved a survey response of between 40% and 50%.

4.3.4 Refinement of the sample database and follow-up telephone interviews

After mailing the survey cover letter, we had to randomly sample an additional 150 rural landholders and 100 urban landholders as a result of an unexpected high number (n = 250) of inaccurate mailing addresses, colloquially referred to as 'return to senders'. Survey packets were administered to this additional sub-group one week after the main round.

We were unable to obtain property owner first and last names from the NSW Government, which we think contributed to a low survey response (10%) after the first round of mailing. To address this issue, we decided to engage a telephone marketing consultant to call all property owners in our sample frame with publicly available telephone numbers who had not completed the survey in order to:

1. Highlight the importance of the mail-based survey;
2. Ask whether they were interested in participating (yes/no);
3. If no, their reasons for not participating;
4. If yes, their first and last name to enable sending of a second survey packet (if they had 'mislaid' the first packet); and
5. Collation of basic socio-demographics (age, gender, education) to enable comparison of non-respondents with respondents.

A total of 458 out of the 900 addresses of property owners who had not responded to the first survey packet were able to be matched to a publicly available (White Pages) record of phone numbers. Of those, approximately 290 were contactable by telephone (that is, phone did not ring out or go to message bank) after a first pass (one telephone call). Sixty-five people hung up on the operator, which was inferred to be a refusal to participate, resulting in 225 effective responses. When examining this effective response, 20 participants noted they had already completed and returned the survey, 165 noted they were willing to participate, 32 refused and 8 did not respond to the question. However, only 50% of those people who expressed a willingness to respond actually responded to the survey. The main benefits of the telephone survey relate to the ability to identify refusals and to examine the representativeness of the sample through a comparison of non-respondent and respondent demographics.

A total of 226 phone surveys were conducted in November 2012. A high proportion of phone interviewees mentioned that they had not received the survey (40.0%); suggesting that they had misplaced it or another member of the household received it. The remainder of interviewees mentioned that they had received the survey (55.3%) or were unsure as to whether they had received it (4.4%). Of those respondents who had received the survey, 78.4% or 98 participants mentioned they had not completed it yet, referred to as non-respondents in the following section.

To ensure our response rate improved after the first mailing, we also increased the incentive to participate from a set of complimentary postage stamps to a $10.00 shopping voucher for every completed response. While it is difficult to measure the effectiveness of this increased incentive, the following section highlights that the overall survey response rate increased from 10% to 40% following the administration of the second survey packet, suggesting that the combined telephone follow-up and increased incentive were worth the time, money and effort.

4.3.5 Survey response

When examining the final response to the mail-based survey, there were 165 excuses or return to senders (not including the initial lot of 'return to senders' received after the first mailing of introductory letters) and 64 surveys sent back uncompleted, resulting in an effective sample frame of 1,001 participants. When examining response rates by community type, 35.0% of rural landholders, 37.1% of urban landholders and 70.3% of planning practitioners completed the survey (Table 6). Rural landholders comprise 40.4% of completed returns, compared with urban landholders (46.3%) and planning practitioners (13.3%).

Table 6 Survey response rates by community type

Respondent Type	N	% of Respondents	% of Initial Sample
Rural landholders	159	40.4	35.0
Urban Landholders	182	46.3	37.1
Planning Practitioners	52	13.3	70.3
Total	393	100	100
Overall response rate	393/1,001 or 39.3%		

The possibility that respondents and non-respondents are different is a potential source of bias. If respondents and non-respondents are different on key personal attributes then it is likely they would have responded differently to survey topics exploring research questions. Our experience is that where surveys response rates are greater than 60%, there is less likelihood of response rate bias. We attempted to test for non-respondent bias by comparing respondents and non-respondents on a limited number of variables by phoning a sample of non-respondents; and by comparing respondents with information obtained by the Australian Population and Household Census. The latter approach is somewhat problematic for our research in that our focus was on urban and rural residents who were adults rather than the wider population in the Lower Hunter Region. Nevertheless, it is possible to compare some census data for the adult population in the Lower Hunter with similar statistics for the survey respondents on topics such as median/mean age and percentage with tertiary education. We are also able to compare mail-based survey respondents to non-respondents identified during the follow-up telephone survey (n = 98).

Analysis of regional census data (ABS 2012) suggests only small differences between our respondents and non-respondents, with the exception of education level, our respondents (28.7% 65 years plus) are slightly older than those from the wider region (21.4% 65 years plus) and are more likely to have tertiary qualifications (44.7% respondents versus 14.4% region). When excluding planning practitioners, the education results are still well above the region (38.0% of rural and urban landholder respondents with tertiary qualifications). Results from the telephone survey analyses revealed that respondents to the survey had a similar age to non-respondents when excluding planning practitioners (mean age 57 years versus 60 years) and had lived in the region for a similar period (mean length of residence 37 years versus 41 years); however, respondents had achieved a higher level of education than non-respondents (38.0% reported attaining a tertiary education versus 28.5% non-respondents).

Overall comparison of survey respondents to both survey non-respondents and ABS Census data reveals that our data is representative of gender in the Lower Hunter Region, but there is a slight bias towards older and more formally educated respondents. A higher response rate would give us more confidence about extrapolating from our sample to the wider populations of urban and rural landholders in the Lower Hunter. Our experience suggests that a higher response rate is possible if the research team has access to an up-to-date mailing list of property owners.

4.3.6 Analyses

We have divided the analyses in this report into two sections. Section 5 provides a general summary of results by survey topic. Section 6 provides more complex analyses and interpretation of findings around three research objectives:

1. To compare and contrast the social values and development preferences assigned by rural and urban landholders to the Lower Hunter Region;
2. To examine the level of spatial overlap between social values, development preferences and matters assessed by Department of Sustainability, Environment, Water, Population and Communities to be of high national environmental significance (MNES); and
3. To compare and contrast the intensity and types of values and development preferences found inside and outside of priority urban development areas, as proposed by the NSW Government in the 2006 Lower Hunter Sustainability Plan.

We present a brief overview of the analytical techniques within the respective sections.

5 Community Appraisal Results

The three most frequently reported threats and opportunities facing regional sustainability in the Lower Hunter Region are listed in Table 7. Please refer to Appendix C for other issues and opportunities. The most frequently identified issues related to existing land use constraints versus demand for residential development, biodiversity offset policy and governance issues. The most frequently identified opportunities related to innovative approaches to biodiversity offsets, provisions for securing existing biodiversity and opportunities for coordination across government sectors.

Table 7 The three most frequently reported threats and opportunities facing regional sustainability planning in the Lower Hunter, as identified by interviewees

Theme	*Description*
Threats	
Land use constraints versus demand	• The Lower Hunter is highly constrained from a land use perspective. Areas available for residential development are limited as a result of mine subsidence, potential for flood inundation, high biodiversity areas, coal mining areas, vineyards, national parks and forestry reserves; • Despite these constraints, there is still demand for rural allotments (that is, three quarter acre blocks).
Biodiversity offsets	• Lack of a standardised approach to offsetting; • Poor accounting of past offsets – evidence of 'double counting'; • Polarised views about the merits of establishing a trust account for government administration of biodiversity offset funds; • Developer concern about the time and financial costs associated with negotiating offsets using 'like' for 'like' principles; • Offsets do not slow development down, but rather legitimises biodiversity loss; • Concerns about the implementation of a trust fund by state agencies because we have not seen transparency and accountability in terms of biobanking and offsets; • Record keeping for offsetting is very poor; • Planning department does not record offsets spatially.
Governance	• Lack of a coordinated approached to regional sustainability planning. The original Lower Hunter Regional Strategy was a land allocation plan and did not adequately consider conservation and infrastructure issues and opportunities (for example, the Lower Hunter Conservation Plan was developed after the Lower Hunter Regional Strategy was endorsed); • Integration of agencies is a huge issue (for example, catchment action plans had a 15-year life plan. They were signed off by cabinet as whole of government plan, but implementation was never a whole of government approach).
Opportunities	
Biodiversity offsets	• There should be a consistent approach to biobanking and offsetting across Australia; • Needs to be good linkages between planning and environmental legislation to enable effective delivery of offsets; • Once completed, a strategic assessment needs to be locked into legislation. When a developer lodges a development application – that process has already been agreed to and the determining authority does not need to revisit. At the moment, you can agree to offset at a state level but at a development application (DA) level, you are redoing the whole assessment. This is double handling; • Need for spatial targeting of conservation priorities; • Commonwealth of Australia Government – more openness to longer-term strategies –ask community what want to see in 50years from now.
Security for existing biodiversity	• Use the Lower Hunter strategy as the core umbrella document; • Need for certainty for biodiversity conservation within the new plan; • Possibility to introduce policy of 50% brownfield and 50% greenfield developments
Coordination across government sectors	• OEH and DPI – need to integrate both Lower Hunter conservation and regional strategy; • Need a catchment wide regional sustainability plan, that is, a Hunter Strategy; • Lower Hunter strategy should encapsulate the other plans – has to mindful of infrastructure that currently exists and what needs to go ahead, needs to recognise the economically realities; • Lower Hunter strategy cannot be merely a land release strategy. Possibility to consider infrastructure and transport planning at the rezoning phase.

6 Results by Survey Topic

In this section, we present results of the Lower Hunter survey across the three cohorts of rural landholder, urban landholder and planning practitioner, with specific focus on rural and urban landholders. For simplicity, we only provide brief interpretation of survey results (in the order of survey topics) in this section. We reserve more complex interpretation of findings to the analysis of specific research questions as outlined in Section 7.

6.1 Threats to Quality of Life in the Lower Hunter Region

We asked survey participants to rate the extent they agree or disagree that 23 issues are a threat to their quality of life in the Lower Hunter Region on a scale where '1 = Strongly Disagree' through to '5 = Strongly Agree'. We summed the scores of all responses to generate a total mean score per item. We ranked these issues from 1 to 23 based on this total score (Table 8). The issues of greatest concern overall out of those listed, based on those ranks are:

1. Insufficient coordination between land-use, conservation, transport and infrastructure planning;
2. Lack of accessible public transport in regional centres;
3. The lack of integrated transport planning; and
4. Biodiversity (the variety of native plants and animals) decline as result of development.

The issues of least concern out of those listed are:

1. The negative impacts from the construction of new roads such as the Hunter Expressway;
2. The establishment of new corridors for biodiversity conservation;
3. The rezoning of private land for biodiversity conservation; and
4. The laws that exist to limit native vegetation clearance.

Biodiversity decline was rated of greater concern by all respondent cohorts than infrastructure concerns such as the lack of cycling paths, the increased frequency of trains to transport coal to the port of Newcastle and the availability of basic services (for example, water, electricity) to support residential development. Coal seam gas exploration was a medium-ranked issue with respect to all other issues listed; however, for rural landholders it was ranked in the top seven.

Both rural and urban landholders sought additional employment opportunities in the region but were concerned about how it was to be achieved. They are concerned about the opening of new sites for residential development outside existing regional centres, the accessibility of public transportation in regional centres, and the lack of integrated transport planning and coordination among government departments to achieve regional sustainability planning goals in the region.

We found significant differences in concerns about issues among rural and urban landholders and planning practitioners. Both landholder cohorts were more concerned than planning practitioners about the lack of opportunities to express their views on regional planning issues that affect their community ($F = 18.51$, $p < 0.001$), in addition to the high rate of population growth of some regional centres and development along main roads ($F \geq 9.34$, $p < 0.001$). The lack of full-time employment opportunities was of greater concern to urban landholders compared with rural landholders and planning practitioners ($F = 11.42$, $p < 0.001$). The establishment of new corridors for biodiversity conservation was of greater concern to urban landholders than planning practitioners ($F = 7.51$, $p < 0.01$), but it is unclear from the results whether this greater concern relates to how it occurred or the potentially negative impacts of its establishment. Landholders were more concerned about the high rate of population growth of some regional centres than planning practitioners.

Table 8 Mean differences in potential threats to quality of life in the Lower Hunter Region among rural and urban landholders and planning practitioners.

Potential Threat to Quality of Life	Rural Landholder	Urban Landholder	Planning Practitioner	*F*	Landholder Mean	Mean Total Rank
Insufficient coordination between land-use, conservation, transport and infrastructure planning	4.24	4.06	4.37		4.15	1
Lack of accessible public transport in regional centres	4.04	4.25	4.22		4.15	2
The lack of integrated transport planning	3.94[a]	4.18[ab]	4.36[b]	4.39*	4.07	3
Biodiversity (the variety of native plants and animals) decline as result of development	4.14a	4.01ab	3.67b	3.13*	4.07	4
The increased amount of road traffic	3.95	4.08	3.85		4.02	5
The lack of investment in renewable energy options (for example, wind energy and solar energy)	3.95	4.00	3.98		3.97	6
The lack of administrative structures to support a whole of government approach to regional sustainability	3.78	3.87	4.00		3.83	7
The lack of full-time employment opportunities	3.61[ac]	4.07[b]	3.33[c]	11.42***	3.86	8
Coal seam gas exploration	3.90	3.72	3.61		3.80	9
Clearing native vegetation to enable development	3.67	3.61	3.50		3.64	10
Lack of cycling paths	3.46	3.70	3.76		3.59	11
Lack of opportunities to express your views on regional planning issues that affect your community	3.74[a]	3.54[a]	2.58[b]	18.51***	3.64	12
The high rate of population growth of some regional centres	3.52[a]	3.50[a]	2.63[b]	11.86***	3.51	13
The increased frequency of trains to transport coal to the port of Newcastle	3.24	3.53	3.22		3.39	14
The opening of new sites for residential development outside existing regional centres	3.44	3.22	3.13		3.32	15
The availability of basic services (for example, water and electricity) to support residential development	3.38	3.33	2.93		3.35	16
The proposed amalgamation of local government areas	3.21[a]	3.22[a]	2.67[b]	3.54*	3.22	17
The limited availability of entertainment hubs, including cafes and restaurants, for social interaction in	2.96	3.18	2.91		3.07	18
Development along main roads	3.03[a]	3.17[a]	2.37[b]	9.34***	3.11	19
The laws which exist to limit native vegetation clearance	2.96	2.99	2.96		2.98	20
The rezoning of private land for biodiversity conservation	2.86	2.83	2.39		2.84	21
The establishment of new corridors for biodiversity conservation	2.71[ab]	2.93[a]	2.20[b]	5.17**	2.82	22
The negative impacts from the construction of new roads such as the Hunter Expressway	2.49[ab]	2.74[a]	2.04[b]	7.51**	2.62	23

Response options: 1 = Strongly Disagree, 2 = Disagree, 3 = Unsure, 4 =Agree, 5 = Strongly Agree.

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

6.2 Knowledge about Aspects of Regional Sustainability Planning

We asked survey participants to rate their knowledge of different aspects of regional sustainability planning on a scale where '1 = No Knowledge' through to '5 = Very Sound Knowledge' (Table 9). This scale has been tested and validated in at least 20 separate surveys with rural landholders in Australia (see Mazur et al. 2013).

All cohorts self-reported most knowledge about the advantages and disadvantages of coal mining and coal seam gas mining, and the threats posed to biodiversity by residential and industrial development in the Lower Hunter Region. This is an interesting finding given that a frequent response to low social acceptability of extractive industries is to recommend public awareness and education campaigns. In this case, it does not appear that lack of knowledge is a key factor explaining the lack of social acceptability of coal seam gas. Indeed, it is possible that knowledge of the potential negative impacts on aquifer integrity and water quality, or for ground subsidence to occur and impact on infrastructure is undermining support for coal seam gas.

Overall, rural and urban landholders self-reported very little to some knowledge on most items measuring knowledge about regional sustainability. For example, most rural landholders reported less than some knowledge for 17 out of the 18 aspects of regional sustainability (greater than 80.1% reported less than some knowledge) and most urban landholders reported less than some knowledge for 16 out of the 18 aspects (greater than 78.2% reported less than some knowledge). These results suggest there is a case for improving public knowledge of regional sustainability planning.

Planning practitioners self-reported significantly more knowledge across every aspect of regional sustainability planning than rural and urban landholders ($p < 0.05$), and most reported sound knowledge (sufficient to act) in relation to threats posed to biodiversity, the development approval process in the Lower Hunter, population growth projections for the region and the process used to rezone land in greenfield areas. The only difference between urban and rural landholders for the knowledge topics related to the process used to rezone land in greenfield (previously undeveloped) areas. Rural landholders had significantly more knowledge about this statement than urban landholders ($F = 125.99$, $p < 0.05$).

Table 9 Mean differences in perceived knowledge about aspects of regional sustainability planning among rural and urban landholders and planning practitioners

Aspect of Regional Sustainability Planning	Rural Landholder	Urban Landholder	Planning Practitioner	*F*	Landholder Mean	Mean total rank
Advantages and disadvantages of coal mining	3.36 [a]	3.13 [a]	3.85 [b]	11.38***	3.23	1
Advantages and disadvantages of coal seam gas mining	3.13 [a]	2.81 [a]	3.33 [b]	5.21**	2.96	2
The threats posed to biodiversity by residential and industrial development in the Lower Hunter Region	2.83 [a]	2.62 [a]	4.09 [b]	37.09***	2.72	3
The availability of water for human consumption in the Lower Hunter Region	2.65 [a]	2.75 [a]	3.57 [b]	15.04***	2.71	4
Road and rail infrastructure needs in the Lower Hunter Region	2.67 [a]	2.64 [a]	3.50 [b]	15.34***	2.65	5
Places of environmental significance (home to significant native animals, native plants, ecosystems or geological features) in the Lower Hunter Region	2.59 [a]	2.55 [a]	3.67 [b]	26.09***	2.57	6
Public transport needs and solutions for the Lower Hunter Region	2.41 [a]	2.54 [a]	3.50 [b]	24.68***	2.48	7
Renewable energy options for the Lower Hunter region	2.46 [a]	2.50 [a]	3.30 [b]	12.43***	2.48	8
Areas of high biodiversity (plants and animals) value in the Lower Hunter Region	2.42 [a]	2.38 [a]	3.67 [b]	31.81***	2.40	9
The development approval process used to assess the merits of residential development in the Lower Hunter	2.42 [a]	2.23 [a]	4.22 [b]	74.26***	2.32	10
Places of cultural significance (provide opportunities to express and appreciate culture or cultural practices such as art, music, history and Indigenous tradition) in the Lower Hunter Region	2.32 [a]	2.56 [a]	3.24 [b]	16.74***	2.44	11
Service infrastructure (for example, electricity, water and sewer) needs in the Lower Hunter Region	2.40 [a]	2.38 [a]	3.54 [b]	32.15***	2.39	12
Current economic indicators (for example, income levels, housing investment) in the Lower Hunter Region	2.29 [a]	2.28 [a]	3.57 [b]	34.34***	2.28	13
Population growth projections for the Lower Hunter Region	2.30 [a]	2.14 [a]	4.04 [b]	67.15***	2.21	14
The process used to rezone land in greenfield (previously undeveloped) areas	2.05 [a]	1.73 [b]	4.17 [c]	125.99***	1.88	15
The process used to identify the type and area of land which needs to be purchased in order to offset the impact of development on biodiversity	1.90 [a]	1.77 [a]	3.74 [b]	80.43***	1.83	16
The land-use planning actions proposed in the Lower Hunter Regional Strategy 2006-31	1.61 [a]	1.47 [a]	3.87 [b]	128.20***	1.54	17
The objectives of the New Planning System for New South Wales – Green Paper	1.49 [a]	1.52 [a]	3.72 [b]	129.58***	1.51	18

Response options: 1 = Strongly Disagree, 2 = Disagree, 3 = Unsure, 4 =Agree, 5 = Strongly Agree.

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

Note: different superscripts between columns in a given row represent significant differences in responses. Mean total rank reflects the mean of all responses ranked from highest to lowest.

6.3 Beliefs about Regional Sustainability Planning

We asked survey participants to respond to a set of 18 belief statements related to regional sustainability (Table 10) on a scale where '1 = Strongly Disagree' through to '5 = Strongly Agree'.

Respondents were generally supportive of a diversified regional economy, including investment into renewable energy options such as wind and solar power generation (78.1% agree versus 12.6% disagree; mean = 4.01), increased tourism development (97.3% agree versus 4.9% disagree; mean = 4.18) and building a more efficient public transport system (90.5% agree versus 4.4% disagree; mean = 4.30). The recent establishment of 20,000 ha of conservation reserves or flora reserves in the Lower Hunter Region was generally seen as an important step in the right direction for the sustainability of the region (80.3% agree versus 7.2% disagree; mean = 4.07).

Overall, the majority of respondents agreed that the economic prosperity of the Lower Hunter Region is too dependent on the coal mining industry (74.5% agree versus 14.0% disagree; mean = 3.93) and the majority disagreed that coal-seam-gas mining is an acceptable land-use in the Lower Hunter Region (60.9% disagreed versus 17.4% agreed; mean = 2.24). Rural and urban landholders agreed significantly more than planning practitioners that coal seam gas mining presents an unacceptable risk to the health of residents in the Lower Hunter Region ($F = 7.08$, $p < 0.01$). Proportionally, 62.0% of rural and urban landholders versus 39.1% of planning practitioners agreed that coal seam gas mining presents an unacceptable risk.

A high proportion of respondents disagreed with belief statements about the openness and fairness of regional planning in the Lower Hunter. For example, a high proportion of respondents disagreed that regional planning organisations are open and honest when explaining plans for future development (49.2% disagreed versus 12.1% agreed; mean = 2.48); but there was uncertainty as to whether the process used to develop land use plans in the Lower Hunter Region is fair and equitable (57.7% unsure versus 30.4% disagree; mean = 2.74). There was also general uncertainty about the sensibility of the changes proposed to the NSW planning system under the 'A New Planning System for New South Wales' (NSW Department of Planning and Infrastructure 2013b), which may partially reflect a lack of knowledge about this new planning process. In the previous section, we showed that both urban and rural landholders had least knowledge (out of all stated items) of the objectives of this green paper and the land-use planning actions proposed in the Lower Hunter Regional Strategy 2006-31 (NSW Department of Planning 2006).

Important differences in beliefs existed between rural and urban landholders and planning practitioner, particularly on the question of urban infill. Compared to planning practitioners, rural and urban landholders were more likely to disagree with the view that higher density residential development should be supported in urban areas ($F = 25.91$, $p < 0.001$). It seems that rural and urban landholders were not convinced that price is the principal driver of the trend towards the purchase of quarter acre blocks in the region. Indeed, rural and urban landholders were more likely than planning practitioners to believe that price was a weaker driver of this trend ($F = 10.84$, $p < 0.001$), suggesting that the 'suburban dream' of owning larger blocks is still alive in the Lower Hunter. All respondents were generally supportive of the restoration of brownfield (for example, old coal mining sites) for residential development ahead of the expansion of greenfield (previously undeveloped) area. Restoration of brownfield areas may be one means of providing for the rural lifestyle needs of the Hunter population whilst minimising impact on biodiversity.

Table 10 Mean differences in beliefs about regional sustainability planning in the Lower Hunter Region

Belief Statements	Rural Landholder	Urban Landholder	Planning Practitioner	*F*	Landholder Mean	Mean Total Rank
Mining, Energy and Transport						
Building a more efficient public transport system is crucial to the sustainability of the Lower Hunter region	4.17	4.40	4.37	3.30*	4.29	1
The establishment of a range of renewable energy options, including wind and solar, is crucial to the sustainability of the Lower Hunter region	3.93	4.08	4.02		4.01	4
Economic prosperity in the Lower Hunter Region is too dependent on the coal mining industry	4.00	3.84	4.07		3.91	5
Coal-seam-gas mining presents an unacceptable risk to the health of residents in the Lower Hunter region	3.99	3.84	3.26	7.08**	3.91	6
The construction of an extensive rail network for transporting passengers between regional centres is more important than the construction of new highways in the region	3.38	3.59	3.46		3.49	9
Coal-seam-gas mining is an acceptable land-use in the Lower Hunter region	2.11	2.27	2.59		2.19	18
Conservation						
The recent establishment of 20,000 ha of conservation reserves or flora reserves in the Lower Hunter Region is important for the sustainability of the region	4.08	4.04	4.17	Agree	4.06	3
The process used by agencies to identify land to offset the clearance of native vegetation is difficult to understand	3.51	3.59	3.96	4.75*	3.56	7
I believe the science used to justify conservation of land in the Lower Hunter Region is sound	3.27	3.30	3.33		3.28	12

Response options: 1 = Strongly Disagree, 2 = Disagree, 3 = Unsure, 4 =Agree, 5 = Strongly Agree.

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

Mean total rank reflects the mean of all responses ranked from highest through to lowest.

Table 10 (continued) Mean differences in beliefs about regional sustainability planning in the Lower Hunter Region

Belief Statements	Rural Landholder	Urban Landholder	Planning Practitioner	*F*	Landholder Mean	Mean Total Rank
Land-use planning						
Increased tourism development in the Lower Hunter is important for the economic viability of the region	4.16	4.24	3.98		4.21	2
Brownfield (for example, old coal mining areas) should be restored and then made available for residential development ahead of the expansion of greenfield (previously undeveloped) areas	3.66	3.58	3.28		3.62	8
Even if the price of housing on small blocks in urban areas was significantly reduced, people will still prefer to live in houses on quarter acre blocks in the Lower Hunter region	3.62	3.40	2.80	10.84***	3.50	10
Higher density residential development should be supported in urban areas	3.42	2.97	4.33	25.91***	3.18	11
The expansion of urban areas in the Lower Hunter Region is essential for the region's sustainability	3.03	3.42	3.17	5.10**	3.24	13
Changes proposed to the NSW planning system under the A New Planning System for New South Wales – Green are sensible	2.91	3.01	3.26	6.24**	2.96	15
The boundaries of existing urban areas in the Lower Hunter Region are appropriate	3.12	3.07	3.04		3.09	14
The process used to develop land use plans in the Lower Hunter Region is fair and equitable	2.62	2.82	2.78		2.73	16
Regional planning organisations are open and honest when explaining plans for future development	2.37	2.48	2.80		2.43	17

Response options: 1 = Strongly Disagree, 2 = Disagree, 3 = Unsure, 4 =Agree, 5 = Strongly Agree.

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

Mean total rank reflects the mean of all responses ranked from highest through to lowest.

6.4 The Mapping of Social Values and Development Preferences

Survey participants were asked to identify places of value, as well as acceptable and inappropriate development on an A1 map of the Lower Hunter Region using a set of sticker dots. The sticker dots were heads-up digitised in ArcGIS using a 1:1 cardinality and then aggregated by value or preference type.

In total, 14,357 value and preference dots were assigned to the map by respondents. Newcastle LGA was assigned the most number of dots (3,305) and Maitland LGA was assigned the least number of dots (2,083). The proportion of total dots assigned by each community type was closely associated with their LGA of residence (Table 11 and Table 12). For example, 35.4% of rural landholders lived in Cessnock LGA and 35.7% of their value and preference dots were assigned to this LGA. Conversely, only 0.7% of rural landholders lived in the Newcastle LGA and they only assigned 0.1% of their value and preference dots to this LGA. Similar patterns were found across the other respondent cohorts. These associations suggest the presence of a form of geographic discounting whereby environmental valuation is discounted from the home perspective across space. A greater proportion of values were assigned closer to one's place (for example, LGA) of residence, and fewer values to places further away. We examined this geographic discounting further in Section 6.

Chi-square tests revealed that planning practitioners and urban landholders were significantly over-represented in Newcastle compared to expected counts based on the assumption of equal representation across the region, whereas urban landholders were significantly under-represented in Cessnock and Maitland (Table 11). Conversely, rural landholders were significantly over-represented in Cessnock and Maitland, and under-represented in Newcastle and Lake Macquarie compared to expected counts ($p < 0.05$). When cross-tabulating the dot assignment by LGA, urban landholder and planning dots were significantly over-represented in Newcastle and Lake Macquarie, and significantly under-represented in Cessnock and Maitland compared with expected counts ($p < 0.05$). The opposite trend was seen for rural landholders (Table 12). These results further support the view that a greater proportion of values were assigned closer to one's place of residence

Table 11 Proportional differences in place of residence across rural and urban landholders and planning practitioners

Place of Residence (by local government area)	N	Rural Landholder	Urban Landholder	Planning Practitioner	X^2	*p*
Newcastle	72	**0.7%$^-$**	**29.8%$^+$**	**46.5%$^+$**	141.80	0.000
Port Stephens	56	14.3%	17.5%	11.6%		
Cessnock	83	**35.4%$^+$**	**15.2%$^-$**	11.6%		
Lake Macquarie	96	**15.6%$^-$**	**36.3%$^+$**	25.6%		
Maitland	54	**34.0%$^+$**	**1.2%$^-$**	4.7%		
	361	100.0%	100.0%	100.0%		

Bolded numbers indicate significant differences between observed and expected values.

A positive symbol (+) indicates that observed values are significantly larger than expected and a negative symbol (–) indicates that observed values are significantly smaller than expected.

Table 12 Proportional differences in the number of value and preference dots assigned to each LGA by rural and urban landholders and planning practitioners

Local Government Area	N	Rural Landholder	Urban Landholder	Planning Practitioner	X^2	*p*
Newcastle	3,305	**0.1%⁻**	**36.3%⁺**	**45.2%⁺**	6061.36	0.000
Port Stephens	2,499	**17.7%**	**19.0%⁺**	**13.8%⁻**		
Cessnock	3,239	**35.7%⁺**	**13.6%⁻**	**12.5%⁻**		
Lake Macquarie	3,231	**13.3%⁻**	**30.6%⁺**	**25.9%⁺**		
Maitland	2,083	**33.2%⁺**	**0.5%⁻**	**2.6%⁻**		
	14,357	100.0%	100.0%	100.0%		

Bolded numbers indicate significant differences between observed and expected values.

A positive symbol (+) indicates that observed values are significantly larger than expected and negative symbol (–) indicates that observed values are significantly smaller than expected.

We then created a series of density surfaces to show where social values or development preferences are concentrated. Density analysis takes known quantities of social value or development preference points (by type) and spreads them across the landscape in accordance to a specified grid cell size and search radius from that cell. In Appendix D, we present 17 value and preference density maps for all respondents based on a 500 m by 500 m grid cell and 3 km search radius of that cell. Below we present some key patterns found in the maps for all respondents. Terms such as 'areas of high value' are used interchangeably with 'tightly clustered' and 'hotspot'. They refer to groups of cells in which 75% of each type of value or preference point fall (that is, the 75th percentile of cases). A similar interpretation can be made for areas of 'high preference'.

6.4.1 Social value patterns for all respondents

1. Aesthetic values were tightly clustered in Tomaree National Park, Newcastle area, Watagans National Park and Catherine Hill Bay (density > 4.9);
2. Newcastle, Tomaree and Watagans National Park were hotspots of recreation value (density > 4.9);
3. Hexham swamp, Tomaree and Watagans National Park were hotspots of biodiversity value and natural significance value. Yengo National Park and the coastline between Morna Point and Newcastle was an additional area of natural significance (density > 4.1);
4. Hexham Swamps was an area of high science and education value (density > 3.7);
5. Health/therapeutic values clustered along the coastline, particularly in Nelson Bay and between Newcastle and Catherine Hill Bay (density > 2.2);
6. Areas of cultural significance were tightly clustered in Newcastle, Maitland and an area beside the Patterson River (density > 7.0);
7. Intrinsic value were more dispersed across the region than other values; although hotpots are apparent in Watagans National Park, Newcastle and Tomaree National Park (density > 1.9);
8. Catherine Hill Bay emerged as a hotspot for food value, as were more traditional agricultural areas north-west of Cessnock and north-east of Maitland (density > 2.0); and
9. Some state forest, in particular Pokolbin, Corrabarn and Olney State Forests were areas of high natural material value, which also has a resource extraction component to its meaning (density > 1.7).

6.4.2 Development preference patterns for all respondents

1. The Catherine Hill Bay area was an area of high preference conflict. It was proposed under the 2006 Lower Hunter Strategy as an area of acceptable urban development but was perceived to be highly inappropriate for residential and industrial development (density > 0.8) and high conservation preference (non-reserves) by survey respondents (density > 0.9);
2. Other (outside of Catherine Hill Bay) preferred residential and industrial development areas closely aligned with the areas identified for development in the 2006 strategy, and also tended to be in close proximity to transport infrastructure such as the Hunter Expressway and its junction with the Sydney to Newcastle Freeway near Minmi (density > 0.8);
3. Wyee, Cooranbong, Kurri Kurri and Cessnock were additional hotspots for acceptable residential development (density > 1.0). Areas near Wallalong and north of Raymond Terrace were perceived to be both acceptable and inappropriate for development;
4. Kurri Kurri, Williamstown Airport and the area north of Cooragang Island were perceived to be appropriate for industrial development (density > 1.7); however, Catherine Hill Bay and the region around Cooragang Island, Tomaree National Park and the Hunter wine region were perceived as inappropriate for development (density > 0.8);
5. Areas of acceptable agricultural development were largely confined to regional areas north of Cessnock (the Hunter Valley) and north east of Maitland (density > 1.4);
6. Catherine Hill Bay was perceived to be off-limits to tourism development (density > 0.7), in addition to all other development classes;
7. Cardiff Heights near Newcastle was perceived to be a hotspot for transport development (density > 3.3); and
8. Agricultural development was perceived to be inappropriate in all national parks and most state forests.

6.4.3 Overlay of Matters of National Environmental Significance (MNES) and perceived conservation values

We overlaid grid surfaces showing the frequency of occurrence of MNES, as defined under the *Environment Protection and Biodiversity Conservation Act 1999*, with density surfaces of biodiversity value, natural significance and areas perceived as acceptable conservation outside of conservation reserves, together referred to as perceived conservation values and preference (Figure 3). Visual assessment of this figure highlighted that existing national parks and conservation reserves in the Lower Hunter were areas of high perceived conservation value, particularly Tomoree National Park, Watagans National Park, Yengo National Park and Heaton and Awaba State Forests. When asked to identify areas that should be conserved outside of national parks and conservation reserves, respondents assigned 70% of their conservation preference dots to the Lower Hunter coastal strip, particularly between Nelson Bay and Newcastle.

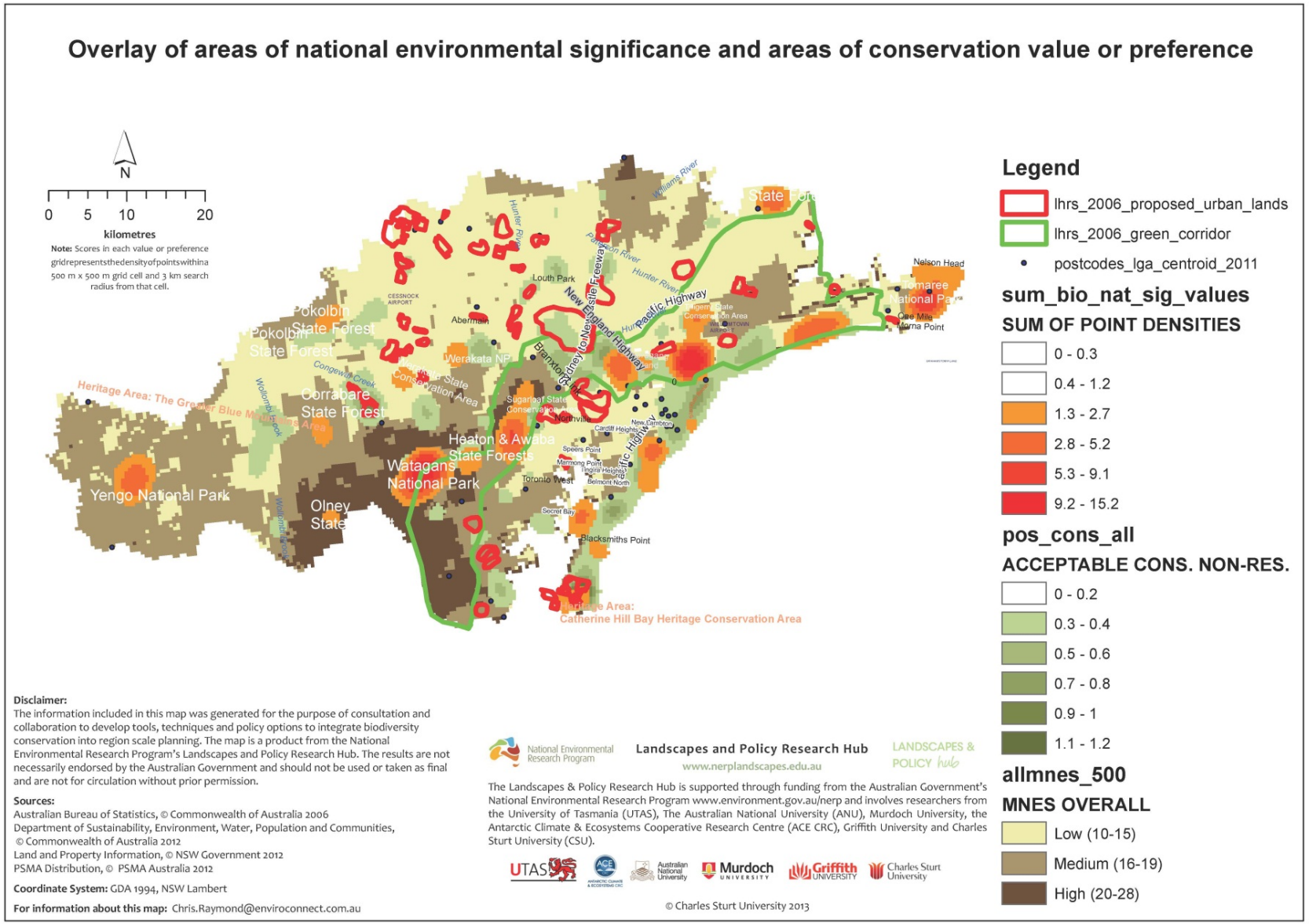


Figure 3 Overlay of hotspots of MNES and conservation value and preference

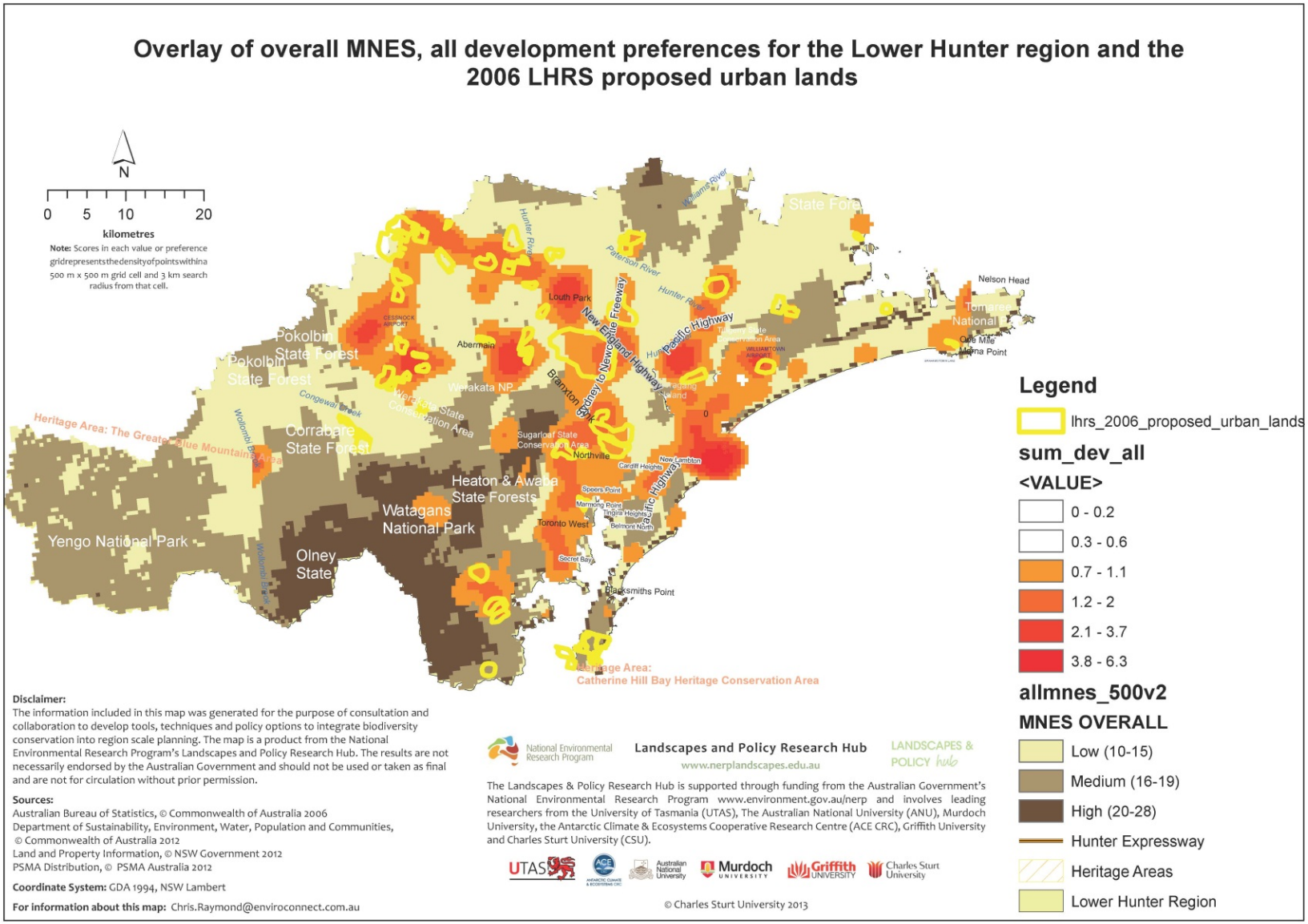


Figure 4 Overlay of hotspots of MNES and acceptable development preferences

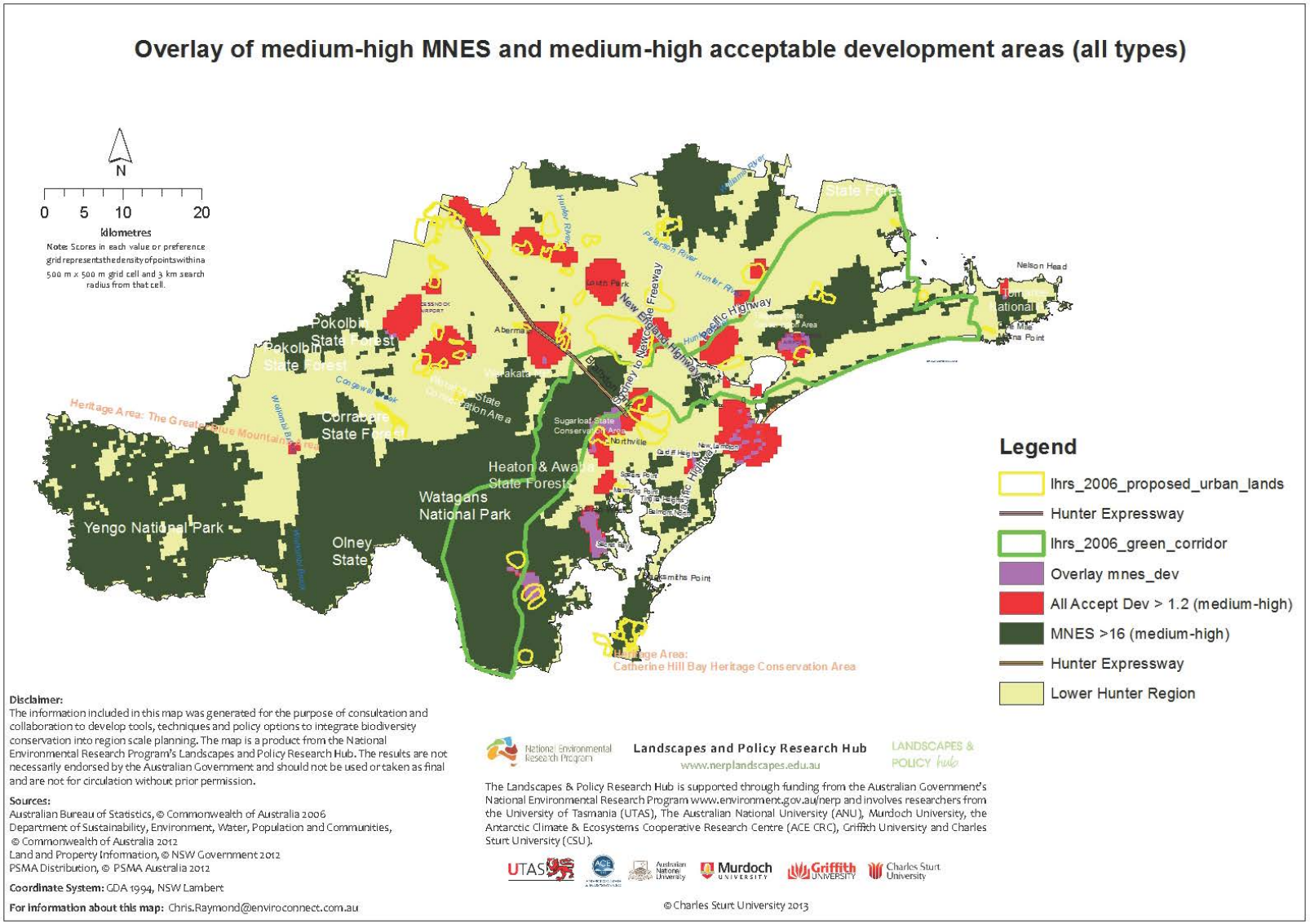


Figure 5 Overlay of areas of moderate to high MNES and moderate-high acceptable development. Purple areas highlight the potential for land-use conflicts.

We also overlaid heat maps of MNES with the sum of all acceptable development preference dots in the Lower Hunter Region (Figure 4). Visual inspection illustrated that acceptable development preferences spatially overlapped with the Lower Hunter Regional Strategy 2006-31 (iteration 1) proposed urban lands, with the exception of Newcastle, areas north-west of Cessnock and north of Cooragang Island. Overall, areas perceived to be highly acceptable for development were typically found outside areas of medium or high areas of MNES, with the exception of the purple areas shown in Figure 5. These areas, including Sugarloaf State Conservation Area, Cooragang Island, Williamstown Airport, Toronto West and an area south of Watagans National Park, represented places of overlap of medium-high acceptable development and medium-high MNES. In addition, the areas of medium-high acceptable development were found within the boundary of the 2006 Lower Hunter Conservation Corridor.

6.5 Attitudes toward Biodiversity Offset Policy

We asked survey participants to rate the extent they agreed or disagreed with 16 statements related to biodiversity offsets. Because offset policy is a complex topic, we provided each participant with some basic background information as follows:

'Biodiversity offsets are used to address the impacts of development on biodiversity, typically as a result of clearing native vegetation. Biodiversity offsets are undertaken elsewhere to the development, typically by purchasing land which has similar ecological characteristics.'

The process for administering biodiversity offsets is currently being reviewed in the Lower Hunter region. Currently, two broad approaches are being considered:

Approach 1 This is where developers are required to identify and acquire 'like areas' (areas of similar ecological characteristics) to offset their impact on biodiversity.

Approach 2 Each developer pays a standard levy (cost per hectare) for the right to develop an area of land, irrespective of whether the area contains native vegetation. The levy is then paid into a trust account administered by an external body. This body is then responsible for identifying and acquiring 'like areas' for the biodiversity offset.'

For ease of interpretation, we grouped responses to the 18 statements into: 1) assessments of effectiveness/social acceptability; 2) type of approach preferred; 3) management of levy; 4) accountability; 5) application; 6) longevity/duration (Table 13).

Almost half of the respondents (48.1%) agreed that biodiversity offsets are an effective approach to maintaining or improving biodiversity in the Lower Hunter Region (overall mean < 3.44); however, there was a lot of uncertainty about their effectiveness (33.4% unsure), suggesting that it was only one of a suite of policy instruments which could be used to address the issue of biodiversity decline. Two of the survey items explored respondent's views about the way that biodiversity offsets should be implemented. Overall, 49.8% of respondents agreed that a standardised approach to biodiversity offsets is needed in the Lower Hunter (versus 20.6% disagreed); and a majority (81.8%) agreed that the Australian Government should play a leadership role in the establishment of a consistent approach to biodiversity offsets in the Lower Hunter Region (versus 6.0% disagreed). Planning practitioners were significantly more supportive of a standardised approach to biodiversity offsets than urban landholders were ($F = 4.13$, $p < 0.05$).

There were four survey items exploring respondent's views about ways to ensure the accountability of those involved in the administration of an offsets levy. Nearly all (93.4%) respondents agreed that a publicly available record needs to be established and updated so that governments, developers and the public can check where offsets have been established. Half (51.0%) of all respondents agreed that developers who do not plan to remove native vegetation should not have to pay the offset levy (versus 26.8% disagreed); and half (51.4%) of all respondents disagreed (versus 29.7% agreed) that developers should be able to negotiate the amount of revegetation required as part of an offset rather than have to follow rules that apply to all cases). There were significant differences across the community types about the extent developers should be responsible for identifying and acquiring areas of similar ecological characteristics for offsets. A high proportion of rural and urban landholders (67.2%) agreed that developers should be responsible (mean > 3.65) whereas a high proportion of planning practitioners (46.6%) disagreed (mean = 2.85, $F = 10.64$, $p < 0.001$).

Two items explored the way in which the biodiversity offset levy should be managed. A majority of respondents agreed (71.3% agreed versus 10.4% disagreed) that a board of trustees independent of government and developer interests should be established in order to manage the levy. There was a lot of uncertainty as to whether the NSW Government could be relied on to effectively manage an offset levy in order to maintain biodiversity in the Lower Hunter Region. Overall, 51.8% of respondents disagreed that the NSW Government could be relied on to manage an offset levy, and 33.4% were unsure. We note that during the time of the survey in late 2012/early 2013 there was an inquiry by the NSW Independent Commission against Corruption into the behaviour of two ministers from the previous government, including the Minister for Planning, in relation to the allocation of mining tenements in the Hunter. Reporting of the evidence presented at the inquiry may have lowered public trust in the state government and influenced the preference for an independent board of trustees to manage the biodiversity offset levy.

We asked five statements about the application of biodiversity offsets. There was general agreement across all respondent cohorts that:

1. Money saved in an offset account by developers in the Lower Hunter Region should only be used to improve biodiversity outcomes in this region;
2. An offset levy should only be used for projects that support biodiversity conservation;
3. Biodiversity offsets should not be applied on land which was previously set aside for conservation;
4. Public land should be considered for implementing environmental offsets if the offset would lead to improved biodiversity outcomes; and
5. Most respondents in each of the cohorts disagreed that areas of land used for biodiversity offsets should be available for future development as long as all biodiversity losses are offset elsewhere.

We sought responses to two statements about the longevity/duration in which the offset should be in place. There was strong support across all respondents cohorts for biodiversity offsets to be listed on the land title held by the NSW Government (mean > 3.81); and moderate support for the view that biodiversity offsets on specific parcels of land should only be erased by a separate NSW Act of Parliament (mean > 3.40). Planning practitioners more were more likely to strongly agree that biodiversity offsets should be listed on the land title held by the NSW Government than urban landholders ($F = 4.83$, $p < 0.01$).

Table 13 Rural and urban landholder and planning practitioner attitudes toward the delivery of biodiversity offsets in the Lower Hunter (no mean differences)

Attitudinal Statements	Rural Landholder	Urban Landholder	Planning Practitioner	*F*	Landholder Mean
Effectiveness/social acceptability					
Biodiversity offsets are an effective approach to maintain or improve biodiversity (plants and animals) in the Lower Hunter region	3.31	3.35	3.44		3.33
Type of approach					
One standardised approach to biodiversity offsets is needed in the Lower Hunter region	3.46[ab]	3.18[a]	3.64[b]	4.13*	3.32
The Australian Government should establish a consistent approach to biodiversity offsets in the Lower Hunter region	4.03	4.11	4.02		4.07
Management of levy					
NSW Government agencies can be relied on to effectively manage an offset levy in order to maintain biodiversity in the Lower Hunter region	2.46[a]	2.45[a]	2.87[b]	3.42*	2.44
A board of trustees independent of government and developer interests should be established in order to effectively manage an offset level for the Lower Hunter region	3.79	3.94	3.56		3.86
Accountability					
A publicly available record needs to be established and updated so that governments, developers and the public can check where offsets have been established	4.33	4.30	4.47		4.32
Developers who do not plan to remove native vegetation should not have to pay the offset levy	3.31	3.24	3.29		3.29
Developers should be able to negotiate the amount of revegetation required as part of an offset rather than have to follow rules that apply to all cases	2.58	2.68	2.73		2.63
Developers who plan to remove native vegetation should be responsible for identifying and acquiring areas of similar ecological characteristics, no matter what time or costs are involved	3.65[a]	3.76[a]	2.85[b]	10.64***	3.69

Response options: 1 = Strongly Disagree, 2 = Disagree, 3 = Unsure, 4 =Agree, 5 = Strongly Agree.

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

Table 13 (cont.) Rural and urban landholder and planning practitioner attitudes toward the delivery of biodiversity offsets in the Lower Hunter (no mean differences)

Attitudinal Statements	Rural Landholder	Urban Landholder	Planning Practitioner	*F*	Landholder mean
Application					
Money saved in an offset account by developers in the Lower Hunter Region should only be used to improve biodiversity outcomes in this region	4.21	4.24	4.16		4.23
An offset levy should only be used for projects that support biodiversity conservation	3.83	3.78	3.57		3.80
Biodiversity offsets should not be applied on land which was previously set aside for conservation	3.83	3.66	3.82		3.74
Public land should be considered for implementing environmental offsets if the offset would lead to improved biodiversity outcomes	3.43	3.52	3.78		3.47
Areas of land used for biodiversity offsets should be available for future development as long as all biodiversity losses are offset elsewhere	2.52	2.73	2.27		2.63
Longevity/duration of the offset					
Biodiversity offsets should be listed on the land title held by the NSW Government	3.93^{ab}	3.81^{a}	4.25^{b}	4.83**	3.87
Biodiversity offsets on specific parcels of land should only be erased by a separate NSW Act of Parliament	3.40	3.46	3.40		3.42

Response options: 1 = Strongly Disagree, 2 = Disagree, 3 = Unsure, 4 =Agree, 5 = Strongly Agree.
*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

6.6 Socio-demographics of Respondents

In Part 6 of the survey, we asked respondents to provide some basic socio-demographic information (Table 14). These data were useful in terms of providing insights into the differences between respondents across community type, explaining differences in values and preferences amongst respondents, and making judgements about the validity of extrapolating from the samples to the wider populations of those community types.

We found mean differences in age across community types. Planning practitioners (mean age = 45.42) were significantly younger than both rural (mean age = 58.21) and urban landholders (mean age 56.23, $F = 16.01$, $p < 0.001$).

Most respondents had lived in the region for a substantial period of time and could be considered long-term residents (83.9% for more than 10 years). There were significant differences in length of residence across the community types in that planning practitioners had lived in the region a significantly shorter period of time (24 years) compared with urban landholders (43 years, $F = 5.80$, $p < 0.01$); and rural landholders had lived in the region a significantly shorter period of time (32 years) than rural landholder ($p < 0.01$).

Surveys of rural landholders often have a significantly higher proportion of men than women as respondents, reflecting in part at least, that in farming communities it is the men who are more likely to identify as 'the farmer' making key decisions. In this research, an equal proportion of males and females responded to the survey in both the rural and urban landholder community types. However, proportionately more planning practitioners were men with high incomes and university or tertiary training (Table 14). Surprisingly, proportionately more rural landholders were university or tertiary institution trained than urban landholders (49.0% versus 28.2%).

Overall, 15.0% of respondents rented their home, which is almost half the regional statistic of 27.3% (ABS 2012). Chi-square tests revealed that urban renters are significantly over-represented ($p < 0.05$) whereas rural renters are significantly under-represented compared to expected counts. There is a surprisingly low level of absentee land ownership across all sub-groups.

A high proportion of rural and urban landholders were retired (43.8% and 52.9%). One reason is that retirees have more time to express their values and preferences and may be more likely to complete and return surveys. A high proportion of retirees presents an opportunity for regional sustainability planning. Potentially, there are a high number of people with time who could be recruited as conservation volunteers or in other volunteer sectors related to regional sustainability (for example, health planning).

We asked survey participants to indicate the total of all their wages and salaries, government benefits, pensions, allowances and any other income they usually receive, before deductions for tax, superannuation contributions, health insurance, amounts salary sacrificed, or any other automatic deductions for the last financial year (2011/2012). Planning practitioners reported substantially higher incomes than both rural and urban landholders. A higher percentage of planning practitioners and rural landholders earned greater than $104,000 in the 2011/2012 financial year than urban landholders (53.5% versus 24.4% and 6.8%). Chi-square statistics revealed that planning practitioners were significantly over-represented in the greater than $104,000 income bracket, whereas urban landholders were significantly under-represented. The rental population's income closely tracked the urban landholder's income. Proportionately fewer renters than homeowners earned greater than $104,000 in the 2011/2012 financial year (3.9% versus 23.5%) and proportionately more renters earned between $20,800 – $51,999 (41.2% versus 24.6%).

Proportionately more rural than urban landholders cited being a member of a conservation group (19.3% versus 6.1%). Planning practitioners had similar levels of membership to rural landholders (20.5% versus 19.3%). Rural landholders were significantly over-represented as conservation group members whereas urban landholders were significantly under-represented based compared with expected counts ($p < 0.05$).

Table 14 Key socio-demographics of survey respondents

Socio-demographic	Response options	N	Rural Landholder (n= 26-87)	Urban Landholder (n = 37-87)	Planning Practitioner (0-32)	X^2	*P*
Gender	Male	206	59.2%	51.5%	72.9%	7.22	0.027
	Female	152	40.8%	48.5%	27.1%		
	Total	358	100%	100%	100%		
Rent or own?	Rent	54	**6.8%-**	**24.6%+**	6.7%	22.10	0.000
	Own	305	93.2%	75.4%	93.3%		
	Total	359	100.0%	100.0%	100.0%		
Principal place of residence?	Yes	344	95.2%	97.6%	95.6%	1.40	0.496
	No	13	4.8%	2.4%	4.4%		
	Total	357	100.0%	100.0%	100.0%		
Education	Primary or secondary school	77	16.3%	**30.7%+**	**6.3%-**	56.97	0.000
	Technical or further education institution	121	34.7%	41.1%	**6.3%-**		
	University or tertiary institution	160	49.0%	**28.2%-**	**87.5%+**		
	Total	358	100%	100%	100%		
Main occupation	Manager	37	10.4%	6.5%	35.0%	74.05	0.000
	Professional	82	25.9%	**17.4%-**	**57.5%+**		
	Retired	116	39.3%	45.7%	n/a		
	Community, clerical or sales worker	33	5.9%	**17.4%+**	2.5%		
	Farmer, machinery driver or trades worker	45	18.5%	13.0%	5.0%		
	Total	313	100%	100%	100%		
2011/2012 Income	$1-$20,799	63	19.3%	25.3%	**0.0%-**	61.47	0.000
	$20,800-$51,999	89	25.9%	35.6%	**4.7%-**		
	$52,000-$103,999	106	30.4%	32.2%	41.9%		
	$104000 or more	66	24.4%	**6.8%-**	**53.5%+**		
	Total	324	100%	100%	100%		
Member of a conservation group?	Yes	47	**19.3%+**	**6.1%-**	20.5%	13.86	0.001
	No	306	80.7%	93.9%	79.5%		
	Total	353	100%	100%	100%		

Note about main occupation question: 313 participants responded to this question. Remainder represent sales, machinery, technician or labourer occupations.

***** some cases contain counts less than 5 and therefore chi-statistic cannot be generated. Bolded numbers indicate significant differences between observed and expected values. A positive symbol (+) indicates that observed values are significantly larger than expected and a negative symbol (-) indicates that observed values are significantly smaller than expected.

7 Findings in Relation to Specific Research Questions

7.1 The Influence of Landholder Type on the Mapping of Social Values and Development Preferences

Norton and Hannon (1997) proposed a spatial theory of environmental evaluation wherein the intensity of environmental valuation is discounted as the distance from the home increases across both time and space – a form of geographic discounting. Brown et al. (2002) empirically tested this theory by examining whether social values are more 'intense' or greater nearer a community. They found that:

1. Social values related to active human use of the landscape (for example, recreation, aesthetic, health) are located nearest to the place of residence;
2. Social values related to passive human use are located furthest from the place of residence; and
3. Proximity of some social values to a place of residence can vary from one region to another.

We are not aware of any studies that have considered whether these associations hold across urban and rural landholders. The question worth considering is whether the social values assigned by rural and urban landholders vary with distance from place of residence, and if so, whether this trend varies across the regional landscape (that is, the LGA in which rural and urban landholders reside).

To address this question, we present three separate forms of analyses:

1. Proportional differences in location of place of residence and location of value and preference by LGA;
2. Mean differences in the distance of social values and development preferences assigned from each place of residence for rural and urban landholders;
3. Mean differences in the distance of value assignment across LGAs; and
4. A brief description of methods for each of these forms of analyses precedes the results.

7.1.1 Differences in the number and proportions of value and preference dots assigned by rural and urban landholders

We first examined differences in the number of value and preference dots assigned by rural and urban landholders (Figure 6 and Figure 7). Results indicate a strong positive correlation between the number of value dots mapped by rural and urban landholders, with the exception of food and water values. Aesthetic, recreation and biodiversity values were most frequently assigned by both landholder types and natural materials, and science were least frequently assigned. Rural landholders assigned significantly more aesthetic, food and water value points to the map than urban landholders ($p < 0.05$, Figure 6).

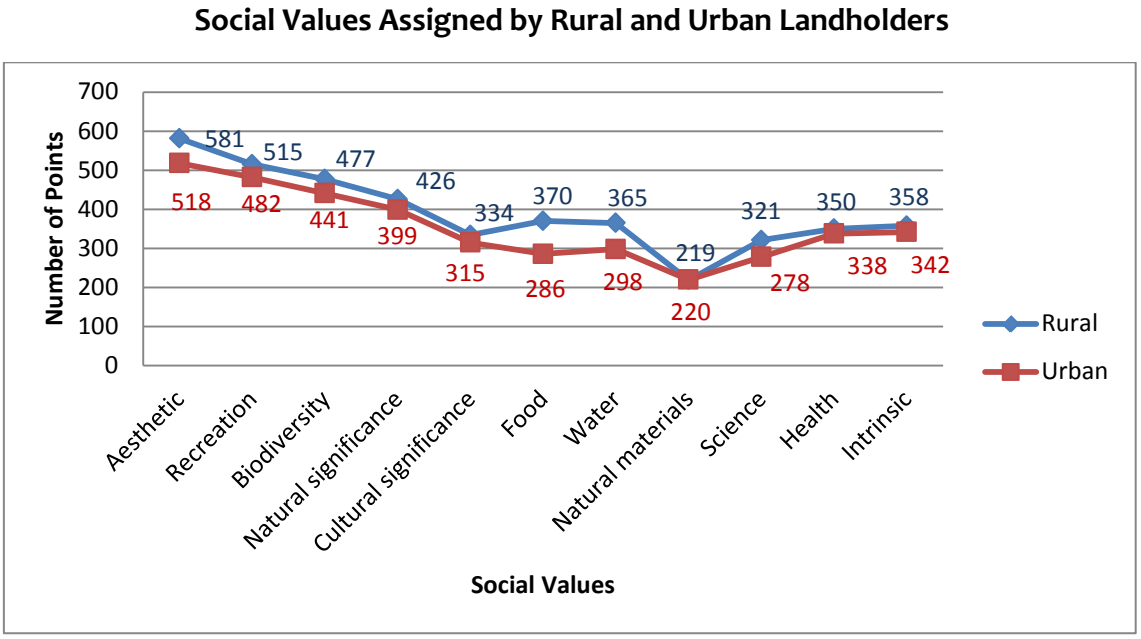


Figure 6 The overall number of value dots assigned to the map of the Lower Hunter by rural and urban landholders

Again, we found a strong positive correlation between the number of development preference dots mapped by rural and urban landholders (Figure 7). Acceptable (positive) and inappropriate (negative) residential development dots were most frequently assigned by rural and urban landholders and inappropriate transport, agricutlure, tourism and conservation preferences were least frequently assigned. Rural landholders assigned significantly more acceptable residential and agriculture development dots to the map than urban landholders ($p < 0.05$). Overall, both rural and urban landhodlers assigned fewer inappropriate transport, agriculture, tourism and conservation dots to the map, suggesting that it was cognitively challenging for respondents to map these preference types, or alternatively, these types of development are more acceptable.

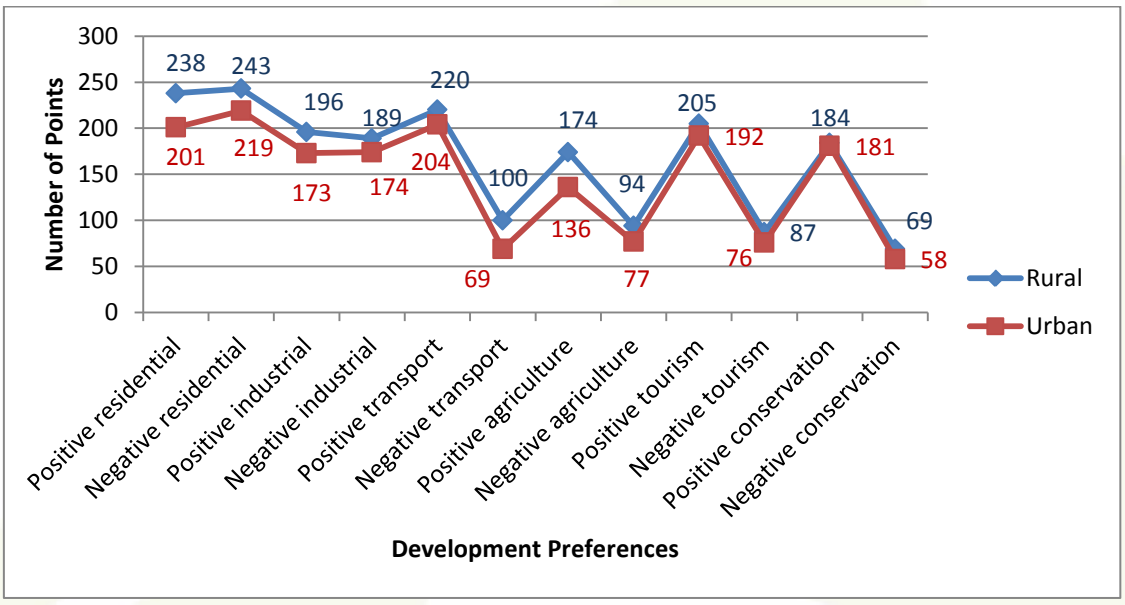


Figure 7 The overall number of development preference dots assigned to the map by rural and urban landholders

We examined the proportional differences in specific types of value and preference dots assigned to each of the five LGAs by landholder type (Table 15). For each landholder type, the proportion of value dots assigned to each LGA type adds up to 100% down a column. We generated this cross-tabulation by intersecting all social values with the boundaries of the five LGAs in the Lower Hunter.

Whilst overall rural and urban landholders were likely to assign more values to their LGA of residence, this trend does not hold for all value types. For example, rural landholders assigned proportionately more recreation values to Newcastle (18.2%) than to Cessnock (9.2%) and Maitland (4.8%) even though the majority of rural landholders reside in Cessnock and Maitland. Similarly, rural landholders assigned proportionately more science value to Newcastle (14.0%) than to Cessnock (5.4%) and Maitland (3.4%). We also found that urban landholders assigned proportionately more water value dots (20.3%) to Port Stephens LGA, even though the majority of urban landholders live in Newcastle and Lake Macquarie, which suggests this sub-group recognises the importance of freshwater reservoirs found in the Port Stephens LGA. Both rural and urban landholders assigned proportionately more food values to Maitland (27.4% and 20.5%, respectively) than any other LGA.

We examined whether there were significant differences between expected and observed value assignment by LGA. For both rural and urban landholders, the following values were significantly over-represented compared with expected counts: aesthetic value in Lake Macquarie, natural significance in Cessnock, cultural significance in Newcastle, food in Maitland, water in Maitland and Port Stephens, natural materials in Maitland, science in Newcastle and health in Lake Macquarie ($p < 0.05$). For both community types, the following values were significantly under-represented: recreation value in Cessnock, cultural significance in Port Stephens, water in Newcastle and Cessnock, natural materials in Port Stephens and Newcastle, and science in Cessnock. There were no instances where the values assigned by rural landholders in a given LGA were over-represented and the values assigned by urban landholders were under-represented.

Table 15 Comparison of the proportion of value dots assigned by rural and urban landholders to five LGAs

Value	Landholder	N	Newcastle	Port Stephens	Cessnock	Lake Macquarie	Maitland
Aesthetic	Rural	581	11.5%	11.3%	**15.8%+**	**16.9%+**	**9.2%-**
Recreation	Rural	515	**18.2%+**	12.1%	**9.2%-**	**16.2%+**	**4.8%-**
Biodiversity	Rural	477	11.6%	12.3%	12.7%	10.1%	**2.2%-**
Natural significance	Rural	426	**6.7%-**	10.8%	**13.1%+**	9.9%	**1.2%-**
Cultural significance	Rural	334	**10.6%+**	**4.4%-**	8.0%	5.6%	**13.7%+**
Food	Rural	370	**5.5%-**	8.7%	**7.6%-**	**5.8%-**	**20.5%+**
Water	Rural	365	**3.5%-**	**15.2%+**	**5.2%-**	**1.6%-**	**19.8%+**
Natural materials	Rural	219	**1.7%-**	**3.5%-**	**6.7%-**	4.9%	**9.4%+**
Science	Rural	321	**14.0%+**	7.2%	**5.4%-**	8.1%	**3.4%-**
Health	Rural	350	9.8%	7.7%	6.8%	**11.5%+**	6.5%
Intrinsic	Rural	358	6.8%	6.8%	9.4%	9.3%	9.4%
	Total	4316	100.0%	100.0%	100.0%	100.0%	100.0%
Aesthetic	Urban	518	13.8%	**10.2%-**	13.6%	**17.3%+**	9.0%
Recreation	Urban	482	14.1%	10.3%	**8.6%-**	**18.5%+**	8.5%
Biodiversity	Urban	441	10.8%	12.5%	12.8%	10.7%	**2.4%-**
Natural significance	Urban	399	8.7%	10.8%	**13.5%+**	9.4%	**1.9%-**
Cultural significance	Urban	315	**9.9%+**	**5.8%-**	6.8%	6.2%	**22.7%+**
Food	Urban	286	6.3%	7.2%	7.2%	5.4%	**19.4%+**
Water	Urban	298	**2.3%-**	**20.3%+**	**2.7%-**	**.9%-**	**17.1%+**
Natural materials	Urban	220	**1.7%-**	**3.7%-**	**10.8%+**	5.3%	**10.4%+**
Science	Urban	278	**11.8%+**	**5.3%-**	7.8%	**4.4%-**	**0.9%-**
Health	Urban	338	**11.4%+**	7.8%	**6.1%-**	**11.0%+**	**2.8%-**
Intrinsic	Urban	342	9.4%	**6.1%-**	10.0%	**11.0%+**	**4.7%-**
	Total	3917	100.0%	100.0%	100.0%	100.0%	100.0%

X^2 = Rural = 622.50***; X^2 Urban = 770.99***

Bolded numbers indicate significant differences between observed and expected values.

A positive symbol (+) indicates that observed values are significantly larger than expected and a negative symbol (-) indicates that observed values are significantly smaller than expected.

We repeated these analyses for the development preferences (Table 16). Overall, rural and urban landholders assigned proportionately more of their acceptable residential development preferences to Lake Macquarie and Cessnock (> 10.2%) and proportionately more of their inappropriate residential development preference dots to Port Stephens (> 15.5%). Industrial development was most preferred by rural landholders in the LGA of Newcastle and Maitland for Urban landholders (> 10.5%). Transport development was most acceptable to both landholder types in Newcastle (> 18.1%) and least acceptable in Cessnock (< 7.9%). Agricultural development was most acceptable to both landholder types in Cessnock and Maitland (> 12.5%), and tourism and conservation were most acceptable in Newcastle LGA (> 14.3%) across both landholder types. Within each LGA, industry and transport development was most acceptable in Newcastle, transport was most acceptable in Port Stephens and Lake Macquarie, agriculture was most acceptable in Cessnock and Maitland. Cessnock, Lake Macquarie and Maitland were LGAs with high potential for conflict in relation to residential development considering the high proportion of both acceptable and inappropriate development dots in these LGAs.

Table 16 Comparison of the proportion of development preference dots assigned by rural and urban landholders to five LGAs

Development Preference		N	Newcastle	Port Stephens	Cessnock	Lake Macquarie	Maitland
Accept resid dev	Rural	238	8.2%	**7.9%-**	10.2%	**19.2%+**	**16.4%+**
Inapp resid dev	Rural	243	**5.5%-**	15.5%	11.3%	11.0%	15.7%
Accept indust dev	Rural	196	**14.8%+**	**6.6%-**	10.1%	9.5%	10.5%
Inapp indust dev	Rural	189	7.7%	9.7%	10.7%	8.2%	8.0%
Accept trans dev	Rural	220	**18.1%+**	11.6%	**7.9%-**	11.7%	14.0%
Inapp trans dev	Rural	100	3.3%	6.6%	5.5%	4.1%	3.5%
Accept agric dev	Rural	174	**0.0%-**	**4.7%-**	**12.5%+**	**2.2%-**	**15.7%+**
Inapp agric dev	Rural	94	5.5%	5.8%	4.8%	5.4%	1.7%-
Accept tourism dev	Rural	205	14.3%	11.3%	10.0%	10.1%	7.3%
Inapp tourism dev	Rural	87	6.0%	**6.6%+**	4.0%	5.0%	**0.7%-**
Accept cons area	Rural	184	**14.3%+**	9.2%	10.0%	8.5%	**4.5%-**
Inapp cons areas	Rural	69	2.2%	4.5%	3.2%	5.0%	1.7%
	Total	1999	100.0%	100.0%	100.0%	100.0%	100.0%
Accept resid dev	Urban	201	**5.9%-**	8.5%	12.3%	13.4%	**21.8%+**
Inapp resid dev	Urban	219	8.8%	**16.8%+**	11.5%	14.5%	**6.8%-**
Accept indust dev	Urban	173	8.1%	10.7%	9.8%	9.1%	13.6%
Inapp indust dev	Urban	174	9.7%	10.2%	9.0%	10.2%	11.6%
Accept trans dev	Urban	204	**19.1%+**	10.2%	**6.1%-**	14.1%	9.5%
Inapp trans dev	Urban	69	**7.2%+**	4.7%	3.5%	2.3%	1.4%
Accept agric dev	Urban	136	**0.3%-**	5.5%	**16.2%+**	**3.4%-**	**14.3%+**
Inapp agric dev	Urban	77	4.4%	6.3%	4.3%	3.9%	1.4%
Accept tourism dev	Urban	192	**15.3%+**	11.8%	9.2%	9.5%	8.8%
Inapp tourism dev	Urban	76	4.4%	4.7%	4.7%	4.5%	1.4%
Accept cons area	Urban	181	12.8%	8.5%	10.2%	10.9%	7.5%
Inapp cons areas	Urban	58	4.1%	2.2%	3.3%	4.1%	2.0%
	Total	1760	100.0%	100.0%	100.0%	100.0%	100.0%

X^2 Rural = 192.76***; X^2 Urban =207.48

***Bolded numbers indicate significant differences between observed and expected values.

A positive symbol (+) indicates that observed values are significantly larger than expected and a negative symbol (-) indicates that observed values are significantly smaller than expected.

We also examined whether there were significant differences between expected and observed preference assignment by LGA. There was greater heterogeneity in preference assignment between landholder types. The following preferences were significantly over-represented for rural landholders: residential development in Lake Macquarie and Maitland, industrial and transport development as well as conservation preferences in Newcastle, agricultural development in Cessnock and Maitland, and tourism development in Port Stephens. The following preferences were significantly over-represented for urban landholders: residential development in Maitland, inappropriate residential development in Port Stephens, transport and tourism development in Newcastle, and agricultural development in Cessnock and Maitland.

A variety of preferences were also under-represented for rural and urban landholders. The following preferences were under-represented for rural landholders: inappropriate residential and agricultural development in Newcastle, residential, industrial and agricultural development in Port Stephens, transport development in Cessnock, agricultural development in Lake Macquarie and inappropriate agricultural and tourism development together with positive conference preferences in Maitland. The following preferences were under-represented for urban landholders: residential and agricultural

development in Newcastle, transport development in Cessnock, agricultural development in Lake Macquarie and inappropriate residential development in Maitland.

An alternative way of understanding the effect of spatial discounting on the assignment of values by rural and urban landholders is to examine the mean differences in distance each respondent type assigns their values and preferences from their place of residence. These analyses are explored in the following section.

7.1.2 *Mean differences in distance of social values and development preferences from place-of-residence assigned by rural and urban landholders*

We first examined the mean difference in the distance of value and preference dots assigned by each respondent from their place of residence. The place of residence represents the centroid of the land parcel owned or rented by the rural or urban landholder. Working from that location, we calculated the mean distance for the location of all the dots expressing social values and preferences for each respondent. A similar calculation was undertaken for development preferences for each respondent. We then summed all individual means to calculate the mean distance for all rural and all urban respondents for both values and preferences (Table 17) and graphed the results for both values (Figure 8) and preferences (Figure 9).

Table 17 Mean differences in distance of value or preference point from place of residence for rural and urban landholders.

Respondent Type	Number of Dots (N)		Mean Distance (km)			
Social Values	Rural Landholder	Urban Landholder	Rural Landholder	Urban Landholder	t	Total Mean Rank
Aesthetic	581	518	28.43 (6)	25.28 (10)	2.64**	7
Recreation	515	482	34.42 (1)	23.83 (11)	8.25***	5
Biodiversity	477	441	29.97 (3)	26.96 (4)	2.27*	4
Natural significance	426	399	29.79 (5)	28.34 (2)	1.03	3
Cultural significance	334	315	27.37 (8)	25.84 (9)	1.06	8
Food	370	286	24.81 (11)	27.33 (3)	-1.79	10
Water	365	298	25.19 (10)	26.17 (8)	0.02	11
Natural materials	219	220	27.78 (7)	30.58 (1)	-1.62	1
Science	321	278	33.59 (2)	27.06 (6)	3.71***	2
Health	350	338	29.84 (4)	26.73 (7)	1.90	6
Intrinsic	358	342	26.63 (9)	27.23 (5)	-0.39	9
Development preferences						
Acceptable residential dev	238	201	19.96 (9)	22.95 (7)	-2.17*	9
Inappropriate residential dev	243	219	18.19 (11)	22.70 (9)	-2.85**	10
Acceptable industrial dev	196	173	21.91 (7)	21.18 (10)	0.54	11
Inappropriate industrial dev	189	174	18.64 (10)	23.89 (6)	-2.78**	8
Acceptable transport dev	220	204	21.13 (8)	15.85 (12)	3.62***	12
Inappropriate transport dev	100	69	24.95 (5)	22.29 (8)	-0.10	3
Acceptable agriculture dev	174	136	17.13 (12)	31.08 (1)	-9.13***	5
Inappropriate agriculture dev	94	77	28.18 (2)	29.19 (2)	-0.32	2
Acceptable tourism dev	205	192	26.43 (4)	27.57 (4)	-0.58	4
Inappropriate tourism dev	87	76	30.35 (1)	29.10 (3)	0.39	1
Conservation preferences						
Acceptable conservation	184	181	23.71 (6)	20.70 (11)	1.58	7
Inappropriate conservation	69	58	27.97 (3)	25.67 (5)	0.73	6

Note: numbers in parentheses represent the rank order of value or preference means for each landholder type

We found significant differences in the mean distances of dot assignment between rural and urban landholders for recreation, science and aesthetic values. In each case, rural landholders assigned the value type a significantly larger distance from their place of residence than urban landholders ($t > 2.27$, $p < 0.05$). Indeed, rural landholders identified recreation values up to 1.5 times further from their residence than was the case for urban landholders ($t = 3.71$, $p < 0.001$).

We found similarities and differences in the ranks of the values between rural and urban landholders. Rural landholders assigned recreation value the largest distance from their place of residence, but this was assigned the shortest distance by urban landholders (11). This finding is inconsistent with research in Alaska, which found that recreation values were placed closest to one's place of residence across 12 Alaskan communities (Brown et al. 2002). In contrast, rural landholders assigned food values closest to their place of residence (11). This value was assigned the third largest distance from the place of residence by urban landholders (3). Similar mean distances exist between place of residence and biodiversity, natural and cultural significance across both sub-groups (Figure 8).

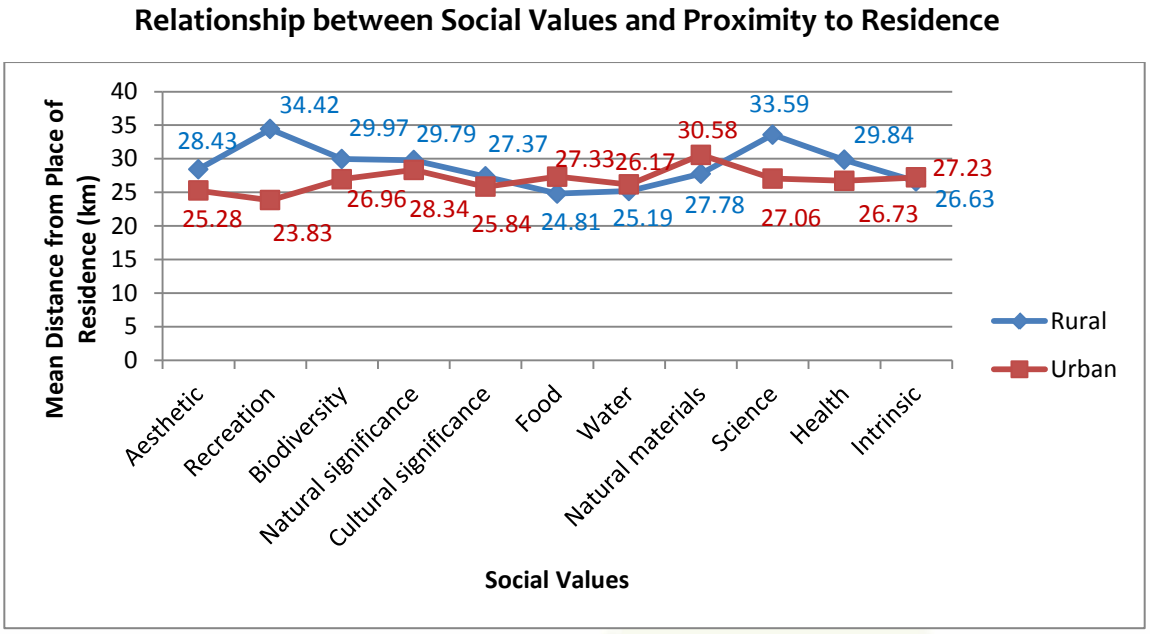


Figure 8 Mean differences in distance of value point from place of residence across rural and urban landholders.

Significant differences exist in the mean distances of four development preferences between rural and urban landholders. Rural landholders assigned acceptable and negative residential development, inappropriate industrial and acceptable agricultural preferences significantly closer to their place of residence than urban landholders ($t > 2.17$, $p < 0.05$). However, urban landholders assigned acceptable transport significantly closer to their place of residence than rural landholders did ($t = 3.62$, $p < 0.001$).

We also found similarities and differences in the ranks of the preferences between rural and urban landholders. Two out of the 12 preferences (acceptable agricultural development and acceptable conservation) showed large differences in ranks and the remaining 10 preferences (acceptable and inappropriate residential, industrial transport, tourism, inappropriate agricultural development and inappropriate areas for conservation) were ranked similarly. Overall, areas inappropriate for tourism development were assigned the greatest distance from place of residence, followed by negative agriculture and negative transport. Those preference dots assigned closest to ones place of residence include areas acceptable for transport, acceptable industrial and inappropriate residential (Figure 9).

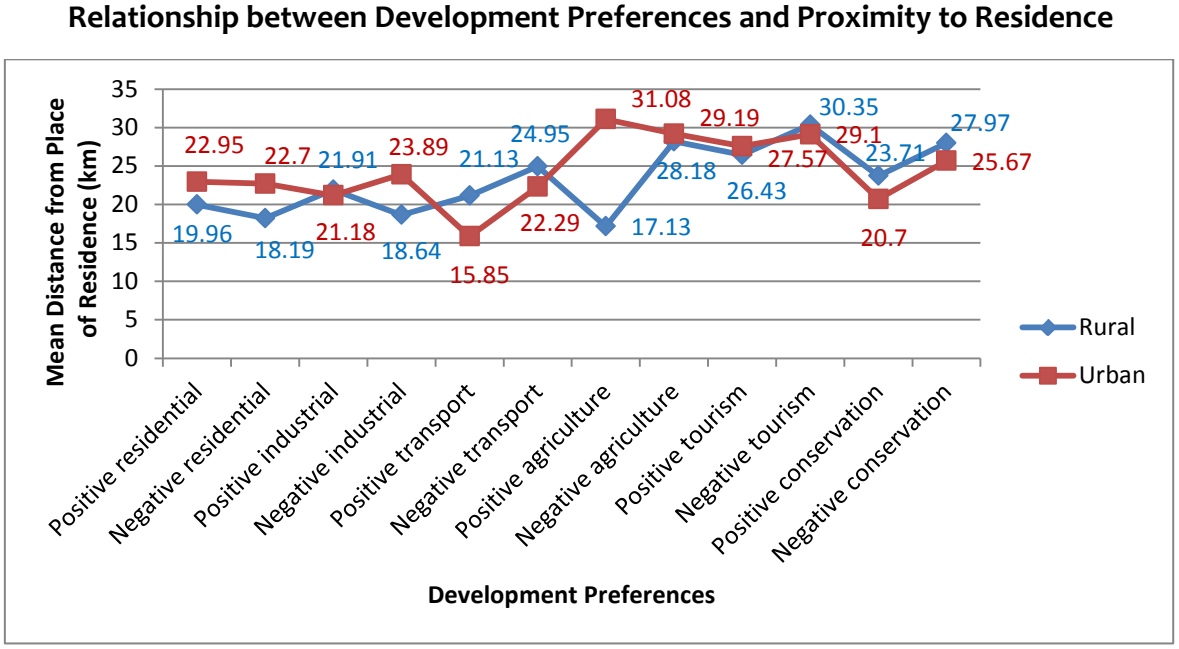


Figure 9 Mean differences in distance of preference point from place of residence across rural and urban landholders

7.1.3 The effect of LGA of residence and landholder type on the mean distance of value and preference dot assignment

In the previous section, we found that aesthetic, recreation, biodiversity and science values were assigned at significantly different distances from one's place of residence by rural and urban landholders. In this section, we examine whether LGA of residence also has an influence on these distance effects, and if so, whether the effect of LGA of residence is greater or lesser than the effect of landholder type. One may postulate that distances may vary from one LGA to another considering each LGA has different landscape characteristics that provide for different types of values such as recreation or aesthetics.

We examined the effect of both LGA of residence and landholder type on distance by constructing a univariate general linear model. The dependent variable in this model is the mean distance each value type was assigned from one's place of residence and the fixed factors were LGA of residence and landholder type (rural or urban). In each analysis, we controlled for value type. The results of the model enable one to test whether the distance landholders assign values from their place of residence is significantly affected by landholder type, LGA of residence or the interaction effect between landholder type and LGA of residence. An *F* statistic is generated for each of these main effects. We then repeated this analysis for the development preferences found to be significantly different in Table 17 (acceptable and inappropriate residential development, inappropriate industrial and acceptable transport, and acceptable agricultural development).

Overall, the model including LGA of residence and landholder type was a significant predictor of aesthetic value distance ($F = 4.23$, $p < 0.001$, Table 18). However, only LGA of residence was a significant main effect; both landholder type and the interactive effect of LGA of residence and landholder type had no significant effect on the model ($p > 0.05$). In contrast, LGA of residence and landholder type were both significant predictors of recreation value distance ($F > 6.03$), suggesting that distance in which recreation dots are assigned from one's place of residence is influenced not only by the LGA in which the respondent lives, but also whether they consider themselves to be urban or rural landholders.

The LGA of residence was a significant predictor whereas landholder type was not a significant predictor of biodiversity and science value distance.

Table 18 The effect of LGA of residence and landholder type on the distance values were assigned from place of residence

Value	Model Overall Significance (*F* –value)	LGA Residence	Landholder Type	LGA Residence* Landholder Type
Aesthetic	4.23***	5.68***	0.52	0.52
Recreation	13.04***	6.03***	12.09**	1.38
Biodiversity	4.71***	5.63***	0.01	1.92
Science	6.87***	7.10***	0.61	2.96*

Statistically significant effect of LGA of residence on distance, $F = 7.25$, $p < 0.001$, and statistically significant interaction effect of LGA of residence* landholder type, $F = 10.64$, $p < 0.001$.

Refer to Appendix E for the data underpinning these results.

Overall, landholder type was a stronger and more consistent predictor of preference distance than value distance. The LGA Area of residence, landholder type and LGA residence* landholder type were significant predictors of acceptable residential development ($F > 3.32$, Table 19) and acceptable agricultural development ($F > 7.61$). Landholder type ($F = 4.59$) but not LGA of residence was a significant predictor of inappropriate residential development distance and the interaction effect of LGA of residence and landholder type was the only significant predictor of acceptable transport development ($F = 3.32$).

Table 19 The effect of LGA of residence and landholder type on the distance preferences were assigned from place of residence

Development Preference	Model Overall Significance (*F* –value)	LGA Residence	Landholder Type	LGA Residence Landholder Type
Accept resid dev	5.26***	3.42**	18.00***	5.55**
Inapp resid dev	1.95*	1.13	4.59*	0.37
Accept agric dev	14.61***	7.61***	25.25***	1.21
Accept trans dev	4.42***	1.16	0.08	3.32*

Statistically significant effect of LGA of residence on distance, $F = 5.78$, $p < 0.001$, and statistically significant interaction effect of LGA of residence* landholder type, $F = 13.52$, $p < 0.001$.

Refer to Appendix E for the data underpinning these results.

7.2 Social Values Compatibility with Conservation Priorities in the Lower Hunter

Substantial research attention has been devoted to assessing conservation priorities using elements of conservation value, threat and more recently, cost effectiveness. However, few studies have spatially assessed the compatibility between these spatially-explicit conservation priorities and social values for places. Social, economic and ecological layers need to be considered together in order to ensure scientifically defensible and socially acceptable conservation planning outcomes. In this section, we present a method for understanding social values compatibility. It enables the identification of social values that are compatible, or not compatible, with conservation priorities located inside and outside of areas of MNES in order to enhance the social acceptability of conservation planning decisions by local actors, in this case rural and urban landholders and planning practitioners who live in the Lower Hunter Region. We acknowledge that social values are just one indicator of social acceptability; however, it provides an indication of the level of community support or opposition to conservation proposals.

7.2.1 Spatial overlay of social values with MNES frequencies

We overlaid the spatial layer for social values in the Lower Hunter collected through our research with MNES frequencies prepared by the Department of Sustainability, Environment, Water, Population and Communities. The intent of the MNES frequency analysis was to measure the frequency of occurrence of distinct MNES on the landscape. MNES value reflected a frequency count of distinct MNES [species/ecological communities/wetlands etc.] that occurred within each cell. They neither indicated species population or level of importance.

The following MNES data were used to derive the frequency values:

1. Threatened communities [known & likely] - this dataset indicates extent of distribution, not population;
2. Threatened species [known & likely] - this dataset indicates extent of distribution, not population; species point data was not used;
3. Migratory species [known & likely] - this dataset indicates extent of distribution, not population;
4. World heritage [declared];
5. National heritage [listed places]; and
6. Ramsar Wetlands.

These layers were provided to the research team by the Department of Sustainability, Environment, Water, Population and Communities. The main limitation of the MNES layers is that the frequency count of species in the MNES register was not based on ecological indicators derived from the conservation planning literature. Specifically, it was restricted to the extent of threatened, migratory, world heritage, national heritage and Ramsar listed species and not an assessment of other indicators such as species richness and species diversity. In future, we will undertake research to overlay the social values presented in this report with conservation priority layers generated using conservation planning theory.

Relative to other regions in Australia, the Lower Hunter contains a high frequency of species of MNES (see the Interim Biogeographic Regionalisation for Australia (DSEWPaC 2013) http://www.environment.gov.au/parks/nrs/science/bioregion-framework/ibra/). However, for statistical comparison purposes, we needed to generate arbitrary thresholds of low, medium and high MNES frequency for the Lower Hunter. These thresholds were generated using a 'natural breaks' classification in ArcGIS. Low MNES frequency refers to 500 m cells that contain 10-15 species of national significance; medium MNES frequency refers to 500 m cells that contain 16-20 species of national significance and high MNES frequency refers to 500 m cells that contain 20-28 species of national significance.

We then compared the overall number of value and preference dots assigned by the three respondent types to areas of low, medium and high MNES frequency. In this analysis, we compared the relative proportion of values and preferences assigned by each type and we controlled for the amount of dots assigned by each type.

After comparing the overall distribution of values and preferences, we then compared the relative proportions of specific values and preferences found in each MNES frequency category. To do this, we spatially joined the social value and development preference dots with the MNES frequency layer by converting the MNES frequency grid into polygons of low, medium and high MNES frequency based on the aforementioned threshold.

We found no significant proportional differences in the values and preferences expressed by the three respondent types in the Lower Hunter areas of low, medium and high MNES frequency (Table 20). We therefore focus on the associations between the overall number of value and preference dots mapped in areas of low, medium and high MNES frequency in the following analyses.

Table 20 Proportional differences in the total number of value and preference points mapped in areas of low, medium and high MNES frequency by the three respondent types

Respondent Type	N	Low MNES Frequency	Medium MNES Frequency	High MNES Frequency
Rural landholder	5,423	44.7%	43.7%	42.4%
Urban landholder	4,488	35.2%	37.0%	40.4%
Planning practitioner	2,390	20.1%	19.3%	17.2%
Total	12,301	100.0%	100.0%	100.0%

Proportionately more social values which support conservation (biodiversity, natural significance and intrinsic) were found in areas of medium and high MNES than low MNES, highlighting that respondents recognise that high and medium MNES areas are important for conservation (Table 21). Areas of high MNES also contained a higher proportion of aesthetic and recreation value dots than low MNES areas (17.0% versus 10.4%; 13.6% versus 9.4%), highlighting the visual appeal of these areas and their importance for passive forms of recreation. No proportional differences in natural materials, science and health values were found across the three MNES.

Areas of low MNES frequency were more aligned with productive uses of the land (Table 21). For example, proportionately more food and water values were assigned to areas of low MNES frequency than to areas of high and medium MNES. Overall, these value results suggest that the protection of medium and high MNES areas will be socially acceptable amongst urban and rural landholders.

We then examined the proportional differences in development preferences across the three MNES areas. Biodiversity and natural significance values were significantly over-represented in medium (13.8% and 13.6%) and high (15.9% and 15.1%) MNES frequency areas compared to expected values, and under-represented in low MNES frequency areas (8.0% and 7.3%) (Table 21). Conversely, areas perceived to be inappropriate for residential and agricultural development were over-represented in areas of medium (15.7% and 6.4%) and high (16.7% and 8.4%) MNES frequency. As expected, inappropriate transport development preferences and acceptable conservation preferences were over-represented in areas of high MNES frequency (7.4% and 14.3%). Overall, these development preference results suggest that Lower Hunter residents support the conservation and protection of areas of medium and high MNES frequency in the Lower Hunter.

Table 21 Proportional differences in the number of social values and development preferences assigned in areas of low, medium and high MNES frequency

Spatial Attribute	N	Low MNES Frequency	Medium MNES Frequency	High MNES Frequency	X^2
Social Values					
Aesthetic	988	**10.4%-**	13.0%	**17.0%+**	789.01
Recreation	808	9.4%	9.0%	**13.6%+**	($p < 0.001$)
Biodiversity	882	**8.0%-**	**13.8%+**	**15.9%+**	
Natural significance	834	**7.3%-**	**13.6%+**	**15.1%+**	
Cultural significance	677	**10.5%+**	7.7%	**4.4%-**	
Food	647	**11.3%+**	6.9%	**1.4%-**	
Water	804	**15.8%+**	**5.0%**	**1.5%-**	
Natural materials	549	7.5%	6.2%	6.3%	
Science	579	6.6%	**8.7%+**	7.4%	
Health	535	6.1%	7.0%	**8.2%+**	
Intrinsic	643	**7.2%-**	9.1%	9.3%	
Total	7,946	100.0%	100.0%	100.0%	
Development Preferences					
Acceptable residential dev	537	12.9%	12.5%	**5.8%-**	207.13
Inappropriate residential dev	530	**10.1%-**	**15.7%+**	**16.7%+**	($p < 0.001$)
Acceptable industrial dev	458	**12.3%**	**7.6%-**	**3.7%-**	
Inappropriate industrial dev	408	9.1%	9.4%	10.3%	
Acceptable transport dev	507	12.5%	10.9%	**6.1%-**	
Inappropriate transport dev	210	4.1%	5.8%	**7.4%+**	
Acceptable agricultural dev	393	**10.4%+**	**6.6%-**	**4.2%-**	
Inappropriate agricultural dev	207	**3.6%-**	**6.4%+**	**8.5%+**	
Acceptable tourism dev	386	9.5%	**6.5%-**	9.5%	
Inappropriate tourism dev	181	**3.3%-**	4.8%	**8.7%+**	
Acceptable conservation	399	**7.8%-**	10.8%	**14.3%+**	
Inappropriate conservation	176	4.3%	3.0%	4.8%	
Total	4,392	100.0%	100.0%	100.0%	

Bolded numbers indicate significant differences between observed and expected values.

A positive symbol (+) indicates that observed values are significantly larger than expected and a negative symbol (–) indicates that observed values are significantly smaller than expected ($p < 0.05$).

7.3 Spatial Overlap between Proposed Urban Lands and Social Values and Development Preferences

The Department of Planning and Infrastructure (NSW) provided access to a spatial layer identifying the boundaries of lands proposed for development under the 2006 Lower Hunter Regional Strategy. Some of this land has been developed, whereas others remain undeveloped. In this section, we explain and report on analysis combining the map of proposed urban land development and social values and development preferences. The urban development polygons presented by the Department of Planning and Infrastructure (NSW) distinguish between residential and industrial land-uses. Initially we focus on whether the values and preferences fall within urban lands irrespective of use. We then present indices that enable the identification of potential conflict with regards to specific residential or industrial development proposals (see Section 7.3.1).

The first aim was to assess consistency between the proposed urban lands and social acceptability of land-use. We examined the level of consistency by assessing the proportion of each value and preference found within or outside urban lands with respect to the number of other values and preference dots found inside and outside them (Table 22). The proportions were generated by intersecting the polygons defining the proposed urban lands with the value and preference dots. Points

located inside these polygons were assigned a '1'. We then joined the resulting maps with those points located outside the proposed urban lands. We assigned these points a '0'. Results were exported into SPSS for cross-tabulations of values against a variable marking whether the points were located inside (1) or outside (0) these polygons. Only 2% of value and preference dots were located inside the proposed urban lands and therefore we were restricted to examining proportional differences of all values and preferences outside or inside proposed urban lands to determine the relative proportion of all value and preference dots found inside and outside of the 2006 Lower Hunter Regional Strategy proposed urban lands.

Acceptable residential (23.0%) and industrial development (16.1%) were significantly over-represented within the proposed urban lands (Table 22). However, agricultural (5.0%) and tourism development (2.9%) were significantly under-represented in proposed urban lands, as were conservation preferences (5.8%). Natural materials value was significantly over-represented in proposed urban lands (17.0%) but recreation (7.0%), natural significance (4.8%) and science values (3.5%) were significantly under-represented. Social values and development preferences therefore appear consistent with the intended residential and industrial uses of the proposed urban lands.

Table 22 Proportions of social values and development preferences found inside and outside of new urban land allocations proposed in the 2006 Lower Hunter Regional Strategy (LHRS)

Spatial Attributes	N	Outside 2006 LHRS Proposed Urban Lands	Inside 2006 LHRS Proposed Urban Lands	X^2
Social Values				
Aesthetic	1,328	12.9%	16.2%	77.89
Recreation	1,215	12.0%	**7.0%-**	($p < 0.001$)
Biodiversity	1,132	11.2%	7.4%	
Natural significance	1,026	10.2%	**4.8%-**	
Cultural significance	821	8.0%	9.6%	
Food	804	7.9%	7.0%	
Water	822	8.0%	9.2%	
Natural materials	567	5.3%	**17.0%+**	
Science	755	7.5%	**3.5%-**	
Health	852	8.3%	9.6%	
Intrinsic	882	8.6%	8.7%	
Total	10,204	100.0%	100.0%	
Development Preferences				
Acceptable residential dev	547	10.5%	**23.0%+**	129.92
Inappropriate residential dev	573	11.5%	**18.0%+**	($p < 0.001$)
Acceptable industrial dev	468	9.3%	**16.1%+**	
Inappropriate industrial dev	445	9.5%	7.1%	
Acceptable transport dev	531	11.1%	11.9%	
Inappropriate transport dev	224	5.0%	**1.6%-**	
Acceptable agricultural dev	395	8.6%	**5.0%-**	
Inappropriate agricultural dev	221	4.8%	**2.1%-**	
Acceptable tourism dev	506	11.3%	**2.9%-**	
Inappropriate tourism dev	211	4.5%	3.2%	
Acceptable conservation	467	10.1%	**5.8%-**	
Inappropriate conservation	185	3.9%	3.2%	
Total	4,773	100.0%	100.0%	

Bolded numbers indicate significant differences between observed and expected values.

A positive symbol (+) indicates that observed values are significantly larger than expected and a negative symbol (–) indicates that observed values are significantly smaller than expected ($p < 0.05$).

7.3.1 Potential for residential and industrial development conflict in the Lower Hunter

Land-use conflicts emerge as a result of different values and preferences for the use of areas. The journey towards regional sustainability inevitably requires addressing the potential for land-use conflicts between conservation and urban development, and between different types of urban development. In this section, we examine two difference indices for examining the potential for conflict between residential and industrial development preferences. We chose these two preferences because they were most frequently mapped by survey respondents and are therefore the most powerful in statistical analyses. The first index focuses on development preferences as a measure of conflict potential. The second index focuses on the interactions between development preferences and values as a measure of conflict potential. Each index and associated outputs was generated by Associate Professor Greg Brown from the University of Queensland. For further information about these indicators, refer to Brown and Raymond (under review).

7.3.1.1 Development preferences as an indicator of conflict potential

The first index of conflict potential focused on the distribution and intensity of acceptable and inappropriate industrial and residential development dots. With this approach, the numeric *difference* between the number of mapped preferences (acceptable and inappropriate) for a particular land use was used to measure the overall directionality of the land use preference as well as the level of agreement with the proposed land use. A preference score (*PS*) was generated for each sampling grid cell. The magnitude of the preference difference was assumed to be a proxy for conflict potential with larger quantitative differences between acceptable and inappropriate uses indicative of greater agreement (less ambivalence) on the land use and hence, less potential conflict. For each sampling grid cell, the number of inappropriate preferences was subtracted from acceptable preferences. The resulting sign (positive or negative) determined the directionality of the land use preference (acceptable or inappropriate). The level of agreement for a particular land use within a sampling grid cell (which could be either acceptable or inappropriate) was computed as a ratio of preference points that varies between zero and one. The smallest number of the acceptable or inappropriate land use preferences became the numerator in the ratio while the largest number became the denominator. A ratio value of one (equal number of acceptable and inappropriate preferences) reflected the lowest level of agreement, or alternatively, the highest degree of ambivalence toward the land use in that location, while values approaching zero represented the highest degree of land use preference agreement. For example, a sampling grid cell with three points favouring residential development and three points inappropriate residential development had a ratio of 3:3 or one, the largest ratio possible and thus, the least agreement as to the prospective land use. In contrast, a sampling grid cell with one acceptable land use preference point and five inappropriate preference points had a ratio of 1:5 or 0.2, indicating a higher level of agreement or concurrence with the prospective land use. The logic was that the greater the mapped ambivalence regarding a particular land use, the larger the preference difference ratio, and the greater the potential for conflict for the particular land use in that area. To handle the case where the numerator preference may be zero but the denominator is not, the numerator value was set to a small, non-zero value of 0.1. A cell with no preference data had a true ratio of zero, which equates to no information about land use preferences.

The preference equation is

$$PS = \frac{MAX(MIN(P_S, P_O), 0.1)}{MAX(P_S P_O)}$$

where PS is the preference score per cell, P_S is the number of preferences supporting the land use, P_O is the number of preferences inappropriate the land use, and MAX and MIN are functions to select the largest and smallest of two numbers, respectively.

7.3.1.2 Values and preferences combined as an indicator of conflict potential

With this approach, land use preferences that identify the level of agreement (acceptable or inappropriate) in an area, were amplified by the number of social values expressed in the same area. To operationalise, the preference scores (PS) in each sampling grid cell were multiplied by the number of social values located in the sampling grid cell. The resulting preference and value score (PV) for each cell represents a conflict potential index on a continuous scale with higher scores associated with higher conflict potential.

$$PVS = \frac{MAX(MIN(P_S, P_O), 0.1)}{MAX(P_S P_O)} * V_c)$$

where PV is the preference and value score per cell, P_S is the number of preferences supporting the land use, and P_O is the number of preferences opposing the land use, and Vc is the total count of all social values in the cell.

Results of the preference multiplied by values conflict index indicated place-specific differences in the level of potential for land-use conflict at a 2 km grid resolution. We presented the potential for residential development conflict as a case-in Figure 10. To evaluate the validity of the index, we identified whether the index highlighted known areas of community concern (reference sites) regarding land-use proposals (Table 23). These reference sites were marked with stars on Figure 10. To do this, we identified whether the index flags each proposal as an area of high land use conflict potential (top 10% of preference dots for the respective land-use). Catherine Hill Bay, Branxton-Huntlee, Thornton North, Cooranbong, Lochinvar and Anambah were all identified as high conflict potential for both residential and industrial development. North Raymond Terrace, Bellbird and Newcastle Airport Employment Zone were identified as areas of high potential conflict for residential development. The Hunter Economic Development Zone (Kurri Kurri) and Togago Employment Zone were identified as areas of high potential conflict for industrial development. The consistency of the results suggest that the method is a reliable way of identifying potential for land-use conflict and therefore can be used to predict conflict in grid cells outside of these reference sites. However, the method does not identify land-use conflicts that are driven by non-local stakeholders (that is, other community types).

Table 23 Evaluation of development reference sites within study region by the preference magnified by values conflict potential method. The marks indicate reference sites that were flagged as an area of high land use conflict potential (top 10%) with the method.

Site/Project	Development Type	Conflict Potential Mapping Method	
		Preferences + Values (Res)	Preferences + Values (Ind)
Catherine Hill Bay	Residential	*	*
Branxton–Huntlee (up to 7,200 dwellings)	Residential	*	*
Thornton North (up to 7,000 dwellings)	Residential	*	*
North Raymond Terrace (up to 5,000 dwellings	Residential	*	
Bellbird (up to 4,000 dwellings)	Residential	*	
Cooranbong (up to 3,000 dwellings)	Residential	*	*
Lochinvar (up to 5,000 dwellings)	Residential	*	*
Anambah (up to 4,000 dwellings)	Residential	*	*
Wyee (up to 2,000 dwellings)	Residential		*
Hunter Econ. Dev. Zone (Kurri Kurri)	Industrial		*
Newcastle Airport Employment Zone	Industrial	*	
West Wallsend Employment Zone	Industrial		
Tomago Employment Zone	Industrial		*

Table prepared by Associate Professor Greg Brown

Map of Potential Conflict

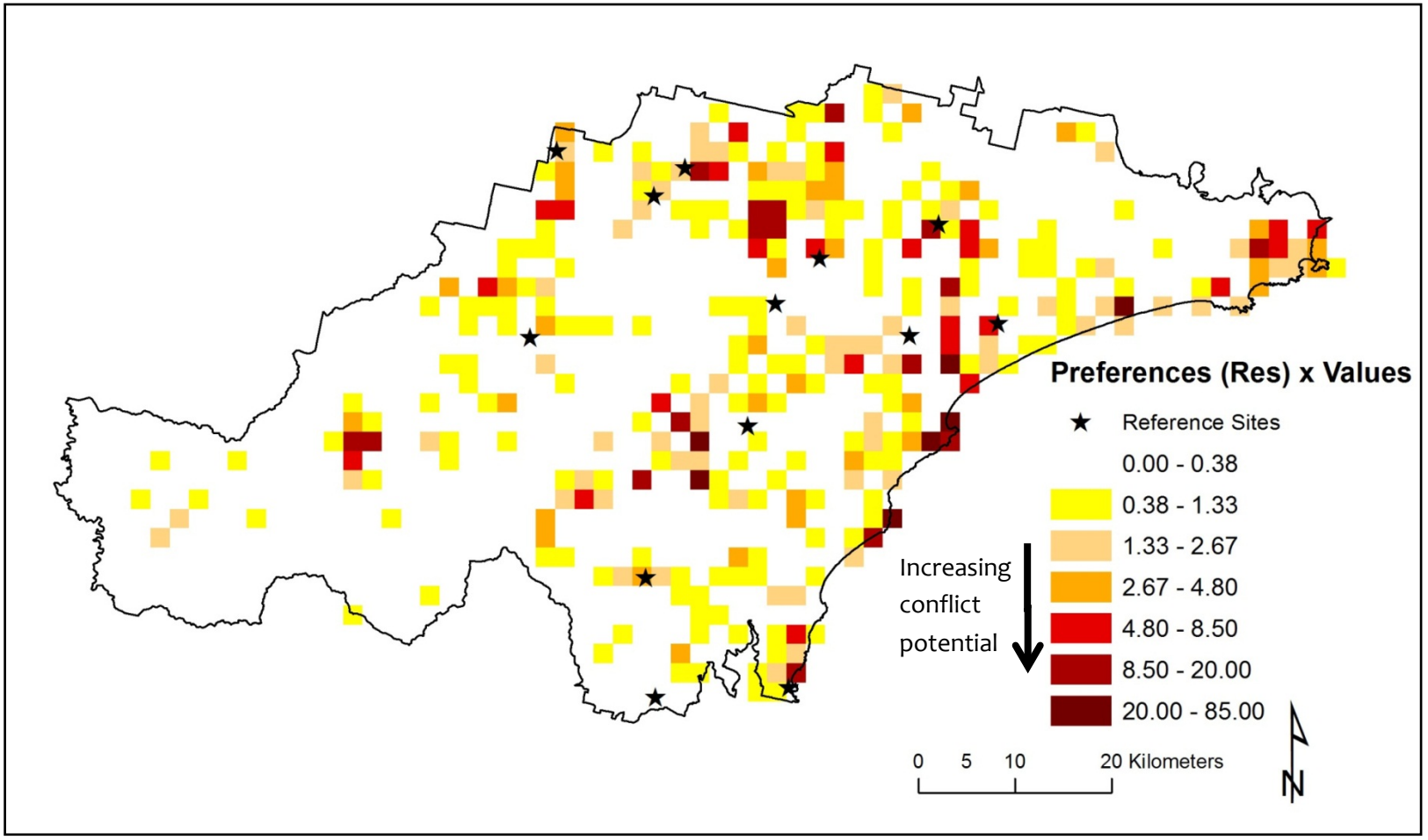


Figure 10 Map of conflict potential for residential development derived from the difference in mapped residential development preferences (in each sampling grid cell) that are amplified (multiplied) by the number of social values mapped in each cell. Larger numbers on the index indicate increasing residential conflict potential.

Figure prepared by Associate Professor Greg Brown

8 Discussion and Conclusions

In this section of the report, we focus on providing a response to each of the key aims of this research:

1. Identify and map the values assigned by multiple community types to natural and built features in the Lower Hunter region;
2. Develop a robust methodology for eliciting community values for natural and built features which can be applied in multiple regional planning contexts; and
3. Provide information and a series of policy recommendations that can be used to inform the Lower Hunter Regional Sustainability Plan, including a reliability check of sites tagged for conservation and regional development.

We have elected to address the third aim in two sub-sections. We discuss findings related to a reliability check of sites tagged for conservation and regional development. We then provide a series of policy recommendations relevant to the wider survey findings.

8.1 Values Assigned by Multiple Community Types to Natural and Built Features in the Lower Hunter

Previous public participation GIS studies have investigated the distribution and intensity of values assigned to places by single community types (for example, residents or visitors). This study is one of the first to compare and contrast values across urban and rural landholders and planning practitioners. The primary means for identifying values was by participants placing dots on maps (see Appendix D).

The proportion of total dots assigned by each community type was closely associated with their LGA of residence, suggesting that rural and urban landholders and planning practitioners each tend to assign values closer to where they live rather than further away. For example, 35.4% of rural landholders lived in Cessnock LGA and 36.3% of all value and preference dots mapped by this sub-group were assigned to this sub-region. In contrast, only 0.7% of rural landholders lived in Newcastle and only 0.1% of all rural landholder value and preference dots were assigned to this LGA. The tendency to place values and preferences close to one's place of residence made it difficult to compare the assignment of urban and rural landholder values across the whole region; however, the results are still representative of the values and preferences that Lower Hunter residents assign to the region.

We then examined the mean distance from place of residence (that is, property parcel) in which rural and urban landholders and planning practitioners assign their values and preferences. We found no significant differences between rural landholders and planning practitioners on the mean distances from place of residence for each type of value and preference. We therefore decided to focus the remainder of the distance analyses on the rural and urban landholder sub-groups.

We examined whether rural and urban landholders assigned each value and preference at a different distance from their place of residence. Generally, both rural and urban landholders assigned development preference dots closer to their place of residence than value dots. Areas of acceptable and inappropriate residential and industrial development were assigned the closest to one's place of residence (reflecting the extent of the perceived risk of that development) and areas of acceptable and inappropriate tourism development furthest away. A variety of value types including biodiversity, natural significance, cultural significance, food, water and intrinsic values were all located around the 25 km range from rural and urban landholders' place of residence, highlighting the importance for

managing natural assets for a range of values in close proximity to residences in the Lower Hunter. Watagans National Park, Yengo National Park, Heaton and Awaba State Forests, Tomaree National Park and the Hexham Swamps consistently emerged as areas of high biodiversity, natural significance and intrinsic value. Areas along the coastline between Nelson Bay and Catherine Hill Bay were identified as additional hotspots of intrinsic value. Cultural significance tended to be clustered around Newcastle and Maitland, and water around key reservoirs in the north-east of the region. Established agricultural areas in the Lower Hunter wine region, Maitland region, Newcastle and Blacksmiths Point were identified as areas of high food value.

Rural landholders were prepared to travel 1.5 times the distance of urban landholders in order to undertake recreational pursuits ($t = 3.71$, $p < 0.001$). Similar distance trends were found for aesthetic values. One plausible explanation is that those areas of high recreation value are also areas of high aesthetic value. This view is supported by the density maps, which highlight hotspots of aesthetic value in Watagans National Park, Newcastle and Catherine Hill Bay Area. When planning for regional sustainability, it is therefore important to consider recreational opportunities for rural landholders that extend beyond their LGA of residence.

We also found that urban landholders placed areas of acceptable transport development significantly closer to their place of residence than rural landholders, whereas rural landholders assigned areas of acceptable agricultural development closer to their place of residence. These results suggest a preference for new and reliable forms of transport in urban areas and new forms of agricultural development in rural areas of the Lower Hunter.

8.2 Applicability of the Community Values Mapping Method for Regional Sustainability Planning in Australia

We evaluate the success of the social values and development preference method for regional sustainability planning on four criteria: 1) the effort required to obtain a representative survey response; 2) the validity and reliability of the survey results and 3) the extent to which the methods can be applied in other regions, and; 4) extent to which the approach generated new knowledge that could inform policy and management in relation to regional sustainability planning.

8.2.1 Survey Response

A high survey response rate is important to ensure that the results of the survey can be extrapolated across the region under assessment. Previous applications of the mail-based values mapping method in Australia have achieved response rates greater than 40%. The current study achieved a survey response of 40% after significant effort involving:

1. Provision of a complimentary set of postage stamps;
2. Postage of three reminder postcards after the mailing of the first survey packet;
3. Personal phone call to remind participants to respond to the survey and, if refused, to obtain a reason for refusal; and
4. One final reminder postcard after the mailing of the second survey packet.

This research was completed within a very short time-frame that limited the time available to develop and pre-test the survey and to access an up-to-date mailing list. In previous studies, Raymond, Brown and colleagues have not had to remind non-participants about the survey via telephone. The difficulty in obtaining responses in this survey can be attributed to:

1. The initial data file contained a high proportion (> 20%) of non-identifiable addresses, resulting in a high rate of return to senders;
2. We were unable to personalise the first survey packet because we did not have access to participant first and last names;
3. Part of the sample was targeted to urban landholders employed in manufacturing and retail sectors who are generally more reluctant to respond to surveys than urban landholders with professional backgrounds or rural landholders; and
4. The survey contained some challenging topics that may have 'turned-off' some participants.

To increase survey response in future studies, we recommend:

1. Acquiring an up-to-date mailing list of survey participants, including first and last names, prior to commencing the mailing process. Ideally, that list is provided by state agency or local government partners who are custodians of those types of lists. This may also involve engaging a consultant to phone survey participants ahead of time to gauge their willingness to participate and to obtain first and last names;
2. Undertaking further piloting of the survey with urban and rural landholders who are not from farming, natural resource management or land-use planning backgrounds to ensure that survey questions, particularly biodiversity offset questions, are accessible to them;
3. Stratifying the target sample into age groups (for example, 18-34, 35-49, 50-64, > 65) to ensure that a diversity of age cohorts are represented; and
4. Concurrently conducting workshops with quieter voices (for example, the elderly, unemployed and lone parents) to encourage a wider response from different sections of the community, including those who are less formally educated.

Despite these challenges, we believe that the mapping method is applicable to other study areas with an interest in regional sustainability planning. It is one of the first methods of its kind that can systematically assess and map values, attitudes and preferences in relation to land-use, conservation, transport and infrastructure planning and provides a platform for linking social values with other planning inventories, such as ecological value assessments. Future research could experiment with online, mail-based and workshop mapping environments to increase the breadth of respondent groups. For example, researchers could engage school students in value and preference mapping through workshops undertaken in school computer labs. School students could be provided with access to an online mapping tool. A link to an online mapping tool could be sent out to participants in the 18-49 age group who may be less willing to respond using a paper-based approach.

8.2.2 Validity and reliability of survey results

Overall, we believe that the results of the survey are valid and reliable. Despite the slight bias toward older and more knowledgeable residents in the Lower Hunter, the majority of survey participants responded to all questions in the survey. There was little evidence of response bias, such as responding to statements with a consistently high or low score. There was also little evidence of non-response bias, with no evidence of a signal as to why participants did not respond to the survey. Follow-up telephone interviews revealed that participants found some of the questions quite complex, particularly statements related to biodiversity offset policy. These statements may require simplification in future studies. Statement wording could be refined through additional pilot surveys.

This study was the first to map areas of both acceptable and inappropriate development across a range of types. The mapping of areas acceptable for development appears to have high face validity (preference statements were well understood) considering the high number of acceptable preference dots mapped by rural and urban landholders (see Figure 7). Some revisions may need to be made to the inappropriate development preferences, particularly questions that ask respondents to map areas of inappropriate transport, agriculture and tourism development, as well areas unacceptable for conservation. Each of these inappropriate preferences were conceptually challenging for survey respondents to map, as shown by the lower number of dots assigned for these preference types (see Figure 7).

The results of this study appear consistent with previous studies. Like other studies, aesthetic and recreation values were most frequently mapped by survey participants, and health and intrinsic values less frequently mapped. Further, direct use values such as recreation and health tended to be more clustered on the landscape than indirect use values such as intrinsic value (see Brown & Weber 2011; Brown 2012; Raymond & Brown 2007).

8.2.3 Extent to which the mapping method can be applied in other regions

The community values mapping method reported on here has now been applied in over 20 applications and across conservation, development, tourism and regional land-use planning contexts using paper, internet and workshop data collation modes (see Table 24). It has also been widely adopted by the US Forestry Service (for example, Brown & Reed 2012) as a way of systematically integrating social values into forestry planning. In this light, the method is adaptable to a range of regional sustainability planning problems and contexts. In this report, we have provided a detailed explanation of the community values mapping approach and therefore believe that a capable social scientist with GIS expertise could apply it to other regions in Australia. The work can be undertaken at a cost of $180,000 per region, which is cheap considering the vast amount of spatially referenced social data collated as part of the project.

The majority of studies to date have focussed on representative samples of households, rather than specific interest groups such as planning practitioners. Future research could tailor the social value mapping method to mining and non-local conservation non-government organisations so as to enable more effective comparisons among communities of place, interest, practice and identity. The focus on specific community types is expected to provide insights more relevant to policy and management of the environment, particularly for those interested in scanning for potential conflicts and opportunities. We are a not aware of applications that have applied the social value mapping method presented here to the elicitation of Indigenous values. This is an important gap to be addressed in partnership with

researchers and practitioners with well-established relationships with Indigenous communities in Australia. Such studies could develop an expanded typology of values and preferences to be considered in regional sustainability planning. However, we discourage the trading-off of value types assigned by Indigenous and non-Indigenous Australians.

This study assumed that any given type of development was acceptable or inappropriate; however, preferences may change according to the types, methods and scales of regional development. We therefore recommend future studies consider the measurement of preferences across not only different types, but also different scales and methods of development, such as tourism development and mining development.

Table 24 The application of the social values mapping method in other contexts

Year	Method	Location	Attributes Mapped
2013	Internet (Google Maps)	Tongass National Forest	Social values, forest management preferences
2013	Internet (Google Maps)	Adelaide, Australia	Urban park physical activities, park benefits, climate change behaviour
2013	Internet (Google Maps)	New South Wales, Australia	Mountain bike and horse riding behaviour and track preferences
2012	Paper	Lower Hunter region, NSW	Social values and development preferences
2012	Internet (Google Maps)	Alaska (USA) and California (USA)	Social values, forest management preferences
2011	Internet (Google Maps)	Southland and Otago regions, NZ	Social values, experiences, development preferences
2010	Internet (Google Maps)	Southwest Victoria, Australia	Park activities and perceived environmental impacts
2010	Internet (Google Maps)	Grand County, Colorado	Ecosystem services
2009	Internet (Flash)	Victoria, Australia	National park experiences and environmental impacts
2007	Internet (Flash)	Mt Hood. National Forest, Oregon	Social values
2007	Internet (Flash)	Deschutes National Forest, Oregon	Social values
2007	Internet (Flash)	Coconino National Forest, Arizona	Social values
2006	Paper/Workshop	Southern Fleurieu, South Australia	Social values and perceived climate change risks
2006	Paper	Murray River, Victoria, Australia	Social values
2005	Paper	Otways region, Victoria, Australia	Social values and development preferences
2004	Paper	Kangaroo Island, South Australia	Social values and development preferences
2003	Paper	Anchorage, Alaska	Parks and open space values
2002	Paper	Kenai Peninsula, Alaska	Social values and activities
2001	Paper	Alaska Statewide	Highway qualities; best/worst places
2000	Paper	Prince William Sound, Alaska	Coastal landscape values
1998	Paper	Chugach National Forest, Alaska	Social values

8.3 A Reliability Check of Sites Tagged for Conservation and Development

This study revealed that areas of medium and high MNES are acceptable to Lower Hunter residents for conservation. Proportionately more social values which support conservation (biodiversity, natural significance and intrinsic) were found in areas of medium and high MNES than low MNES, highlighting that respondents recognised that high and medium MNES areas were important for conservation. Biodiversity and natural significance values were significantly over-represented in medium (13.8% and 13.6%) and high (15.9% and 15.1%) MNES frequency areas compared to expected values and under-represented in low MNES frequency areas (8.0% and 7.3%). Areas perceived to be inappropriate for residential and agricultural development were over-represented in areas of medium (15.7% and 6.4%) and high (16.7% and 8.4%) MNES frequency. However, there were areas of potential conservation conflict, as highlighted in purple in Figure 5. These purple areas represent areas of medium-high MNES and medium-high acceptable development preference. Catherine Hill Bay and Coorangbong, in particular, represent areas of high potential conservation conflict and could be starting points for engaging with local communities about conservation values and threats.

The study also revealed that proposed urban lands in the 2006 Lower Hunter Regional Strategy were generally acceptable for development (Figure 4); however, all reference sites were not without potential for conflict (Table 23). Results of analysis using the preference multiplied by values conflict index indicated place-specific differences in the level of potential for land-use conflict at a 2 km grid resolution. We presented the potential for residential development conflict as a case-in Figure 10. The modelling of potential residential development conflict highlighted a suite of dark red 2 km grid cells across the Lower Hunter landscape, which signified areas of high potential conflict. These areas could be starting points for the management of residential land-use conflicts. It is important to note that many of these areas of residential development conflict also emerge as conservation values conflict in Figure 4.

Finally, we considered opportunities for the expansion of native habitat and conservation corridors in the Lower Hunter Region. Based on the conservation preferences, the Lower Hunter coastline and the areas buffering Corrabare State Forest and Olney and Awaba State Forest appear promising for conservation of native plants and animals outside of the 2006 Lower Hunter Regional Strategy conservation corridor. The area around Branxton appeared promising for the conservation of native plants and animals within the conservation corridor. Areas north-east of Tilgerry Conservation Area were not areas of high perceived conservation value or preference, even though they are contained within the 2006 Lower Hunter Regional Strategy conservation corridor.

8.4 Future Delivery of the Community Values Mapping Method

Section 6 of this report highlighted a number of strengths, weaknesses and future research directions of the community values mapping method. Here we focus on some key learnings for the Department of Sustainability, Environment, Water, Population and Communities:

1. The provision of a clean database of names and addresses is a key to the success of the method. For a number of reasons (including time constraints), we were unable to access such a database for this research. We therefore encourage the department to consider the inclusion of a clause in future agreements with partner state agencies which requires the provision of cadastral databases containing the longitude and latitude coordinates and property identity number of

each parcel and the names and address of each parcel/property owner. When it is not possible to access such a database, additional project funds need to be made available to the research team ($20,000) to collate a clean database of names and addresses. This can be achieved by using electoral rolls and hiring a telephone survey consultant to ring all households to check the addresses and individual's names;

2. The community values mapping method has not yet been applied to the consideration of non-local community stakeholders, Indigenous values and the values of specific interest groups such as mining interests and conservation non-government organisations. The Department of Sustainability, Environment, Water, Population and Communities could consider engaging researchers to expand the method to engage these wider stakeholders in regional sustainability planning in other areas of Australia;
3. Alternative environments for eliciting community values are available to the Department of Sustainability, Environment, Water, Population and Communities, including online-mapping and workshop platforms, and focus groups with selected key stakeholder representatives. The Department of Sustainability, Environment, Water, Population and Communities could experiment with the use of multiple mapping platforms in order to engage a wider range of rural and urban landholders in regional sustainability planning; and
4. There is potential to spatially integrate the social values and preference data presented here with ecological values collated and modelled by ecologists. One of the wider benefits of this project is the current collaboration between researchers at the NERP Environmental Decisions Research Hub and NERP Landscape Policy Research Hub. Researchers including Amy Whitehead (University of Melbourne), Heini Kujala (University of Melbourne), Christopher Ives (RMIT University), Ascelin Gordon (RMIT University), Pia Lentini (University of Melbourne) and Christopher Raymond (Charles Sturt University and Enviroconnect) are currently developing methods for integrating social values as benefits to conservation and development preferences as costs to conservation within a zonation conservation prioritisation tool. This tool enables policy makers to determine land-use trade-offs, such as the proportion of the landscape or species distributions that will be lost (or gained) as a result of the consideration of policy scenarios that include social values and development preferences. The results of this work were recently presented by Dr Raymond to a departmental seminar and will be available in the near future as a journal publication (see Whitehead et al. in review). It is recommended that the department support this integrated analysis in other regions as part of future regional sustainability plans, or in other policy applications as noted in Section 8.6.

8.5 Policy Implications

The community values mapping method presented here generated new knowledge that could inform policy and management in four areas as described below:

8.5.1 Community consultation

We presented a systematic method for identifying and assessing local values and concerns in regional sustainability planning. The results could be overlaid with government land-use-proposals and then used to consult with the local community about the relative merits of such proposals. Banner size maps (A1 size) could be generated by Department of Sustainability, Environment, Water, Population and Communities staff and then used within workshop environments to engage multiple stakeholders in

regional sustainability planning. For example, local community members could mark areas on maps where development proposals could be changed based on the preferences expressed during the community values mapping survey.

8.5.2 Social acceptability and social licence to operate

To enjoy public support, regional sustainability plans need to be both scientifically defensible and socially acceptable. The community values mapping method provides a way of understanding the social acceptability of conservation and land-use planning decisions, providing government agencies and corporate enterprises with a social licence to engage in specific land-use activities. Further, whilst there is no legal mandate under the *Environment Protection and Biodiversity Conservation Act 1999* for the Minister to set conditions based on the social acceptability of protecting matters of national environmental significance (MNES), there is a requirement for the Minister to consider the social acceptability of conservation provisions. The community values outputs presented here may provide policy makers with a systematic way of providing advice to the Minister on the social acceptability of such provisions, with the view towards systematically considering social values and preferences alongside attributes of biological importance. The outputs could also be used by agencies as a tool for community consultation on proposed developments (for example, as part of education programs). Researchers from both the NERP Landscapes and Policy Research Hub and the Environmental Decisions Research Hub are currently considering policy pathways to enable this systematic consideration (see Ives et al. in preparation).

8.5.3 Conflict resolution

The community values mapping method enables policy makers to identify potential for conflict and target conflict management to areas of local concern. For example, we presented conflict indices based on areas where development preferences overlapped with MNES areas in the Lower Hunter. Results indicate that areas near Catherine Hill Bay high for potential conflict and therefore conflict resolution could be targeted here. We also developed an index that identified areas of potential conflict based on the relative difference between acceptable and inappropriate residential development dots found within each 2 km grid cell, and the number of social values found in each cell. Such an index can be used as a reliable predictor of potential land-use conflict and hence a means to identify priority areas for conflict resolution on the landscape.

8.5.4 Trade-off analyses

Current inter-disciplinary research being undertaken by the NERP Landscapes and Policy Research Hub and the NERP Environmental Decisions Research Hub is investigating the trade-offs resulting from the integration of social and ecological values for conservation. Specifically, zonation modelling tool is being used to determine the proportion of the landscape or species distributions that will be lost (or gained) as a result of a consideration of social values and preferences under six different policy scenarios. The results of this modelling could be used by Department of Sustainability, Environment, Water, Population and Communities to understand the trade-offs resulting from considering community values separate to, or as part of, a conservation priority assessment. Subsequent advice could be provided to the Minister in relation to how community values or concerns may be affected as a result of conservation of MNES.

The following policy recommendations are based on the findings of the 2012 Lower Hunter community values survey. Our recommendations are pertinent to regional sustainability planning in the Lower Hunter and are divided into the areas of biodiversity offsets, conservation of MNES, land-use, mining and energy, transport and infrastructure planning.

8.6 Policy Recommendations

8.6.1 Conservation of MNES

Areas of high and medium MNES frequency in the Lower Hunter were also highly valued by survey respondents for conservation and considered highly inappropriate for residential or industrial development. These finding suggest the priorities and actions of environment/conservation agencies are likely to enjoy widespread community support in the Lower Hunter and that development proposals that threaten those values will be contested. At the same time, there are areas in the Lower Hunter where there is potential conflict between conservation and development. The Catherine Hill Bay area was one of those areas identified as acceptable for urban development by the NSW Government, as proposed under the 2006 Lower Hunter Strategy, but the majority of survey respondents identified this as an area where residential and industrial development was inappropriate. To address these potential conflicts, the Department of Sustainability, Environment, Water, Population and Communities, and the NSW Department of Planning and Infrastructure should consider:

1. Identifying in relevant planning documents those areas this study suggests are areas of potential conflict if residential or industrial development is proposed for areas currently conserved;
2. Developing and publicising a policy which enables areas of identified potential conflict to be systematically considered at multiple stages of the strategic assessment process, including proposed action, assessment and decision phases; and
3. Further understand the nature of the land-use conflicts in the Catherine Hill Bay area to ensure areas of MNES are appropriately conserved.

8.6.2 Integrated regional sustainability planning

Respondents appear to be supporting a more co-ordinated approach to regional sustainability planning in the Lower Hunter. As part of a more co-ordinated approach, the Department of Sustainability, Environment, Water, Population and Communities should:

1. Liaise with local and state government bodies to identify instances where areas in close proximity to MNES are proposed to be developed and then consider developing tools and processes to identify and evaluate the impacts, including cumulative impacts, of those potential developments on MNES;
2. Work with local and state governments to fund research to forecast demand for residential development in the Lower Hunter during the next 20 years and to explore the extent that demand can be met with a combination of increased density in existing urban areas, development of rehabilitated coal mining areas and new greenfield areas that can be developed consistent with MNES;
3. Fund research (including a literature review and specific case studies) investigating the apparent preference for larger (for example, quarter acre) suburban and peri-urban residential land

amongst those living in regional Australia. That research should consider the economic and social factors at work and the opportunities to alter existing preferences through a suite of instruments, including marketing;

4. Investigate the need and utility of potential approaches for undertaking catchment-based assessments of the impacts of development proposals. This would entail understanding the socio-economic and environmental impact of development proposals on the Hunter Valley Catchment, not just the Lower Hunter Region; and
5. Further understand the social drivers of the 'suburban dream' of owning larger blocks in the Lower Hunter, and identify effective policies to manage this preference into the future.

8.6.3 Mining and energy

A majority of respondents across all community types expressed views suggesting they believe that coal seam gas is an unacceptable land-use in the Lower Hunter Region, which suggests that proposals to explore and mine coal seam gas in the Lower Hunter Region will generate widespread opposition. These community concerns need to be acknowledged and addressed by the mining industry and governments if those stakeholders remain committed to coal seam gas mining in the Lower Hunter Region.

8.6.4 Transport and other infrastructure

The Lower Hunter Region is a high residential development growth region and the need to provide an integrated transport network and other infrastructure to cope with those pressures was a concern to a majority of respondents. Given the likelihood of major infrastructure development in the region in the immediate future, including to service coal seam gas development, and of the potential for infrastructure development to negatively impact on MNES, we recommend that the Department of Sustainability, Environment, Water, Population and Communities work with the Department of Planning and Infrastructure (NSW), Hunter Development Corporation (NSW) and Department of Roads and Maritime (NSW) to consider ways to:

1. Integrate transport planning into the 2013 revision of the Lower Hunter Regional Strategy; and
2. Provide infrastructure such as water, sewerage and power to areas proposed for new developments in a way that minimises the impact on areas of MNES

8.6.5 Biodiversity offsets

Biodiversity offset policy is complex; however, our findings present some clear signals with respect to the direction of offset approaches and we recommend that:

1. The Department of Sustainability, Environment, Water, Population and Communities consider mechanisms for supporting a standardised, coordinated and transparent approach to biodiversity offsets delivery and accounting in the Lower Hunter that includes some/all of the following elements:
   a) Funds from offsets should only be available for work to improve biodiversity outcomes;
   b) Allow for offsets to occur on public land if the offset would improve biodiversity conservation;

c) The amount of revegetation required as part of an offset be fixed rather than negotiated with developers;

d) Land used for biodiversity offsets should not be available for future development unless all biodiversity losses are offset elsewhere;

e) Biodiversity offsets should not be applied on land previously set aside for conservation;

f) Provide offset revenue which should only be available for use in the region funds were sourced from and for projects that support biodiversity conservation; and

g) Allow offsets to be listed on the land title held by the NSW Government.

2. The Department of Sustainability, Environment, Water, Population and Communities and the Office for Environment and Heritage (OEH) NSW to consider communication/engagement programs to inform rural and urban landholders of the benefits of offsets, including the ways consolidated funds are spent in the Lower Hunter; and to listen to and address where possible, widely or strongly held views that are at odds with current offset policy/management. Engagement programs should focus on issues of conflict between landholders and planning practitioners regarding biodiversity offsets. That is:

   a) Whether developers should be responsible for identifying and acquiring areas of similar ecological characteristics for offsets. Both rural and urban landholders agreed that developers should be responsible whereas the planning practitioners disagreed; and

   b) Whether biodiversity offsets on specific parcels of land should only be erased by a separate NSW Act of Parliament. There was only moderate agreement among all respondents for this view.

Community consultation should also focus on elements a-g above (8.6.5, part 1). However, these elements are at odds with the strategic directions outlined in the *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy* (DSEWPaC 2012c). Specific attention to be directed at whether offsets should be fixed rather than negotiated with developers (element c), the long-term security of environmental offsets (element d), the appropriate siting of offsets (element e) and the listing of offsets (element g).

9 References

ABS (2012) Estimated Resident Population, Local Government Areas, New South Wales, in A. B. o. Statistics, editor, Canberra.

Alessa L, Kliskey A & Brown G (2008) Social-ecological hotspots mapping: A spatial approach for identifying coupled social-ecological space, Landscape and Urban Planning 85:27-39.

Beverly JL, Uto K, Wilkes J & Bothwell P (2008) Assessing spatial attributes of forest landscape values: an internet-based participatory mapping approach, *Canadian Journal of Forest Research* **38**:289-303.

Braithwaite VA & Law HG (1985) Structure of human values - testing the adequacy of the Rokeach value survey, *Journal of Personality and Social Psychology* **49**:250-263.

Braun V & Clarke V (2006) Using thematic analysis in psychology, *Qualitative Research in Psychology* **3**:77-101.

Brown G (2003) A Method for Assessing Highway Qualities to Integrate Values in Highway Planning, *Journal of Transport Geography* **11**:271-283.

Brown G (2005) Mapping spatial attributes in survey research for natural resource management: Methods and applications, *Society & Natural Resources* **18**:17-39.

Brown G (2006) Mapping landscape values and development preferences: A method for tourism and residential development planning, *International Journal of Tourism Research* **8**:101-113.

Brown G (2008) A Theory of Urban Park Geography *Journal of Leisure Research* **40**:589-607.

Brown G (2012) Public Participation GIS (PPGIS) for regional and environmental planning: Reflections on a decade of empirical research, *URISA Journal* **24**:7-18.

Brown G, Montag JM & Lyon K (2012) Public Participation GIS: A Method for Identifying Ecosystem Services, *Society & Natural Resources* **25**:633-651.

Brown G & Raymond C (2007) The relationship between place attachment and landscape values: Toward mapping place attachment, *Applied Geography* **27**:89-111.

Brown G & Reed P (2000) Validation of a forest values typology for use in national forest planning. *Forest Science* 46(2):240-247.

Brown G & Reed P (2012). Values Compatibility Analysis: Integrating public values in a forest planning decision support system. *Applied Spatial Analysis and Policy*, 5(4), 317–332.

Brown GG, Reed P & Harris CC (2002). Testing a place-based theory for environmental evaluation: an Alaska case study, *Applied Geography*, 22(1), 49–76. doi:10.1016/S0143-6228(01)00019-4

Brown G & Weber D (2012): Using public participation GIS (PPGIS) on the Geoweb to monitor tourism development preferences, *Journal of Journal of Sustainable Tourism* 20(1), pp. 1-20

Brown G, Smith C, Alessa L & Kliskey A (2004) A comparison of perceptions of biological value with scientific assessment of biological importance *Applied Geography* **24**:161-180.

Brown G & Weber D (2011) Public Participation GIS: A new method for national park planning, *Landscape and Urban Planning* **102**:1-15.

Brown G & Weber D (in press) Using Public Participation GIS (PPGIS) on the Geoweb to monitor tourism development preferences, *Journal of Sustainable Tourism*.

Brown TC (1984) The concept of value in resource allocation, *Land Economics* **60**:231-246.

Bryan BA, Raymond CM, Crossman ND & King D (2011) Comparing Spatially Explicit Ecological and Social Values for Natural Areas to Identify Effective Conservation Strategies, *Conservation Biology* **25**:172-181.

Clement JM &Cheng AS (2011) Using analyses of public value orientations, attitudes and preferences to inform national forest planning, in *Colorado and Wyoming. Applied Geography* **31**:393-400.

Crosby LA, Bitner MJ & Gill JD (1990) Organizational structure of values. Journal of Business Research **20**:123-134.

Curtis A, McDonald S, Mendham E & Sample R (2008) *Understanding the social drivers for natural resource management in the Wimmera region*, Institute for Land Water and Society, Charles Sturt University, Albury.

DECCW (2009) *Lower Hunter Regional Conservation Plan*, Department of Environment, Climate Change and Water NSW, Sydney.

Dillman D (2007) *Mail and internet surveys: The tailored design method* (2nd Edn.) John Wiley and Sons, New Jersey.

DSEWPaC (2011) *A guide to undertaking strategic assessments,* Deparment of Sustainability, Water, Population and Communities, editor. Commonwealth of Australia, Canberra.

DSEWPaC (2012a) *Sustainable Regional Development Program,* Department of Sustainability, Environment, Water, Population and Communities, Canberra.

DSEWPaC (2012b) *The Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy,* Department of Sustainability, Environment, Water, Population and Communities , Australian Government, Canberra.

DSEWPaC (2012c) *The Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy,* Department of Sustainability, Environment, Water, Population and Communities, Australian Government, Canberra.

DSEWPaC (2013) *Australia's bioregions (IBRA)* Accessed Online:www.environment.gov.au/parks/nrs/science/bioregion-framework/ibra/

Feather NT & Peay ER (1975) Structure of terminal and instrumental values - dimensions and clusters, *Australian Journal of Psychology* **27**:151-164.

Harrington C, Curtis A & Black R (2008) Locating communities in natural resource management, *Journal of Environmental Policy and Planning* **10(2)**:199-215.

Hofstede G (1980) Culture's consequences: International differences in work-related values, Sage, Beverly Hills, CA.

Ives C, Hardy M, Wolnicki M, Biggs D & Raymond CM (in prep) Incorporating social feasibility into legal frameworks for conservation, *Conservation Biology*.

Kaplan R & Kaplan S (1989) *The Experience of Nature: A Psychological Perspective,* Cambridge University Press, Cambridge.

Kaplan R, Kaplan S & Brown T (1989) Environmental Preference - A Comparison of 4 Domains Of Predictors, *Environment and Behavior* **21**:509-530.

Lockwood M (1999) Humans valuing nature: Synthesising insights from philosophy, psychology and economics, *Environmental Values* **8**:381-401.

Mazur N, Curtis A & Rogers M (2013) Do you see what I see? Rural landholders' belief in climate change, *Society and Natural Resources*, DOI:10.1080/08941920.2012.686650

Mcdonald R, Britton K, Deeming S, Hawkins R, Jonita M, Pritchard J, Ramanathan S, Searles A, Shellard D, Steverson E, Veldhuizen C & Williams J (2008) *Newcastle and The Hunter Region: 2008-2009,* The Hunter Valley Research Foundation, Maryville, NSW.

McIntyre N, Moore J & Yuan M (2008) A place-based, values-centered approach to managing recreation on Canadian Crown lands, *Society & Natural Resources* **21**:657-670.

Najder Z (1975) *Values and evaluations,* Clarendon Press, London.

Nielsen-Pincus M (2011) Mapping a values typology in three counties of the interior northwest, USA: Sale, geographic associations among values, and the use of intensity weights,. *Society & Natural Resources* **24**:535-552.

Norton BG & Hannon B (1997) Environmental values: A place-based theory, *Environmental Ethics* **19**:227-245.

NSW Department of Planning (2006). The Lower Hunter Regional Strategy: 2006-31. Government of New South Wales, Sydney.

NSW Department of Planning and Infrastructure (2013a) Standard Instrument Local Environmental Plan (LEP) Program. Accessed Online: www.planning.nsw.gov.au/LocalPlanning/StandardInstrument/tabid/247/language/en-AU/Default.aspx

NSW Department of Planning and Infrastructure (2013b) *A New Planning System for NSW: White Paper*, NSW Government, Sydney, NSW.

Raymond CM & Brown G (2006) A method for assessing protected area allocations using a typology of landscape values, *Journal of Environmental Planning and Management* **49**:797-812.

Raymond CM & Brown G (2007) A spatial method for assessing resident and visitor attitudes toward tourism growth and development, *Journal of Sustainable Tourism* **15**:520-540.

Raymond CM & Brown G (2011) Assessing spatial associations between perceptions of landscape value and climate change risk for use in climate change planning, *Climatic Change* **104**:653-678.

Raymond CM, Brown G & Weber D (2010) The measurement of place attachment: Personal, community and environmental connections, *Journal of Environmental Psychology* **30**:422-434.

Raymond CM, Bryan BA, MacDonald DH, Cast A, Strathearn S, Grandgirard A & Kalivas T (2009) Mapping community values for natural capital and ecosystem services, *Ecological Economics* **68**:1301-1315.

Rescher N (1969) *Introduction to value theory*, Englewood Cliffs, Prentice-Hall.

Rokeach M (1973) *The nature of human values,* Free Press, New York.

Schwartz SH & Bilsky W (1987) Toward a universal psychological structure of human values, *Journal of Personality and Social Psychology* **53**:550-562.

Sherrouse BC, Clement JM & Semmens DJ (2011) A GIS application for assessing, mapping, and quantifying the social values of ecosystem services, *Applied Geography* **31**:748-760.

Tuan Y (1976) *Space and Place: The Perspective of Experience,* University of Minnesota Press, Minneapolis.

Tyrvainen L, Makinen K & Schipperijn J (2007) Tools for mapping social values of urban woodlands and other green areas, *Landscape and Urban Planning* **79**:5-19.

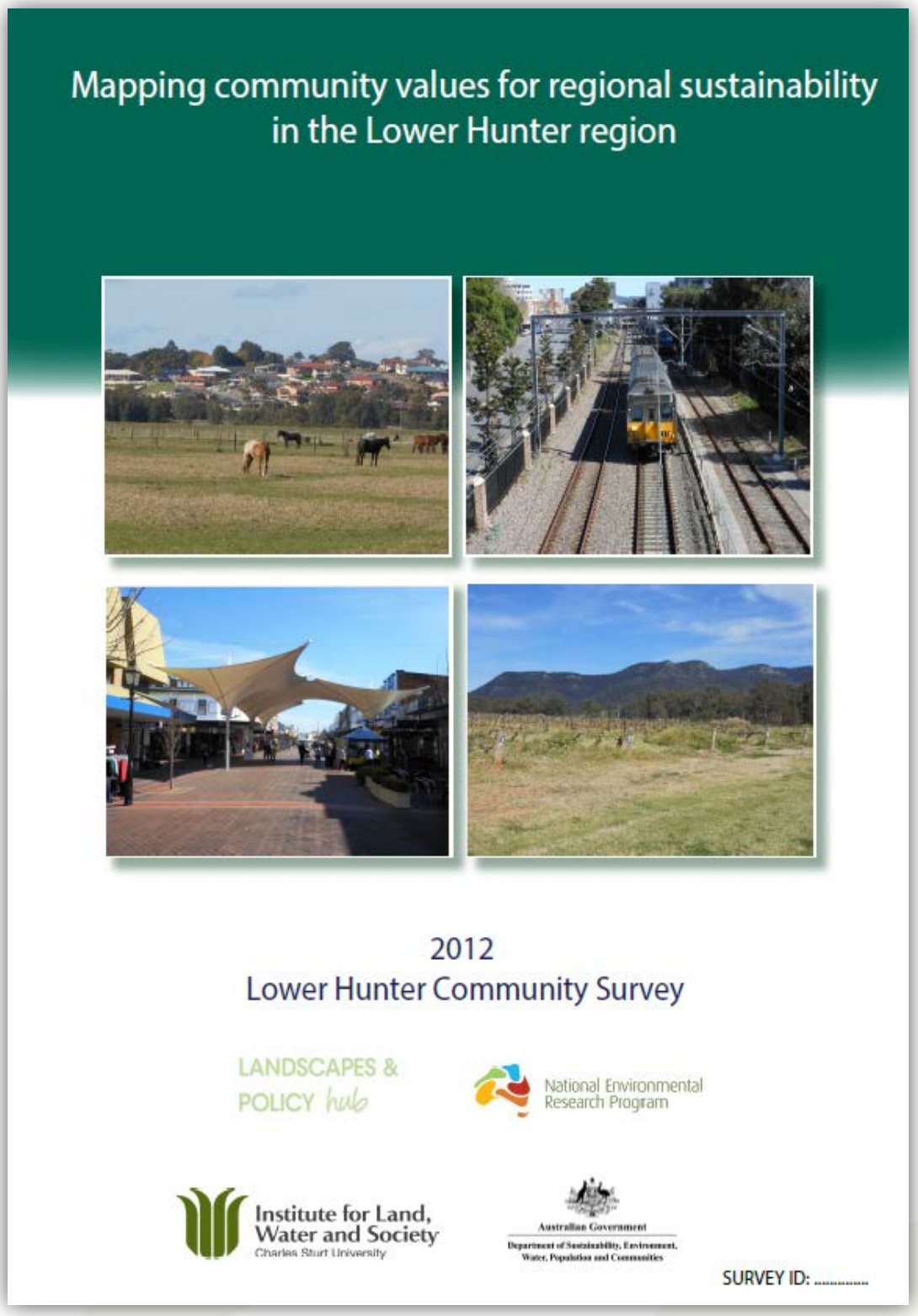
Whitehead A, Kujala H, Lentini P, Ives PC, Gordon A & Raymond CM (in review) An approach for integrating social and ecological values into conservation planning, *Conservation Biology*.

Zube EH (1987) Perceived land use patterns and landscape values, *Landscape Ecology* **1**:37-45.

Appendix A: Interview Script

1. Which communities of practice or interests do you represent in the Lower Hunter Region?
2. Which community perspective will you talk from today?
3. What are the major issues facing regional sustainability in the Lower Hunter Region from your community's perspective? Can you identify them on the map?
4. What solutions (for example, policies or programs) can you offer for addressing these issues?
5. Can you provide a list of up to 10 other individuals from your industry or group who may be interested in being involved in a survey of community values for regional sustainability?

Appendix B: Survey Instrument



Mapping community values for regional sustainability in the Lower Hunter region

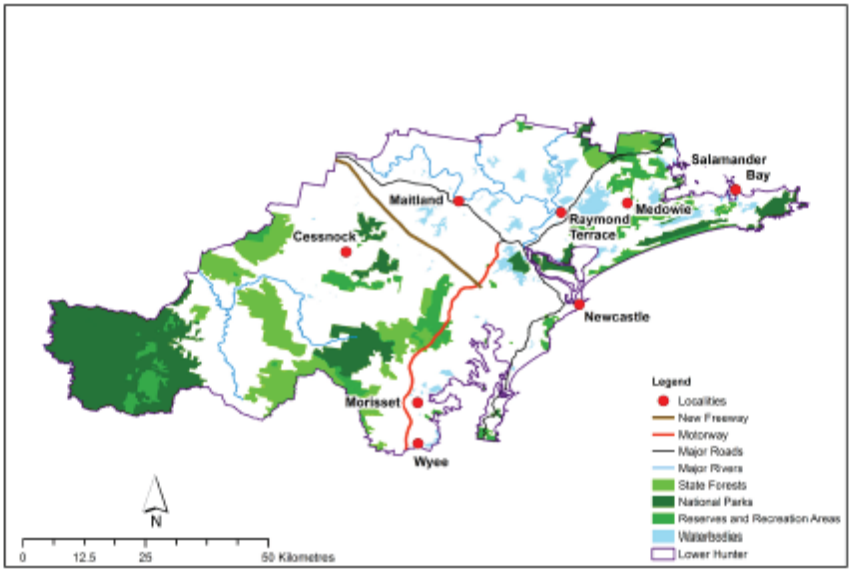
2012
Lower Hunter Community Survey

LANDSCAPES & POLICY hub
National Environmental Research Program
Institute for Land, Water and Society
Charles Sturt University
Australian Government
Department of Sustainability, Environment, Water, Population and Communities

SURVEY ID: .....

Mapping community values for regional sustainability planning in the Lower Hunter region

Thank you for your interest in this survey. You are an important source of information about the Lower Hunter region. This survey asks what you value about the Lower Hunter region (as shown in the map below), in addition to your preferences for land use and conservation planning. We appreciate your opinions. The information that you provide will inform Australian and State government approaches to regional planning and may influence programs developed for residents in your area.



Surveys have been sent to a sample of rural and urban landholders and renters, as well as planning practitioners in the Lower Hunter region. It is important that you complete and return your survey. This is an opportunity for a wide group of people to have their say and influence government decisions. It should take approximately 45 minutes to complete. **Once you have completed the survey, please place it in the reply paid envelope and mail it to us.**

You are assured of complete confidentiality. Your name will never be placed on the survey or used in any reports. No group outside Charles Sturt University will have access to the survey data. Information is published at the district scale and individual information is never published.

☎ If you have any questions regarding the survey, please phone Dr Christopher Raymond or Professor Allan Curtis at the University on **1800 605 187**.

To show our thanks for your efforts, we have included a complimentary set of postage stamps in the survey packet.

Thank you for your assistance,

Dr Christopher Raymond

Professor Allan Curtis

1

PART 1 YOUR VIEWS ON REGIONAL SUSTAINABILITY ISSUES

1. This set of statements seeks your opinion about the importance of a range of social, economic and environmental issues that may affect residents in the Lower Hunter region.

To what extent do you agree or disagree that the following issues are a threat to your quality of life in the Lower Hunter region? *[Examine each statement in the table, then place the number for your response in each space provided for '**Your view**'].*

RESPONSE OPTIONS:

Strongly Disagree	Disagree	Unsure	Agree	Strongly agree	Not applicable
1	2	3	4	5	6

Potential threats to your quality of life in the Lower Hunter region	Your view
The high rate of population growth of some regional centres	
The laws which exist to limit native vegetation clearance	
The increased frequency of trains to transport coal to the port of Newcastle	
The opening of new sites for residential development outside existing regional centres	
Lack of accessible public transport in regional centres	
Lack of cycling paths	
Clearing native vegetation to enable development	
Coal seam gas exploration	
Biodiversity (the variety of native plants and animals) decline as result of development	
The lack of full-time employment opportunities	
The negative impacts from the construction of new roads such as the Hunter Expressway	
Lack of opportunities to express your views on regional planning issues that affect your community	
Insufficient coordination between land-use, conservation, transport and infrastructure planning	
The limited availability of basic services (e.g., water and electricity) to support residential development	
Development along main roads	
The establishment of new corridors for biodiversity conservation	
The limited availability of entertainment hubs, including cafes and restaurants, for social interaction in urban and regional centres	
The lack of integrated transport planning	
The proposed amalgamation of local government areas	
The rezoning of private land for biodiversity conservation	
The increased amount of road traffic	
The lack of administrative structures to support a whole of government approach to regional sustainability planning	
The lack of investment in renewable energy options (e.g., wind energy and solar energy)	

PART 2 YOUR KNOWLEDGE OF REGIONAL SUSTAINABILITY ISSUES

2. In this section we would like you to provide **an assessment of your knowledge** about several topics. *[Examine each statement in the table, then place the number for your response in each space provided for '**Your knowledge**'].*

RESPONSE OPTIONS:

No knowledge	Very little knowledge	Some knowledge	Sound knowledge (sufficient to act)	Very sound knowledge (could give a detailed explanation)	Not applicable
1	2	3	4	5	6

Topic	Your knowledge
The development approval process used to assess the merits of residential development in the Lower Hunter region	
The process used to rezone land in greenfield (previously undeveloped) areas	
The process used to identify the type and area of land which needs to be purchased in order to offset the impact of development on biodiversity	
The objectives of the *New Planning System for New South Wales – Green Paper*	
The land-use planning actions proposed in the *Lower Hunter Regional Strategy 2006-31*	
Places of environmental significance (home to significant native animals, native plants, ecosystems or geological features) in the Lower Hunter region	
Places of cultural significance (provide opportunities to express and appreciate culture or cultural practices such as art, music, history and Indigenous tradition) in the Lower Hunter region	
Areas of high biodiversity (plants and animals) value in the Lower Hunter region	
Population growth projections for the Lower Hunter region	
Advantages and disadvantages of coal mining	
The threats posed to biodiversity by residential and industrial development in the Lower Hunter region	
Renewable energy options for the Lower Hunter region	
Advantages and disadvantages of coal seam gas mining	
Road and rail infrastructure needs in the Lower Hunter region	
Service infrastructure (e.g., electricity, water and sewer) needs in the Lower Hunter region	
Public transport needs and solutions for the Lower Hunter region	
The availability of water for human consumption in the Lower Hunter region	
Current economic indicators (e.g., income levels, housing investment) in the Lower Hunter region	

PART 3. YOUR BELIEFS ABOUT THE FUTURE OF THE LOWER HUNTER REGION

3. In this section we would like to know **how closely the statements presented below reflect your beliefs about the future of the Lower Hunter region.** There are no right or wrong answers and there is no need to think at great length about your responses. *[Examine each statement in the table below, then place the number for your response in <u>each</u> space provided for '**Your view**'].*

RESPONSE OPTIONS:

Strongly disagree	Disagree	Unsure	Agree	Strongly agree	Not applicable
1	2	3	4	5	6

Belief statements for the Lower Hunter region	**Your view**
I believe the science used to justify conservation of land in the Lower Hunter region is sound	
The process used by agencies to identify land to offset the clearance of native vegetation is difficult to understand	
Coal-seam-gas mining is an acceptable land-use in the Lower Hunter region	
Brownfield (e.g., old coal mining areas) should be restored and then made available for residential development ahead of the expansion of greenfield (previously undeveloped) areas	
Higher density residential development should be supported in urban areas	
The boundaries of existing urban areas in the Lower Hunter region are appropriate	
The process used to develop land use plans in the Lower Hunter region is fair and equitable	
Changes proposed to the NSW planning system under the *A New Planning System for New South Wales – Green Paper* are sensible	
The establishment of a range of renewable energy options, including wind and solar, is crucial to the sustainability of the Lower Hunter region	
The expansion of urban areas in the Lower Hunter region is essential for the region's sustainability	
Building a more efficient public transport system is crucial to the sustainability of the Lower Hunter region	
Increased tourism development in the Lower Hunter is important for the economic viability of the region	
The construction of an extensive rail network for transporting passengers between regional centres is more important than the construction of new highways in the region	
Coal-seam-gas mining presents an unacceptable risk to the health of residents in the Lower Hunter region	
Even if the price of housing on small blocks in urban areas was significantly reduced, people will still prefer to live in houses on quarter acre blocks in the Lower Hunter region	
The recent establishment of 20,000 ha of conservation reserves or flora reserves in the Lower Hunter region is important for the sustainability of the region	
Economic prosperity in the Lower Hunter region is too dependent on the coal mining industry	
Regional planning organisations are open and honest when explaining plans for future development	

PART 4. YOUR VALUES AND PREFERENCES FOR THE LOWER HUNTER REGION

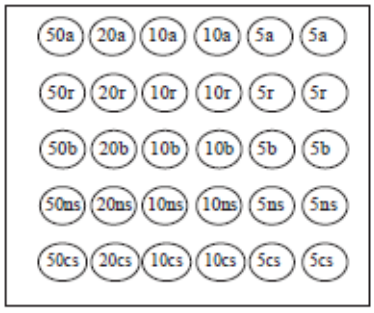
4. And now for something different! Different people value different places in the Lower Hunter region for different reasons. In this section, please show us the specific places in the Lower Hunter you value. **Please follow the steps explained below.**

Step 1: Mapping Your Values for the Lower Hunter

Find the ***attached*** Lower Hunter map and set of sticker dots. There first set of dots identify different values in the Lower Hunter such as aesthetic value or recreation value. Stick the dots on the Lower Hunter map where you think these values apply.

These dots also have "importance" ratings from 5 (least) to 50 (most) points. Put the most important aesthetic dots (50a) on the most scenic places, the most important recreation dots (50r) on places with the highest recreation value, and so on with the other value dots.
Use as many or few dots as you like.

MAP DOTS **PUT ON** → **LARGE ENCLOSED LOWER HUNTER MAP**



Aesthetic Value

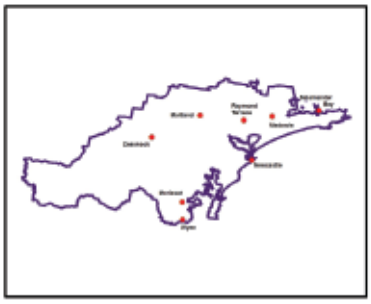
Recreation Value

Biodiversity Value

Natural significance

Cultural significance

Etc.



STEP 2: Mapping Places for Development or No Development

Are there places in the Lower Hunter region where future development could or should not occur?

*Use the + dots to show areas where **development** could occur with a good plan.*
*Use the – dots to show areas where **development** should not occur.*
Use as many or few dots as you like.

For example:
Use **rd1+, rd2+** and **rd3+** dots to show places where **residential development** could occur with a good plan and **rd1-, rd2-** and **rd3-** dots to show places where residential development *should not* occur. **The numbers in these dots do not represent importance weightings.** Rather, use the rd1+, rd2+ and rd3+ to show the 3 places which are most acceptable for residential development and the rd1-, rd2- and rd3- dots to show the 3 places which are the most inappropriate for residential development, and so on with the other preference dots.

Repeat this process for the remaining development preference dots on the map legend.

PART 5. YOUR ATTITUDES TOWARD BIODIVERSITY OFFSETS

5. Biodiversity offsets are used to address the impacts of development on biodiversity (the variety of native plants and animals), typically as a result of clearing native vegetation. Biodiversity offsets are undertaken elsewhere to the development, typically by purchasing land which has similar ecological characteristics.

The process for administering biodiversity offsets is currently being reviewed in the Lower Hunter region. Currently, two broad approaches are being considered:

1) Approach 1 - this is where developers are required to identify and acquire 'like areas' (areas of similar ecological characteristics) to offset their impact on biodiversity.
2) Approach 2 - each developer pays a standard levy (cost per hectare) for the right to develop an area of land, irrespective of whether the area contains native vegetation. The levy is then paid into a trust account administered by an external body. This body is then responsible for identifying and acquiring 'like areas' for the biodiversity offset.

Please tell us the extent to which you **agree** or **disagree** with the following statements related to these approaches being considered by the NSW Government. *Examine each statement in the table below, then place the number for your response in <u>each</u> space provided for '**Your view**'].*

RESPONSE OPTIONS:

Strongly disagree	Disagree	Unsure	Agree	Strongly agree
1	2	3	4	5

Statements about your views toward biodiversity offsets	**Your view**
Biodiversity offsets are an effective approach to maintain or improve biodiversity in the Lower Hunter region	
Developers who plan to remove native vegetation should be responsible for identifying and acquiring areas of similar ecological characteristics, no matter what time or costs are involved	
NSW Government agencies can be relied upon to effectively manage an offset levy in order to maintain biodiversity in the Lower Hunter region	
A board of trustees independent of government and developer interests should be established in order to effectively manage an offset levy for the Lower Hunter region	
Developers who do not plan to remove native vegetation should not have to pay the offset levy	
Money saved in an offset account by developers in the Lower Hunter region should only be used to improve biodiversity outcomes in this region	
Biodiversity offsets should not be applied on land which was previously set aside for conservation	
Developers should be able to negotiate the amount of revegetation required as part of an offset rather than have to follow rules that apply to all cases	
One standardised approach to biodiversity offsets is needed in the Lower Hunter region	
Areas of land used for biodiversity offsets should be available for future development as long as all biodiversity losses are offset elsewhere	
Public land should be considered for implementing environmental offsets if the offset would lead to improved biodiversity outcomes	
Biodiversity offsets should be listed on the land title held by the NSW Government	
Biodiversity offsets on specific parcels of land should only be erased by a separate NSW Act of Parliament	
A publicly available record needs to be established and updated so that governments, developers and the public can check where offsets have been established	
An offset levy should only be used for projects that support biodiversity conservation	
The Australian Government should establish a consistent approach to biodiversity offsets in the Lower Hunter region	

6

PART 6. YOUR BACKGROUND

6. In this section we are seeking information about your background. We recognise that several people may be involved in decision making and have helped complete the survey. For these topics we need information about the **principal decision maker for Your Property**.

What is your gender?	❑ Male ❑ Female
What is your age?	_____yrs
How many years have you lived in the Lower Hunter region?	_____yrs
Do you rent or own the property in which you currently live? (owning includes home with mortgage)	❑ Rent ❑ Own
What is the approximate size of the property in which you currently live?	_____m^2 OR _____ha
What is the postcode for the area where you live?	_____postcode
Is this property your principal place of residence?	❑ Yes ❑ No
Are you a member of a **conservation group** (e.g., Landcare, environmental agency, conservation non-government organisation)?	❑ Yes ❑ No

7. What is the highest level of formal education you have completed? *Please tick <u>one</u> response.*

- ❑ No formal schooling
- ❑ Primary school
- ❑ Secondary school
- ❑ Technical or further education institution
- ❑ University or tertiary institution

8a. What is your main occupation? *Please tick <u>one</u> response.*

- ❑ Manager
- ❑ Professional
- ❑ Farmer
- ❑ Retired
- ❑ Community or personal service worker
- ❑ Clerical or administrative worker
- ❑ Sales worker
- ❑ Machinery operator or driver
- ❑ Technician or trades worker
- ❑ Labourer
- ❑ Other_____

8b. Which sector do you work in? (e.g., government administration and defence, health and community services, hospitality, retail, education, property and business services, mining)

_____

9. Please indicate the total of all your wages and salaries, government benefits, pensions, allowances and any other income you usually receive, before deductions for tax, superannuation contributions, health insurance, amounts salary sacrificed, or any other automatic deductions for you last financial year (2011/2012). [*Please tick one response beside the appropriate dollar range].*

- ❑ Negative income
- ❑ Nil income
- ❑ $1-10,399
- ❑ $10,400-$15,599
- ❑ $15,600-$20,799
- ❑ $20,800-$31,199
- ❑ $31,200-$41,599
- ❑ $41,600- $51,999
- ❑ $52,000-$64,999
- ❑ $65,000-$77,999
- ❑ $78,000-$103,999
- ❑ $104,000 or more

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PART 7. OTHER COMMENTS

10. Is there anything else you would like to tell us about the potential threats and opportunities facing regional sustainability planning in the Lower Hunter region over the next 5-10 years? We would appreciate any comments.

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Would you like to be sent a copy of the survey results?

☐ **YES. PLEASE SEND ME A SUMMARY OF THE SURVEY RESULTS**

My email address is..... .....
(If you prefer an email response)

THANK YOU FOR YOUR HELP!

Privacy Note:
We are committed to keeping the information you provide in this survey strictly confidential and anonymous. Charles Sturt University authorises collection of this information. This information will be used by area managers to better serve the public. Response to this request is voluntary. Your name is used for follow-up mailing purposes only. When analysis of the survey is completed, all name and address files will be destroyed. Thus permanent data will be anonymous.

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Appendix C: Additional Interview Data

Additional issues facing regional sustainability in the Lower Hunter

Prospective developments	• Speculative rezoning of high biodiversity areas to residential or industrial development, even though demand may not be apparent; • Little use of old mine sites for industrial or residential development.
Loss of biodiversity to residential and industrial development	• Ongoing decline in biodiversity and native vegetation cover; • Greenfield residential and industrial developments have resulted in the loss of important biodiversity areas. It is more expensive to remediate old coal mining sites than to clear native vegetation; • All the regional plans have delivered on the development aspect of their balance but not the conservation side.
Conservation corridors	• Polarised views in the community about corridor establishment. It is seen as either a positive or negative. Those people who oppose them generally own land contained within the corridor boundary; • Conservation corridors are not targeted to specific places on the landscape; • The information base for conservation planning is not that good in terms of knowledge of threatened species and vegetation communities.
Infrastructure	• Areas where development is occurring are difficult to service. Developers have historically been responsible for covering the costs of utilities. However, development project is not economically viable when utility costs are accounted for; • Lack of a funded plan for the development of infrastructure (water and power etc) as well as transport; • Lack of a sensible transport strategy. Transport planning decisions are made largely from Sydney.
Road traffic congestion	• Increased road traffic and lack of foresight re. public transport to service regional centres; • Huge amount of traffic on New England Highway.
Community consultation	• Lack of effective and independently facilitated community consultation on regional sustainability planning; • Land-use plans have been dramatically changed after community consultation using stealthy practices.
Coal chain	• Issue with coal chain moving through a high growth area, including health issues related to coal dust; • No thinking of an economic future for the Hunter beyond coal; • All the pollution issues and social equality issues are not being addressed because of the strong economic return of coal.
Water security	• Water security issue is under catered for in drought – no real contingency plans in place

Additional opportunities for regional sustainability in the Lower Hunter

Infrastructure planning	• Need a new infrastructure plan – now b/c developers cannot be charged a capital works program
Residential infill	• Need to infill low density areas – provide right incentives
Transport planning	• A lot of old railways are disused – corridors still there – could have a climate change proofed rail link; • Possibility for electrified or light rail between Sydney and Newcastle.

Appendix D: Maps Showing Social Value and Development Preference Hotspots

For ease of reading, maps are packaged as a separate document.

Appendix Reference	Full Title	Short Reference
Map 1	Hotspots of aesthetic value assigned to places in the Lower Hunter Region by rural landholders, urban landholders and planning practitioners	Aesthetic Value
Map 2	Hotspots of recreation value assigned to places in the Lower Hunter Region by rural landholders, urban landholders and planning practitioners	Recreation Value
Map 3	Hotspots of biodiversity value assigned to places in the Lower Hunter Region by rural landholders, urban landholders and planning practitioners	Biodiversity Value
Map 4	Hotspots of natural significance value assigned to places in the Lower Hunter Region by rural landholders, urban landholders and planning practitioners	Natural Significance Value
Map 5	Hotspots of natural significance value assigned to places in the Lower Hunter Region by rural landholders, urban landholders and planning practitioners	Cultural Significance Value
Map 6	Hotspots of food value assigned to places in the Lower Hunter Region by rural landholders, urban landholders and planning practitioners	Food Value
Map 7	Hotspots of water value assigned to places in the Lower Hunter Region by rural landholders, urban landholders and planning practitioners	Water Value
Map 8	Hotspots of natural materials value assigned to places in the Lower Hunter Region by rural landholders, urban landholders and planning practitioners	Natural Materials Value
Map 9	Hotspots of science value assigned to places in the Lower Hunter Region by rural landholders, urban landholders and planning practitioners	Science Value
Map 10	Hotspots of health value assigned to places in the Lower Hunter region by rural landholders, urban landholders and planning practitioners	Health Value
Map 11	Hotspots of intrinsic value assigned to places in the Lower Hunter Region by rural landholders, urban landholders and planning practitioners	Intrinsic Value
Map 12	Hotspots of acceptable and inappropriate residential development identified by rural landholders, urban landholders and planning practitioners	Residential Development
Map 13	Hotspots of acceptable and inappropriate industrial development identified by rural landholders, urban landholders and planning practitioners	Industrial Development
Map 14	Hotspots of acceptable and inappropriate transport development identified by rural landholders, urban landholders and planning practitioners	Transport Development
Map 15	Hotspots of acceptable and inappropriate agricultural development identified by rural landholders, urban landholders and planning practitioners	Agricultural Development
Map 16	Hotspots of acceptable and inappropriate tourism development identified by rural landholders, urban landholders and planning practitioners	Tourism Development
Map 17	Hotspots of acceptable and inappropriate conservation or restoration assigned outside of national parks and conservation reserves by rural landholders, urban landholders and planning practitioners	Conservation Values Private Land

Appendix E: Additional Distance Analyses

Appendix E Table: The effect of LGA of residence and landholder type on the distance values were assigned from place of residence

Values	LGA of Residence	Landholder Type	N	Mean Distance (km)	Standard Deviation	F
Aesthetic	Newcastle	Urban landholder	166	25.85	17.08	Model:
		Total	166	25.85	17.08	4.23***
	Port Stephens	Rural landholder	104	28.83	17.55	
		Urban landholder	45	30.43	26.45	LGA Res:
		Total	149	29.31	20.56	5.68***
	Cessnock	Rural landholder	261	27.93	23.25	
		Urban landholder	41	26.13	17.80	l/hold type:
		Total	302	27.69	22.57	0.52
	Lake Macquarie	Rural landholder	82	23.03	17.82	
		Urban landholder	201	22.67	17.94	LGA Res* l/hold type
		Total	283	22.77	17.87	0.52
	Maitland	Rural landholder	128	33.93	19.07	
		Urban landholder	57	29.98	15.76	
		Total	185	32.72	18.16	
	Total	Rural landholder	575	28.73	20.89	
		Urban landholder	510	25.48	18.47	
		Total	1,085	27.21	19.85	
Recreation	Newcastle	Urban landholder	156	23.27	17.50	Model:
		Total	156	23.27	17.50	13.04***
	Port Stephens	Rural landholder	101	31.65	16.04	
		Urban landholder	45	29.76	22.66	LGA Res:
		Total	146	31.07	18.27	6.03***
	Cessnock	Rural landholder	222	37.88	26.29	
		Urban landholder	42	26.98	19.51	l/hold type:
		Total	264	36.15	25.62	12.09**
	Lake Macquarie	Rural landholder	72	28.07	20.71	
		Urban landholder	191	20.88	17.34	LGA Res* l/hold type
		Total	263	22.85	18.56	1.38
	Maitland	Rural landholder	114	35.96	16.33	
		Urban landholder	41	32.55	15.29	
		Total	155	35.06	16.09	
	Total	Rural landholder	509	34.83	21.99	
		Urban landholder	475	24.05	18.31	
		Total	984	29.62	20.99	

Appendix E Table: (continued): The effect of LGA of residence and landholder type on the distance values were assigned from place of residence

Values	LGA of Residence	Landholder Type	N	Mean Distance (km)	Standard Deviation	*F*
Biodiversity	Newcastle	Urban	138	27.28	18.19	Model:
		Total	138	27.28	18.19	4.71***
	Port Stephens	Rural	92	26.29	18.01	
		Urban	44	29.45	28.11	LGA Res:
		Total	136	27.31	21.73	5.63***
	Cessnock	Rural	204	31.49	22.46	
		Urban	30	28.38	20.10	l/hold type:
		Total	234	31.09	22.15	0.01
	Lake Macquarie	Rural	58	20.92	18.00	
		Urban	181	25.40	17.39	LGA Res* l/hold type
		Total	239	24.32	17.61	1.92
	Maitland	Rural	117	36.25	19.67	
		Urban	41	30.97	16.24	
		Total	158	34.88	18.94	
	Total	Rural	471	30.36	20.95	
		Urban	434	27.14	19.07	
		Total	905	28.81	20.12	
Science	Newcastle	Rural		n/a		Model:
		Urban	79	22.97	20.27	6.87***
		Total	80	22.69	20.31	
	Port Stephens	Rural	60	29.66	19.68	LGA Res:
		Urban	34	38.36	33.16	7.10***
		Total	94	32.81	25.57	
	Cessnock	Rural	128	39.40	24.68	l/hold type:
		Urban	24	39.46	16.93	0.61
		Total	152	39.41	23.58	
	Lake Macquarie	Rural	49	26.75	14.82	LGA Res* l/hold type
		Urban	113	25.11	17.69	2.96*
		Total	162	25.60	16.84	
	Maitland	Rural	77	34.39	17.83	
		Urban	24	21.88	10.88	
		Total	101	31.42	17.24	
	Total	Rural	315	34.23	21.38	
		Urban	274	27.11	21.24	
		Total	589	30.92	21.59	

Statistically significant effect of LGA of residence on distance, $F = 7.25$, $p < 0.001$, and statistically significant interaction effect of LGA of residence* landholder type, $F = 10.64$, $p < 0.001$

Appendix E Table: (continued): The effect of LGA of residence and landholder type on the distance preferences were assigned from place of residence

Preference	LGA of Residence	Landholder Type	N	Mean Distance (km)	Standard Deviation	F
Pos residential dev	Newcastle	Urban	48	18.87	12.19	Model:
		Total	48	18.87	12.19	5.26***
	Port Stephens	Rural	37	13.85	10.80	
		Urban	24	31.95	19.07	LGA Res:
		Total	61	20.97	17.00	3.42**
	Cessnock	Rural	99	23.06	14.74	
		Urban	17	21.70	16.11	l/hold type:
		Total	116	22.86	14.88	18.00***
	Lake Macquarie	Rural	35	13.96	12.54	
		Urban	85	22.98	12.99	LGA Res* l/hold type
		Total	120	20.35	13.45	5.55**
	Maitland	Rural	64	22.91	14.49	
		Urban	23	25.76	12.57	
		Total	87	23.66	14.00	
	Total	Rural	235	20.21	14.35	
		Urban	197	23.29	14.30	
		Total	432	21.61	14.39	
Neg residential dev	Newcastle	Urban	56	24.82	17.06	Model:
		Total	56	24.82	17.06	1.95*
	Port Stephens	Rural	43	13.88	14.59	
		Urban	21	22.04	22.78	LGA Res:
		Total	64	16.55	17.93	1.13
	Cessnock	Rural	99	18.61	16.09	
		Urban	14	20.97	15.77	l/hold type:
		Total	113	18.90	16.00	4.59*
	Lake Macquarie	Rural	33	16.92	14.91	
		Urban	97	21.77	16.26	LGA Res* l/hold type
		Total	130	20.54	16.01	0.37
	Maitland	Rural	65	21.90	19.92	
		Urban	28	24.46	15.78	
		Total	93	22.67	18.72	
	Total	Rural	240	18.42	16.94	
		Urban	216	22.88	17.01	
		Total	456	20.53	17.10	

Appendix E Table: (continued): The effect of LGA of residence and landholder type on the distance preferences were assigned from place of residence

Preference	LGA of Residence	Landholder Type	N	Mean Distance (km)	Standard Deviation	*F*
Pos agricultural dev	Newcastle	Urban	27	32.53	13.00	Model:
		Total	27	32.53	13.00	14.61***
	Port Stephens	Rural	24	18.89	12.90	
		Urban	17	34.01	16.55	LGA Res:
		Total	41	25.16	16.19	7.61***
	Cessnock	Rural	78	16.28	13.96	
		Urban	13	20.83	8.52	l/hold type:
		Total	91	16.93	13.38	25.25***
	Lake Macquarie	Rural	26	25.24	15.25	
		Urban	62	33.76	10.80	LGA Res* l/hold type
		Total	88	31.25	12.80	1.21
	Maitland	Rural	43	14.00	10.76	
		Urban	14	23.38	13.32	
		Total	57	16.31	12.03	
	Total	Rural	171	17.43	13.67	
		Urban	133	31.19	12.88	
		Total	304	23.45	14.96	
Pos transport dev	Newcastle	Rural	1	0.00		Model:
		Urban	52	12.31	12.00	4.42***
		Total	53	12.08	12.01	
	Port Stephens	Rural	38	15.67	9.97	LGA Res:
		Urban	24	23.97	15.52	1.16
		Total	62	18.88	12.95	
	Cessnock	Rural	94	24.66	17.96	l/hold type:
		Urban	17	16.15	14.44	0.08
		Total	111	23.36	17.68	
	Lake Macquarie	Rural	36	21.03	15.98	LGA Res* l/hold type
		Urban	78	14.53	12.18	3.32*
		Total	114	16.58	13.76	
	Maitland	Rural	48	20.40	16.44	
		Urban	29	19.50	13.95	
		Total	77	20.06	15.46	
	Total	Rural	217	21.43	16.40	
		Urban	200	15.94	13.42	
		Total	417	18.80	15.27	

Statistically significant effect of LGA of residence on distance, $F = 5.78$, $p < 0.001$, and statistically significant interaction effect of LGA of residence* landholder type, $F = 13.52$, $p < 0.001$

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