People in context: critical social dimensions in complex landscape systems.

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April 2007

A thesis submitted for the degree of Doctor of Philosophy in Environmental Sociology from Murdoch University, Western Australia.

Declaration

I hereby certify that the work contained in this thesis is my own work, and that I have cited in the references all works and sources consulted in the writing thereof.

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Dedication

This thesis is dedicated to the Zulu people of southern Africa who taught me the poetry in landscapes, and the Indigenous peoples of Australia who have showed me the meaning of belonging in landscapes.

Acknowledgements

I would like to acknowledge advice from people who have supported this research: Professor Richard Hobbs and Dr Susan Moore, Science and Engineering, Dr Laura Stocker, Institute of Sustainability and Technology Policy, Murdoch University, Western Australia. I would like to thank Murdoch University for support provided through a Completion Scholarship that provided resources and support in completing the writing for this thesis.

Dr Hume Winzar, Dr Sally Rickson, Dr Malcolm Alexander, Professor John Fien, Dr Richard Hindmarsh and Dr Jenny Cameron of Griffith University helped me in earlier stages of the research. School administration staff, Sheryl Williams, Janice Mitchell and Frank Salleo provided important insight and support into the various functions of the University system.

I was very fortunate to be able to participate in testing the new version of PATN developed by Lee Belbin. This has provided my research with a profound dimension that offers important insights into analysis in the social sciences. My husband, Grant, provided outstanding support in this form of multivariate analysis and critical comments on numerous drafts of my work. Lee and Douglas have advised and helped with computer related issues and made cups of tea at crucial times.

Jill Richardson of the Blackwood Basin Group and Angela Stuart-Street of Agriculture WA provided crucial support, good company and insight during field work in WA. The catchment communities in the Katanning Zone of the Blackwood Basin in Western Australia and the Headwaters of the Condamine River at the top of the Murray Darling Basin in Queensland gave me the opportunity to explore the social dimensions of landscape management with generosity and critical interaction. This empirical basis has given depth and richness to a story of Australian relationships with the land and spelt out the complexity that is faced in management in an ancient landscape.

I was fortunate to be funded in this research by:

- the Queensland Government's Smart State Postgraduate Funding Program, mentored through Dr Lyn Aitken and Melva Hobson of the Department of Natural Resources and Mines.
- the CRC for Plant-based Management of Dryland Salinity with faith in and support for postgraduate scholarship through Professor David Pannell, Professor Phil Cocks and Daryll Richardson.
- The Blackwood Basin Group, in particular Jill Richardson and Saan Ecker, supported and encouraged the research.

Opportunities for discussion and insights into complex systems were provided by Professor Peter Campbell of the University of South Australia, Dr Pascal Perez and Professor Roger Bradbury of ANU, Dr Roger Cropp of Griffith University and CSIRO researchers: Dr John Finnigan, Art Langston, Dr Nick Abel, Dr Andrew Rixon and Dr Brian Walker. Critical comment and insights into theory, methods and results came from Dr Neil Barr, Dr Roger Wilkinson, Professor John Dryzek, Professor Jann Williams and A/Professor Pierre Horwitz.

The Condamine Catchment Management Association has provided direction and advice in the selection of study sites and helped me contact people to involve in the study. The Department of Primary Industry and Fisheries through Dr James Gaffney and Dr David Freebairn provided insight into the agricultural systems in the Darling Downs. Generous hospitality has been provided by numerous friends during the extensive travels undertaken to conduct the research, not least, Angela Stuart-Street, Professor Jonathan Majer and Dr Mazé Majer, A/Prof Pierre Horwitz and Dr Kath Broderick.

The South Western Indigenous Reference Group based in Toowoomba provided advice and contacts with the appropriate Indigenous communities in Queensland.

I would like to thank the broader postgraduate community in the CRC Salinity, Griffith University and the University of Queensland who engaged with the issues at hand and sustained my commitment through the darker periods of the quest.

Preface

Research for this thesis has been presented at numerous fora that have assisted in synthesising research questions and results. Opportunities for feedback and testing new ideas have been presented through papers presented at:

- **Systems Thinking and Complexity Science**: Insights for Action, 11th Annual ANZSYS Conference/Managing the Complex V, Christchurch, NZ, December 2005
- International Conference on **Engaging Communities**, Brisbane August 2005.
- **World Congress of Rural Sociology**, Trondheim, Norway, July 2004.
- **International Soils Organisation Conference**, Brisbane, July 2004.
- International Association for Landscape Ecology Congress, Darwin, 2003.
- **The Ecological Society of Australia**, Armidale 2003.
- **The Sociological Association of Australia**, annual conference, Armidale 2003.
- **Productive Uses and Restoration of $aline Lands annual conference**, Yeppoon 2003.

Publications that have arisen from the research conducted for this thesis include:

Wardell-Johnson, A. (2005) *Social relationships in landscape systems: identifying values and variables that drive social interactions*. For proceedings for **Systems Thinking and Complexity Science**: Insights for Action, 11th Annual ANZSYS Conference/Managing the Complex V, Christchurch, NZ, December 2005.

Wardell-Johnson, A. (2005) A Sense of Place: valuing landscapes in the Condamine Headwaters. Proceedings of **Asia Pacific Extension Network: Building Capacity for Sustainable Resource Management Conference**: Toowoomba, 28 – 29 September 2005.

Wardell-Johnson, A. (2005 in review). *Participatory Frameworks and the Community: the relationships between definition and inclusion.* **World Congress of Rural Sociology**, Trondheim, Norway: submitted for Rural Society Special issue on Governance and NRM.

Cook, F.J., X. Su, A.P. Campbell, G.D. Carlin, **A. Wardell-Johnson**, B. Nancarrow, A. Rixon, S. Asseng (2005) *Uncertainty In Modelling Human-Landscape Interactions*. **International Congress on Modelling and Simulation**, December 2005, Melbourne, Australia.

Campbell, P., Asseng, S., Su, X., and **Wardell-Johnson**, A. (2005) Coupling Bio-physical and Social Models: Conceptual Model and Implementation Details for a Simulation of the Katanning Zone, West Australian Wheat Belt. Proceedings of The Agent-Based Modelling Working Group and Human Ecosystems Modelling with Agents (CABM-HEMA-SMAGET) Workshop: **"Smart models? Good uses?"**, Les Arcs, France.

Abstract

Landscape-based approaches to solving environmental issues have been widely recommended by scientists and policy makers. These issues are found at the interface of social and ecological systems. Understanding the social dimensions of landscape issues has been suggested as part of the solution. This doctoral research integrated theoretical concepts with survey-based numerical taxonomy and qualitative analysis to explore three social dimensions underpinning decision-making at the landscape scale in rural Australia.

These linked social dimensions that provided a research focus were sense of place and accompanying social capital that is embedded within private, social and institutional practice in discourses of the environment. Complex systems theory provided the framework to explore the interactions and relationships between these dimensions and to describe the emergent processes.

The first phase of this research developed theoretically and empirically derived conceptual models for the three dimensions. These models provided a basis for operationalisation for the survey-based numerical taxonomy in the second phase. Data for this analysis was collected through survey questionnaires (124 returned with 60% response rate) from two social catchments (the Katanning Zone in the Blackwood Basin in Western Australia and the Condamine Headwaters in the upper reaches of the Murray Darling Basin in Queensland). The results from the numerical taxonomy provided a focus for semi-structured interviews (24 representative participants) that provided further analysis through qualitative methods in the third phase.

Combining conceptual models with quantitative and qualitative analysis was used to expose three emergent processes that maintain resilience in these landscape systems. The first was formed through the interactive social relationships between communities of place, identity and interest that constitute social catchments. The second emergent process formed at the nexus of local,

scientific and Indigenous frameworks of knowledge. The interactive social catchment relationships and three knowledge frameworks dictated the relative weightings of social, ecological and economic values of the triple bottom line, which formed the third emergent process. It is suggested that the interactions of these emergent processes characterised resilience in these systems.

The social dimensions in this thesis provided a focus that suggests that the interactions between community in a social catchment governs the predominance of knowledge form and the accommodation of the values in the triple bottom line. The integration of theoretical, quantitative and qualitative approaches can be couched within a complex systems framework. This contributes to a re-framing of the social relationships in landscapes to identify social catchments as the appropriate focus for interaction in decision-making at the landscape scale.

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Introduction

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critical social dimensions of complex landscape systems.

Resilience is found at the nexus of ecological systems and human social systems. Almost all environmental issues result from specific social patterns. The interactions between individuals, communities and society, and the environment to which they are connected are not well understood, nor often considered in environmental policy development and application contexts (Brinkley, Fisher and Gray 2001). This results in poor integration of institutional structures with the values held by the local human communities, often resulting in further pressure on the ecological processes in landscapes (Brunckhorst and Coop 2001). Contemporary calls for sustainable

use of environmental resources imply a consideration of decision-making relationships across social and landscape scales. This consideration requires integration of local context with macro-scales. It is possible that such an approach would accommodate the resilience requirements of linked biophysical and socio-economic systems. Therefore, the frameworks (or expectations and paradigms) that shape questions, discoveries and solutions need to include both social and environmental approaches. Inquiry and research into landscapes is more likely to be productive and meet the needs of socio-ecological integration if it accommodates both human and biophysical disciplines (Gunderson and Holling 2002).

Social and political processes through normative ecological and economic approaches may have negative implications for both ecosystems and social resilience. Scheffer *et al.* (2002) recommend four considerations worthy of inclusion in planning to maintain resilient socio-ecological systems. They advocate explicit and shared knowledge of the utilities of ecosystems and insight into the impacts of people on these ecosystems. It therefore follows that the politics of organisational power exercised by decision-making sectors must be acknowledged and bridged to accommodate a range of interacting social and geographic scales. In linking the needs of people with the landscapes upon which they depend, this approach would suggest a research strategy that links social and geographic scales focused at the landscape scale.

Landscapes reflect the needs, preoccupations and dreams of society, shaping common identities and social practices (Hay 2002). Interactions between people and the landscapes in which they live reflect social practices and values that are played out at the complex interface of human and ecological systems (Malpas 1999). This interface is often made explicit through conflicts arising from the expression of values, definitions, goals and the interaction of power (Duane 1997). In contemporary Australian policy, strategies aimed at the re-orientation of a moral imperative of sustainability at the landscape scale acknowledge the importance of engaging and including local people (Gray and Lawrence 2001, Whitehead 2003). It is these people, who make the daily decisions about their

environments, that hold the key to resilience in linked social-ecological systems (Holling 2001, Berkes *et al.* 2003).

The acknowledgement of social components in the 'triple bottom line' (Spiller 2000) to complete the ecological - economic trilogy in landscape management has resulted in a timely and explicit re-connection of people with the landscapes in which they live. Symbolic and material interactions construct people's relationships with landscapes to dialectically frame social values. Social values are often expressed through symbolic means (Bourdieu 1986). It follows that these symbolic values generate and constrain practice frameworks that result from the merging of ideals, ideology and practice and interact with quantifiable material values. This would therefore imply that decision-making in landscape management integrates symbolic and material values. According to Higgins and Lockie (2002) symbolic values are quantitatively and statistically challenging expressions of people's relationships with landscapes. They advocate the accommodation and integration of these intangible values with material values in order to avoid limiting understandings of the relationships people have with the landscapes in which they live (Higgins and Lockie 2002). This indicates that the assumptions and social conditions that underpin decision-making are critical to understanding strategies in landscape management.

Communities and Catchments

Local people are considered critical players in contemporary Australian policies and strategies aimed at implementing sustainability at the landscape scale (Gray and Lawrence 2001, Whitehead 2003). In general, a broader notion of stakeholder inclusion is based on the assumption that a wide range of "stakeholders are more likely to behave responsively" (Winter 2000 p. 143) and include mutually reinforcing commercial and social values. Further assumptions claim that transparency leads to explicit organisational efficiency and is more successful than limited representation by sectoral interests (Winter 2000). Current inclusion is based on selective nominations and a limited representation largely of those with a history of participation (Moore 2004). This would imply that a re-definition of the narrow inclusion of stakeholders to include a more

representative definition is necessary to overcome the limitations of this approach.

This research explores representation and social values that drive decision-making in relation to a variety of community sectors that might be included in participatory democracy in landscape management. A key focus revolves around the conceptualisation of community in relation to the maintenance of adaptive capacity and the ability of social catchments to self-organise in the face of perturbation.

Catchments are biophysical boundaries used in Australia as a means of defining landscapes for intervention and regulation (Beilin 2001). They encompass a range of landscape elements and human communities within conveniently delineated hydrologic boundaries. It might be possible to improve this definition by using a human population conceptualised as a social catchment that is broader than the population living in the hydrologic catchments that frame each research site.

The ability for social catchments to self-organise and adapt in the face of perturbation relates to opportunities for innovation and adoption in landscape management. These opportunities may come through three linked and inseparable social dimensions that will be explored in this thesis: sense of place, social capital and discourses of the environment. This exploration requires a broad identification of decision-making sectors in social catchments in the study.

Each social dimension that is explored in this thesis is outlined and presented in subsections of this chapter. The research questions that are used in the exploration of each of these linked dimensions are introduced. These research questions are brought together in the section that outlines the structure of the research process for this thesis. These research questions are also outlined in each of the discrete chapters that explore and discuss each social dimension explicitly.

Three interacting social dimensions of landscape management

Society reflects a complex assemblage of beliefs, attitudes and behaviours. In attempting to understand interactions and relationships between humans and the landscape a wide range of influences are to be expected. Assumptions about these relationships and the attitudes and behaviours upon which they are based has given rise to a variety of expectations and policies relating to landscape management (Harré 1999, Dryzek 1997). It will be necessary to examine the relationships between three social dimensions that impact on decision-making in landscape management. These relationships are exemplified through an inquiry that links the three social dimensions in this study: sense of place, social capital and discourses of the environment. Each of these dimensions provides insight into a discrete social process with these complex adaptive systems. The relationships between the dimensions may provide insight into the assumptions that govern decision-making in and between interacting sectors in rural agricultural landscapes.

The development of a sense of place is mediated over time by relationships between people (Tall 1996). These relationships form social capital that is in turn defined and constrained by discourses of the environment that frame personal and institutional practice. These dimensions encompass formal and informal social structures (Flora 1998) and reflect both symbolic and material relationships among people in association with the landscapes in which they live. It is likely that the differences in value frameworks between different groups of people contributing to the decision-making in the same landscape in this study are based on the complex relationships between these three dimensions.

Sense of place

Sense of place is a distinctive way of defining community within three social scales of decision-making: the individual; the collective, expressed at the community scale; and society. The interacting elements that comprise sense of place include: identity, attachment and the physical landscape. Over time, the processes that define sense of place ideally result in an evolution from

belonging, through attachment to commitment in landscapes (Tall 1996). Thus valued, landscapes accommodate and represent feelings, attitudes and behaviour that form a dialectically shaped identity (Kaltenborn 1998, Hay 2002). This conceptual framing integrates both temporal and spatial scales.

This thesis explored the values defining sense of place relationships in rural Australian agricultural landscapes. The relationships between, and importance of the sense of place values was examined through an assessment of individual commitment to maintaining specific landscape values. The contribution of symbolic and material values in landscapes to defining the importance of each of the three components of the triple bottom line was also an important question in this thesis. The relationships between sense of place and social relationships were explored through the expression of processes of social capital.

Social capital

Social capital has evolved out of a broader conceptual framework of capital and may be distinguished from economic, human, cultural, physical and natural capital. Social capital can serve as a positive resource or as a source of social control which, through bounded solidarity and enforceable trust renders more formal arrangements unnecessary. Resources are developed and made available through micro, meso and macro social support structures (Field 2003). Social capital is the transformation of interactions and networks to incorporate resources that cannot exist outside the broader social context of community. The processes of social capital interact to play a functional and prescriptive role in outcomes for communities that are important for individuals and social groups at a range of scales (Wall 1998). Networks of interaction between the elements of social capital act across three scales: micro, meso and macro social scales (Woolcock 1998).

This thesis explored the social scales and networks that influence relationships with the environment and decision-making at the landscape scale. Social capital was explored through the interacting elements of: social networks; norms of reciprocity expressed through practices of exchange; and relations of trust.

These were explored in relation to their constraining capacity and facilitation of approaches to landscape management.

Social capital contributes to norms of practice in landscape management and is defined and confined by frameworks of private and institutional practice that were conceptualised as the third linked dimension in environmental discourse.

Discourses of the environment

Environmental discourse represents the link between natural and cultural ecosystems in a critical metadiscourse. Discourses that pertain to the environment exist within a range of fields and disciplines, both in support of and in opposition to forms of ideology and practice. All those who are engaged with environmental decision-making at the landscape scale can be defined as adherents to one or other environmental discourse with implications for practice in landscape management at individual, societal and environmental scales (Dryzek 1997, Harré *et al.* 1999). Discourse is comprised of three interacting elements that negotiate a final position based on ideals, ideology and practice (Bhaskar 1978, Sayer 2000).

Discourses of the environment were explored by asking: What are the norms of social practice encompassed in discourses of the environment that contribute to decision-making at the landscape scale? The ideals, ideology and practice that operate within the specific context of the individual, and range through to more abstracted norms that are defined by society and constrained by the overarching environmental scale were explored. A further question explored the interactions between these elements and scales in relation to construct of knowledge, notions of truth and the enactment of power.

This research aimed to explore links between these three social dimensions of landscape management in order to expose the constitution of and linked processes that form domains of key interacting variables. This approach aimed to identify the process that define, maintain and re-configure the emergent characteristics that maintain resilience in complex adaptive systems.

Complex adaptive systems

Complex adaptive systems comprise components linked by non-linear interactions that together form a unique entity not reducible from the sum of the parts. Recurrent behaviours and interactions show adaptive capacity and high levels of patterned structural organisation enable self-organisation. These systems are capable of experience, adaptation and change. They learn from the past, and anticipate the future (Marion 1999, Holling 2003). The three social dimensions that form the focus for research in this thesis may exhibit interactions and connections that indicate possible components of a system that is likely not reducible from the sum of the parts. Recurrent behaviours that form both social capital and discourses of the environment and interact within a landscape system to develop sense of place require a broader systemic framework for exploration. The dynamic interactions that frame complex systems approaches provided a suitable heuristic lens for exploration.

This research explores and presents an explicit definition of community that enables an understanding of the re-current behaviours that structure the complex adaptive systems in this study. This requires representation across a social catchment that accommodates decision-making input at a range of interactive scales. This re-configuration of definitions for and understandings of the concept of community pertains to the notion of stakeholders and governance in landscape management. A simpler but broader conceptualisation of community based on the possible combinations of the categories in Duane's (1997) work was used in this research. This allowed the inclusion of a more complete decision-making community that represented people engaged in decision-making about catchments, not just in hydrological catchments.

The processes maintaining complex adaptive systems were explored through the following research questions:

- What are the relationships between the social dimensions of sense of place, social capital and discourses of the environment in relation to the triple bottom line (social, economic and ecological) and the three knowledges (local, Indigenous and scientific)?
- What are the variables that define the boundaries of these complex adaptive systems?

- What characteristics comprise emergent processes in these complex adaptive systems?

Approaches to integration

Interactions between people and the landscapes in which they live are based on a dynamic and complex assemblage of relationships, values and practices (Marion 1999, Holling 2001, Gunderson and Holling 2002). The relationships with place and amongst people encompass both symbolic and material values (Brown and Reed 2000). It is generally understood that culturally bound judgements (with significant symbolic context) allow interpretation or classification of objects. However, it is also important to acknowledge that certain interactions result in consistent and predictable outcomes that are observable in the objective and material sense (Wasserman 2004). To manage for adaptive and resilient agricultural landscapes, it is necessary to identify these relationships and values, and to acknowledge diversity and non-linear connections.

In this research, an attempt was made to reduce *a priori*[1] assumptions about the critical factors in these relationships. Broad conceptual frameworks were developed to integrate spatial, temporal and social scales to operationalise the theoretical dimensions examined in sense of place, social capital and environmental discourse. This approach integrates theoretical and empirical literature to form conceptual models that form the basis for operationalisation in heuristic and explorative approaches.

Assumptions and statements that universalise tend to render difference and the unexpected subjugated, or silent. This can result in over-simplified and artificial portrayals that are potentially flawed and inaccurate (Callon and Latour 1981). To counter this possibility, this research used an exploratory methodology based on heuristic discovery that acknowledges diversity. Explorative research is advocated by Kleining and Witt (2001) as a heuristic paradigm of discovery. Their methodology advocates the use of an extensive range of perspectives in

[1] *A priori*: "valid independently of observation"…"claiming to report matters of fact but actually not supported by factual study" (Macquarie, L.P.L. (1981). *The Macquarie Dictionary*, Sydney: Macqurie University pg 125).

an effort to discover similarity (and thus expose difference) as a primary means of establishing patterns. Their research practice advocates openness of the researcher, the topic and the collection of data. They encourage the integration of a range of perspectives that comprise conceptual models in order to accommodate a broad range of theories, positions and perspectives at the outset. This provides an effective means of bridging conventional divides between social and physical/natural sciences and between qualitative and quantitative methodologies. This approach allowed for the discovery of associated necessity in open-systems to avoid the assumption of regularity and laws of causation (Sayer 2000). This approach accommodates non-linearity in systems and exposes re-current behaviours that structure complex adaptive systems.

This thesis reports on the integrated use of a range of approaches categorised in Eoyang's (2004) human systems dynamics typology continuum that ranges from qualitative approaches to quantitative and abstract mathematical portrayals of structure in complex systems. Eoyang's (2004) classification deals with both the phenomenon of interest and the tools with which to explore and understand these phenomena. Three forms of structure are classified in phenomena: surface, evident deep structure and subtle deep structure. Each of these may be exposed, identified, described and understood through four possible tools: practice, descriptive metaphor, dynamic metaphor and mathematics in a continuum from less abstract (qualitative) to more abstract (quantitative).

The research objectives in this thesis focused on the identification of patterns and structure in these rural agricultural social systems by using a numerical taxonomy package, PATN, developed by Belbin *et al*. (2003). These patterns form the recurrent behaviours of complex adaptive systems and the post-structural equivalent of un-expected and non-linear structure in systems. The research rationale was heuristic and based on an explorative analytical approach. The requirements for exposing these complex structures using numerical taxonomy include the development of a strategy for ecological sampling and a broad operationalised conceptual framework. The results of

numerical taxonomy provided guidance and focus for the qualitative exploration of the structures in these social catchments. Numerical taxonomy was explored as a means of identifying patterns to provide a sound focus for describing and understanding deep structure in complex adaptive linked social-ecological systems.

Catchments and sites of research

To achieve a generalisable result that is able to sustain inference this research required agricultural communities in different regions in Australia that could be loosely compared. A Western Australian catchment in the Blackwood Basin (the Katanning Zone) epitomises a substantially salinised landscape and is contrasted with the less environmentally impacted landscape of the headwaters of the Murray Darling Basin in south-east Queensland (the Headwaters of the Condamine River). This contrast in the state of the environment was a useful initial means of assessing the impact of the environment on decision-making in human populations. While the human population densities in each catchment were not commensurate, the similarities in landscape practice and the population structures of the two catchments allowed comparison (as presented in Chapter Two).

The range of people participating in this study represented the geographical distribution and a cross-section of the people responding to the 2001 national census. This cross-section was included as a representation of decision-makers (social catchment) that impact on landscape management within the hydrological catchments in this study. This approach provided an alternative to random sampling and a cost effective approach to social research at the landscape scale.

Structuring the research

The research was conducted in three phases. The first phase aimed to develop broad conceptual models from a wide range of theoretical and empirical literature in order to effectively operationalise each of the three dimensions (sense of place, social capital, and discourses of the environment). Initial quantitative research was based on a Pilot Study (Appendix 1) conducted on

Nathan Campus, Griffith University, which tested the responses to survey questions and the potential use of numerical taxonomy in the analysis.

The first phase also formed a theoretical exploration of each of the three linked social dimensions within a post-structural approach (Ritzer 1996) and complex systems framework. Sense of place was explored by asking what elements and scales are considered in theoretical and applied literature to comprise the concept. This question was extended heuristically to make explicit the theoretical, dimensional and relational spaces in sense of place that may be developed to form a conceptual model to operationalise empirical research. The same questions were asked to explore social capital but also included a research question exploring institutional forms and social scales at which social capital facilitates decision-making in landscape management. This research question also included asking what social relationships operate across and within scales of decision-making. Discourses of the environment were explored by asking what elements and scales are considered in theoretical and applied literature to comprise environmental discourse, and discourses of the environment.

In the first phase the research asked what questions and tools are necessary for identifying and describing sense of place, social capital and environmental discourse. This phase of the research used these three linked social dimensions to ask how complex adaptive systems can be conceptualised to integrate content with process. This question was extended heuristically to ask what theoretical options exist for integrating incommensurate symbolic and material values that link social and ecological systems. The first phase formed the means of developing broad conceptual models. These models were developed in order to minimise assumptions about what is important in the quantitative survey based exploration that formed the second phase of the research process.

The second phase used the conceptual models developed in the first phase as a means of operationalising the dimensions. This phase of the research involved the development and distribution of a questionnaire survey (Appendix

2) to two reasonably comparable social catchments that sampled equivalent participants in each. This phase of the research asked how sense of place values may differentiate Duane's (1997) three intersecting and overlapping categories of the community: place, identity and interest. This phase also provided the means of answering the social capital question on the forms of social relationships that operate across and within scales of decision-making in social catchments. In addition, this phase asked if it is possible to differentiate Duane's (1997) three categories of community according to environmental discourse.

The survey data was quantitatively analysed in the second phase through numerical taxonomy and more conventional descriptive statistical methods. Numerical taxonomy provides a robust and process based characterization of sets of cases (social assemblages) and value clusters rather than the more conventional linear approach that frames variables as causes (Belbin 1985, Byrne 2002). Numerical taxonomy provided a means of asking if it is possible to improve qualitative results by providing a more explicit and defensible focus for qualitative questions and improve generalisability of qualitative approaches through sampling from statistically tested social assemblages. Numerical taxonomy provided an empirical means of selecting representative social data to be statistically and qualitatively evaluated in the third phase, as well as providing the potential to portray sets of emergent variables.

The third phase drew on the results of the quantitative phase to develop focus questions. This phase ground-proofed the quantitative results and explored the details of the results through further fieldwork involving semi-structured in-depth interviews over three months. Participants representing the range of social assemblages were contacted and interviewed to provide depth and detail to the quantitative results. Research questions for this phase focused on identifying sense of place, social capital and environmental discourse variables to explore emergent characteristics. This third phase used the concept of dynamic structures to ask if resilient processes can be identified. This question was extended heuristically to explore the role of the elements that comprise complex adaptive systems (emergent characteristics, adaptive capacity and self-

organisation) in configuring and maintaining resilient processes. This phase used both quantitative and qualitative results to ask what emergent domains of attraction define and constrain the resilience in these complex adaptive linked socio-ecological systems.

The development of broad conceptual models drawn from theoretical and empirical concepts provided the means of limiting *a priori* assumptions in operationalising this survey based research. Analysis based on characterisation of sets of cases and variables accommodated diversity and non-linear relationships and provided a statistically tested basis for qualitative inquiry. This approach changed the emphasis usually used in qualitative inquiry from explorative to confirmative ensuring a more focused form of inquiry than usually conducted in qualitative research. Integrating quantitative and qualitative approaches was facilitated through numerical taxonomy and provided the means of identifying complex characteristics in these social catchments.

The Chapters

The methodology and methods are described and discussed in Chapter Two. This includes the selection of the two social and hydrological catchments in the case study, and a brief description of the salient social and environmental features of each landscape. This chapter also includes the development and results of validity and reliability testing in the sampling frame.

Chapters Three, Four and Five used each of the three research phases already outlined. Chapter Three addressed sense of place, Chapter Four, social capital and Chapter Five discourses of the environment. The first section of each chapter used theoretical and empirical literature to develop conceptual models. These provided the basis for survey operationalisation and quantitative analysis in the second section of each chapter. The third section presented the voices of each social catchment as evidence through quotes that gave form to the qualitative results. Each chapter concluded with the identification of emergent characteristics defining each dimension.

Chapter Six used a complex systems framework to combine the three dimensions into an interactive dynamic system. The results exposed the emergent characteristics, adaptive capacity and ability to self-organise by merging the accumulated results of the numerical taxonomy and qualitative interview responses.

Chapter Seven presents the insights drawn from this research in relation to the definition of these linked socio-ecological systems in Australia. Factors contributing to the maintenance of parameter phase space and resilience provide insight into more effective strategies for landscape management. Insights on research strategies and tools to expose the variables that drive the processes in complex adaptive rural agricultural systems in Australia are discussed.

This thesis used a complex systems framework based on a broad theoretical conceptualisation and non-linear pattern based analysis to provide an effective means of bridging conventional divides between social and physical/natural sciences. People and the values that underpin their decision-making were given context within a complex landscape system. This form of analysis provided an expanded insight beyond simplistic and reductive socio-demographic divides to an understanding of the social values that drive decision-making in rural agricultural landscape systems.

2

You can add up the parts

but you won't have the sum

You can strike up the march,

there is no drum…

Ring the bells that still can ring.

Forget your perfect offering.

There is a crack in everything.

That's how the light gets in.

Leonard Cohen in "Anthem" 1992.

Methodology

Society reflects a complex assemblage of ideals, ideologies and practices. In attempting to understand interactions and relationships between humans and the environment, a wide range of influences are to be expected. In the past, assumptions about these relationships, and the attitudes and behaviours upon which they are based has given rise to a limited portrayal of people's relationships with the landscapes in which they live. This thesis

aimed to reduce *a priori* assumptions and second order judgements to identify the critical social factors contributing to decision-making in landscape management. This was achieved through the development of conceptual models based on theoretical and empirical literature, which was operationalised for survey based explorative analysis. The results of this analysis provided a focus for the qualitative ground-proofing phase of the research. The accumulated results identified the domains of emergence that characterise resilience in these rural agricultural socio-ecological landscape systems.

This chapter discusses the theoretical and philosophical literature that provides the basis for the research methodology used. This literature is used to develop a range of models to form frameworks for the research approach. The methods and tools used for conducting this explorative heuristic post-structural approach are described and justified. Research into complex systems assumes non-linear interactions, diversity and unexpected relationships requiring a shift in methodological approach that explores the content of systems with the focus on the processes that define, configure and maintain systems as a final research outcome. Special focus in provided through the development of a conceptual framework for ecological sampling that directed the selection of participants in the study. A justification of the use of quantitative methods that included numerical taxonomy and other more conventional social science tools for the analysis of questionnaire surveys is provided. The description of the qualitative approach describes the selection of participants for interviewing and the analysis of the interviews. This numerical taxonomy provided a focus for in-depth interviews and the identification of systemic processes in the social catchments.

This chapter starts by discussing the explorative approach and rationale in Section 1. The second section describes the sampling rationale. Section three discusses the quantitative methods and section four presents the qualitative methods.

Section One: Explorative approach

Explorative research is advocated by Kleining and Witt (2001) as a heuristic paradigm of discovery. Their methodology advocates the use of an extensive range of perspectives in an effort to discover similarity (and thus make differences explicit) as a primary means of establishing patterns. Their research practice requires a diversity of data gathering methods, explorative and heuristic questioning and flexibility in research approach. They encourage the integration of a variety of perspectives that comprise conceptual frameworks to accommodate a broad range of theories and positions. The criteria for meeting this heuristic post-structural approach are detailed in Table 2.1.

Table 2.1 Hamburg rules of explorative research

Hamburg rules of explorative research (Kleining and Witt 2001)
Openness of the research person
Openness of the research topic
Maximum variation of perspectives
Discovering similarities and integrating all data

Kleining and Witt's (2002) approach makes it possible to gain insight into a complex system with emergent characteristics exposing links and relationships in a dialectic medium. The heuristic approach is characterised through the use of conceptual devices such as ideal types, models and working hypotheses. This approach is directed at discovery through cumulative exploration that is re-interrogated in an iterative search for similarities which thus make difference explicit. The post-structural approach (Kendall and Wickham 1999) to meet these rules is outlined in Table 2.2.

Table 2.2 Criteria for post-structural approach

Post-structural Criteria
Discover diversity through relationships
Avoid overarching claims/grand narratives
Avoid second order judgements
Expect dynamic systems
Expect non-linear relationships
Humans are agents
History plays a part

This approach provided the potential to bridge conventional divides between social and physical/natural sciences and between qualitative and quantitative methodologies. It was thus possible to include symbolic and material values to expose the relationships between people and the environment. This allows issues and results to emerge rather than be confined by assumptions and silences to be made explicit.

This approach allowed for discovery of associated necessity that reflects the relationships between ideals, ideology and practice in open-systems. This approach acknowledged interactions and contingency to avoid the linear assumptions of regularity and laws of causation. Three components in these open systems were differentiated (Bhaskar 1978, Chalmers 1994, Sayer 2000):

- the real, which are functional objects that have consistent and predictable behaviour in the objective sense;
- the empirical, which results when the domain of experience and the unobservable results in observable effects in daily practice, and;
- the actual which manifests with the impact of the enactment of power in relation to events and the personal philosophical framework.

This differentiation made it possible to locate emergent social characteristics. These social characteristics arose in relation to biological phenomena that were the result of functioning of chemical and physical strata that comprise a complex system (Marion 1999, Holling 2001). Non-linear relationships and dependencies form the associated necessity of open systems (Sayer 2000). These open systems reflect the interaction of ideals, ideology and practice in framing people's expectations and responses in decision-making processes.

Descriptions, Boundaries and Parameters

Moon (2001) uses decisions, power and alliance theories to explore the shift and current paradigms of government administration and governance. The descriptive approach provides operative standard for decisions. Power is defined as dispositional, facilitative and agency, and alliance theories include concepts of communities, networks and regimes. The cultural parameters, normative standards and procedural patterns in any situation will largely be

determined by the actors operating within that context arena and administrative actors search for cultural meanings to enact their tasks. This integrates the social context of politics of place with politics of interests (Cheng *et al.* 2003) in exploring meaning in relation to frameworks of practice used by each of the discrete sectors of community within these social catchments.

This approach allows for symbolic and material values to have a range of meanings depending on context, which accommodates post-structural criteria, but without denying the objective reality of certain biological or environmental functions. While it is generally understood that culturally bound judgements allow interpretation or classification of an object, it is also important to acknowledge that certain interactions result in consistent and predictable outcomes that are observable in the objective sense (Wasserman 2004).

Conceptualisation allows for the inherent dynamics of social systems across time and space and acknowledges that non-linear relationships and dependencies emerge in locating structure in these open systems. Social processes are contingent on the constitution and constraints within social systems and through interpretations of other actors. The functional components of a system are not derived from regular and causal associations with predictable sequences as presented in the traditional "successionist view" outlined by Hume that is representative of closed systems (Sayer 2000 p. 13). In using a conceptualisation of plurality in philosophical and theoretical approaches, it becomes possible to approach the rural, agricultural systems in this study as whole systems that integrate both biophysical and social components through non-linear relationships.

Assumptions and Judgements

To meet the criteria set in the Hamburg rules (Kleining and Witt 2001) (see Table 2.1) for research and post-structural approach (Kendall and Wickham 1999) (see Table 2.2) it was important to minimise a-priori assumptions and allow the emergence of diversity. In evaluating and interpreting results, second-order judgements can act in collusion with assumptions to mask unexpected or 'unpalatable' relationships (Kendall and Wickham 1999). These judgements are

primarily drawn from previous assumptions and readings, and imposed using the authority of other investigations. Resistance to the *status quo*, 'normal science' or other normative influences thus comes to be framed as the subjugated other (Kuhn 1987, Kuhn 1988, Foucault 1991, Sardar 2000). This subjugation reduces potential exploration to understandings that may be limited by previous preconceptions. Discourses are not only productive, but have been produced as a result of chance combinations of knowledge and practices, adoption, reinvention and revitalisation of older practices (Kendall and Wickham 1999). These oblique and opaque influences and negotiations (non-linear relationships) result in an *ad-hoc* evolution that can be traced through localised context and historically contingent events and discourses. The subjugated symbolic dimensions such as those silenced within a range of values often provide the insight into the silenced values, or 'the other'.

Esping-Anderson (2000) advocates empirical work on the constitution of social transformation through the definition of integrative forces. Empirical work is usually conducted through one of three underpinning methodologies:

- End of history postmodernist response concluding that everything has no inner meaning;
- Change is over-powered by path dependency: re-creating through institutional practice;
- Historical rapture: we are driven by a set of new motivations often using the same language but the meaning is new (Esping-Andersen 2000).

By looking for systemic patterns (recurrent behaviours that structure complex systems) and solidarity in social aggregates (such as social assemblages) Esping-Anderson's methodological approach may predict social outcomes. These comparative methods move beyond description and classification to seek variance and to find regularity through comparative contexts:

> individual action may not matter much if we can agree that social aggregates are tendentially more rational than their individual particles that people combine into social collectivities for some purpose (Esping-Andersen 2000 p. 72).

> locating tension as a starting point for explorative analysis will correct diachronic comparison….meta explanandums give little guidance to empirics (Esping-Andersen 2000 p. 73).

In making explicit the conceptual and social construction of a methodology, and recognising the dependence of observation on the guiding paradigmatic theory within which it is couched, it becomes possible to avoid some of the essentialism[2] that science uses to produce definitive positions. This alternative methodology is in favour of relationships based on context and contingency. Both Belbin (1993) and Callon and Latour (1981) use 'black boxes' as a metaphoric exemplar to draw attention to the limitations of research based on inadequate critique of 'normal science' approaches. Cohen's (1992) lyrics at the beginning of this chapter use 'cracks' and 'light' to expose the boundaries of a system as a potential for illumination and change. The selection of questions and variables through broad conceptual frameworks at the outset provide a greater potential for results that reflect the emergent characteristics and processes of a complex adaptive system.

Values and Descriptors

Universalisation is often based on a 'safe' and limited range within conceptual possibility and results in over-simplified and artificial portrayals that represent limited components of complex systems that are inaccurate. Reduction in quantitative data to more abstract form has potential dangers that include the reduction or disappearance of meaning. Callon and Latour (1981) advocate identifying the 'edges' of a paradigm as the means by which to establish boundaries (Midgley 2000). This identifies what is acceptable and not acceptable in the inclusion of values, descriptors and cases in the portrayal of a system. The transformation of abstract problems into concrete and meaningful relations is then achieved through the identification of similarities and analogies (Kleining and Witt 2001). Numerical taxonomy is a means of discovering "'structure' or pattern in data" (Belbin 1985 p. 15). Belbin goes on to explain the difference between statistical methods and the reasons for using numerical taxonomy:

[2] Essentialism: "a thesis (sketched by Locke) in the philosophy of science…that objects have real essences which are distinct from, but capable of explaining, their observable properties, and that discovery of these real essences is the ultimate goal of scientific investigation" (Bullock, A., and Trombley, S. (2000). The New Fontana Dictionary of Modern Thought, London: Harper Collins Publishers, p. 283).

> "Unlike statistical methods, the techniques are designed to be hypothesis generating rather than hypothesis testing, exploration rather than confirmation. No assumptions about the distributions of variables are necessary…Numerical taxonomic algorithms require considerable computing resources…{these} algorithms do not generally use a 'brute-force' approach, rather, they are heuristic in that they use 'rules of thumb' and iteration" (Belbin 1985 p. 15).

In this research numerical taxonomy locates similarity and difference by using a dissimilarity equation on matrix data. Belbin (1993) developed the PATN analysis package for the analysis of complex data through numerical classification. This package was developed to allow a broad inclusion of variables and cases and a rigorous testing of their contribution within a system.

The research process

Manzo (2003) points out that social science research goes through distinct phases. In the first phase, scholars treat a phenomenon as if there was consensus about its meaning scope and underlying dynamics. Additional research reveals that the phenomena discovered are multidimensional and consist of several related, but different properties. This leads to a second phase of research that explores the diversity of a phenomenon's meanings as a basis for subsequent research. This exposes the plurality within the phenomenon of people's emotional relationships to places.

These phases reflect the process followed in the research for this thesis starting with a broad accommodation of theoretical and empirical literature to ensure a breath of positions are included to develop a conceptual model. This model was then operationalised to capture a range of positions through survey-based quantitative approaches. The numerical taxonomy used in the analysis of the survey data provided the means of identifying value tensions within abstract ordination space that portrayed the relative relationships of people representing the social catchments. This approach takes the guesswork out of traditional grab-bag and "black-box approaches" (Belbin, 1993b, p. 176) while allowing problematisation of assumptions that frame the conventional approaches described as 'black boxes' by Callon and Latour (1981). A Pilot Study using an ecological sampling on Nathan Campus, Griffith University provided an

opportunity for a full analysis to ascertain the usefulness of categories or responses and the numerical taxonomy as a means of analysis. This Pilot Study report is included as Appendix 1. This quantitative approach provided a rigorous approach with cross-validating statistical methods that addressed the limitations of subjectivity and met the requirements for openness and diversity in approach.

This quantitative approach was coupled with ground-proofing and qualitative testing of results that focused the qualitative approaches to follow up un-answered or exposed questions. The accumulated knowledge that resulted exposed the domains of attraction that define the processes of emergence that maintain resilience in these complex adaptive systems (reported in Chapter 6).

Choosing a methodology that challenges assumptions at the outset and works within conceptual frameworks that include a full range, rather than a limiting binary, requires an attempt to limit *a priori* assumptions. The demonstration of difference, and the clarification of relationships, drives much research. This component of the research is often performed on a sub-conscious level that is fraught with subjectivity (Belbin 1985, Sarantakos 1993). This explorative methodology based on heuristic discovery had the intent of forming an inquiry that used a range of methods to build an "incremental accumulation of evidence" (Woolcock 1998 p. 188) which provided a sound basis for theoretical claims and empirical results that are an accurate portrayal of processes and systems.

Section two: the sampling rationale

Social catchments: development of the sampling frame

Relationships between people and the landscapes in which they live include interaction between different sectors of a decision-making community. Thus, it is important in defining the relationships between people and the landscape to locate the community that forms the decision-making relationships with a particular landscape. In defining the study site within a hydrological catchment, rather than a politically defined district, or geographic region, primacy is given to a landscape management unit that interlocks humans with the environment.

Hydrological catchments are biophysical boundaries used in Australia as a means of defining landscapes for intervention and regulation (Beilin 2001). They encompass a range of landscape elements, land uses and human communities within conveniently delineated hydrologic boundaries that form a landscape. The definitions of a landscape are many and frequently defined in contrasting ecological and cultural terms. As this concept is a key component of the conceptualisation for sense of place, there is further discussion about these issues in Chapter Four. This research uses a human population that is broader than the hydrologic catchments. Thus it is social catchments, the decision-making communities associated with catchments that are considered in this approach.

Defining the community

In general, the concept of community is cluttered with a multitude of ill-defined, selective and complex themes (Lockie 2001). Adequate ecological sampling depends on the initial definition of the concept of community. The term community generally refers, in the most minimal sense, to people who live in a particular geographic location. While the term has endured much debate and a variety of uses since early distinctions in sociology, current usage is generally limited by boundaries of interaction, norms and goals between members within a particular location (Abercrombie *et al.* 1994, Black 2005). Individuals rarely belong only to one form of community and thus represent a range of interests in the way in which belonging occurs. In general, membership of a community assumes notions of place, forms of interest and the values and connections that come from a shared identity.

A range of other forms of conceptualisation include the role of power in the way belonging in a community takes form. Guattari (2000) makes the distinction between the concepts of individual and subjectivity to differentiate the role of power. Subjugated groups withdraw into a refuge and develop a collective form of expression as a result of external force. Subject groups develop around a collective and internal source of commonality arising from reaction to other groups, which defines their difference. Subject groups are capable of resingularisation, while subjugated groups are subject to that imposed by

external forces. Guatarri's (2000) differentiation implies the interactions between included and excluded and the notion of subject communities is extended by including Winter's (2000) concept of 'captured' communities. These sectors of the community are those people who are engaged in the relationships of governance and political power. This concept allows the explicit acknowledgement of those who contribute to these decision-making processes but who are not engaged in these relationships and are here defined as 'critical' communities.

In some literature, social catchments refer to descriptive concepts related to socio-demographics (Smailes *et al.* 2005). According to Eisenhauer *et al*. (Eisenhauer *et al.* 2000) there are three defining parts to community:

- Locality which is the context of people's daily interactions around daily needs;
- Local society which is the network of associations and common interests that include infrastructure, local governments, community organisations and services; and,
- Community field, which is the process of collective actions in a local context that reflects the interactions of community and expression of common interests.

Urry (2002) uses similar defining categories to acknowledge the three elements of geographic space, local community and local social activity. These definitions capture the dimensions of social catchments, but do not give explicit acknowledgement of the macro scale interactions that occur in local contexts. Macro scale interaction has an impact in local contexts by introducing new approaches drawn from other contexts or the imposition of power through abstracted relationships with landscapes. In general, definitions of community neglect the impact and importance of interactions between local contexts and macro scales thus reducing sampling strategies to a limited and poor portrayal of social catchments. Gesler (1992) sees community in terms of relative rather than absolute space emphasising the interaction of structure and agency. This provides for process in relationships between social scales that allocates some primacy to processes of social capital and the development and maintenance of social norms that interact across social scale.

Duane (1997) provides a concise categorisation of communities that differentiates between geographic location, identity and interest. This notion extends the boundaries beyond those of hydrologic catchments to include the influences of social catchments on landscapes within a dialogic political interaction that relates specifically to decision-making in landscape management. In general, choices in definition must ultimately relate to and reflect the needs of the research question. The conceptualisation for this research reflects decision-making as a key influence. In Duane's (1997) first category, catchments are home to a community of place, including all those people who live in the geographic, physical space. This community is composed of several smaller communities that may live in specific localities within the catchment. Farmers (and retired farmers) often occupy that niche in the social catchments in the case studies in question.

In Duane's (1997) second category, communities of identity do not necessarily live in the geographical catchment but identify through association or identity sharing social connections or social characteristics. This sector includes non-government organisations that contribute to decision-making through influence and on-ground work, or may include extended families.

In Duane's (1997) third category, communities of interest, consist of those members of the community that relate to a particular place, in either benefiting from a resource or through interactions that contribute to the environmental state of a place. Communities of interest are those decision-makers who may earn an income from business or agency-based employment or in some way may benefit from the resources in the landscape thus contributing to the state of the environment. This group may include the agribusiness sector, business interests and the public service.

Duane's definitions of sectors of decision-making communities in landscape management comprise a social catchment and serve as the definition of social catchments in this thesis (Table 2.3). The political sphere is acknowledged explicitly through the definitions by Guattari (2000) and Winter (2000).

Table 2.3 Defining the social catchment (Duane 1997, Guattari 2000, Winter 2000)

Communities of place	Tied to a physical space through geography
Communities of identity	Tied to each other through social characteristics but may transcend place
Communities of interest	Have commonalities in how they relate to a particular ecosystem or resource as beneficiaries of the place or contributors to its condition.
Status Quo communities	Current normative social arrangement that holds standing
Subjugated communities	Groups withdraw into a refuge and develop a collective form of expression as a result of external force
Subject communities	Develop around a collective and internal source of commonality arising from reaction to other groups, which defines their difference
Captured communities	Part of a process working within status quo frameworks of accepted practice
Critical communities	Generally work outside processes and the frameworks in question

By explicitly differentiating between categories of communities, or combinations of these types, within a social catchment, it was possible to identify the cross-scale impacts and influences of the social on decision-making in these hydrological catchments. This conceptual framework served as a means of identifying the boundaries of the decision-making processes and thus the sampling strategies to represent these social catchments.

Often the same person may belong to more than one community category and behave in a way that requires rationalising one position against another. This dialogue contributes to modification of a discourse, in an interactive dialogue between the institutionalised elements of each of these community categories mediated and sustained through social capital.

The sampling frame that defined and identified these sectors of the communities in each of the catchments is shown in Figure 2.1. The other three

elements that appear in the sampling frame: ecological, economic and social, constitute the interaction of triple bottom line processes evident in sustainability discourses. Notions of sustainability encompass negotiation between social, economic and environmental priorities to achieve a form of balance that will allow the integrity and function of a system to be maintained over time (Dibden and Cocklin 2005). The differentiation and interactions between individuals, communities (operationalised as organisations at the meso scale) and society (operationalised as institutions at the macro scale) are accommodated in the sampling to reflect the nested nature of social forms ranging from local to global scales. This conceptual framing of a social catchment reflects an ecological sampling that accommodates the requirements of numerical taxonomy and Kleining and Witt's (2002) methodology.

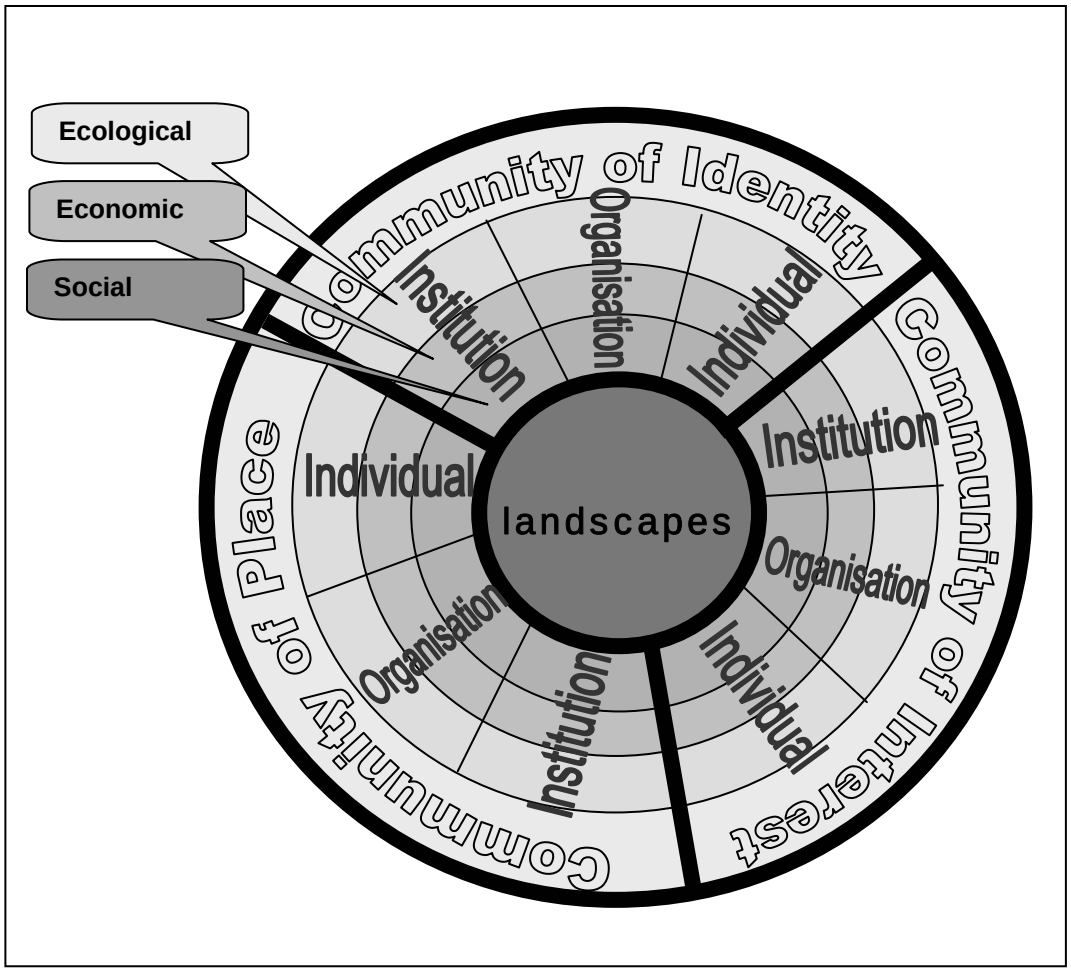

Figure 2.1 Social catchments: a conceptual model for ecological sampling

No view of 'the world' can ever be considered comprehensive, so it is important to explicitly acknowledge the boundaries of what is being considered as a system, while at the same time considering what is excluded as a consequence. Complex adaptive systems are comprised of domains of emergence that drive the processes, which in turn define and constrain systems. Emergence as a property results from interactions within a system as a whole rather than interactions in discrete parts of a system, thus forming a whole that is more than the sum of the parts. This means that problematisation, critique and the consideration of uncertainty is critical in placing boundaries to optimise comprehensiveness (Cook *et al.* 2005). Recognising and testing for sensitivity and the emergent variables that help define and maintain the resilience in a system depend on ethical consideration of the values that define the boundaries of a system. Binaries as a framework for consideration focus on knowledge bases (content of a system) and reduce opportunities to use process-based research to identify systems that are defined by relationships and interaction (Midgley 2000). Process-based explanation provides an insight into function and response in a system in relation to perturbation, while content provides information pertaining to the variables that comprise a system.

The approach used in this thesis is an attempt to ensure that the sampling for this research includes all elements that constitute the functioning of community and social scales related landscape management practice. The sampling model (Figure 2.1) provided the framework to ensuring that a rich cross section of communities and values were included in the survey.

Ecological sampling

An ecological approach to sampling was used to capture the range of decision-making interactions within the two social catchments and to be sure they adequately represented the social catchment. This provided the opportunity to explore a wide range of values and evaluate their contribution to decision-making.

Austin (1991) who contributed to ecological theory on sampling and distributions, emphasises that theoretical concepts influence every stage of

research and may be explicitly stated or "simply implicit in the routine procedures adopted" by the researcher (p. 17). Decisions at each stage are derived from assumptions based on "theoretical concepts of community" (p. 17).

There were two conflicting theoretical positions that influenced the decisions for achieving a representative sampling of the social catchments to include in the survey: continuum versus community. This dilemma broadly reflects the way in which homogeneity changes to heterogeneity across an increasing spatial and social scale. A general rule of thumb from ecological theory of sampling by Austin (1991) states that:

> communities will change if the landscape pattern of the environment changes. It is unlikely therefore that communities from different regions will be exactly the same in composition. The conclusions from this theoretical analysis are:
>
> The continuum concept applies to the abstract environmental space, not necessarily to any geographical distance on the ground.
>
> The concept of a community …can only be relevant to a particular landscape and its pattern of combinations of environmental variables; community is a landscape property. (Austin 1991, p. 19).

Austin continues with:

> The consequences for surveys are obvious. Attempts to equate communities described from different regions are unlikely to be successful unless the regions have similar….(attributes)…landscape patterns. ….Effective surveys will require adequate replication within previously recognised communities to allow for and detect these geographical variants… (Austin 1991 p. 19).

Austin (1991) advises that in order to increase cost effectiveness in survey design and sampling methodology, the "community concept" can be used for "descriptive purposes within a region" (p. 21) but will not necessarily be expected to reflect or equate community at a more generalised scale of different regions. The "continuum concept" that reflects environmental space provides a guide for determining adequate sampling across a range (Table 2.4). This strategy ensures avoiding ecological fallacy in which individual properties are related to individual properties through spatial association rather than through

direct measurement (Byrne 1998). The potential to generalise based on inference requires the boundaries of a system be tested by replication through paired comparison of sampled populations and be explicitly representative.

Table 2.4 Scale and ecological sampling (after Austin 1991)

Continuum	Community
The abstract environmental space of representation across a range	Reflects the context within a specific landscape
Captures the diversity of interacting processes	The pattern of variables that represent a particular landscape context
Sets the boundaries for the context	Describes the content of a landscape context

While Austin works primarily in sampling in ecological systems, the basic tenets apply equally to this research into social catchments. Four theoretical issues are relevant to the context of the sampling framework used here, these relate specifically to decision making in landscape management:

- Scale: decisions are made from the farm level to the global level, and interact politically and economically in decision-making;
- Representation: inclusion needs to move beyond local context of community and include in the sampling strategy those who contribute to decisions;
- Community diversity: issues of homogeneity and heterogeneity: how do decisions reflect diversity in, and of communities?; and how does this diversity influence landscape scale decision-making?
- Geographic distribution of community: requires that the way different people relate to and use the landscape within a landscape/catchment scale in the geographic sense are included to capture the continuum.

Surveys can detect patterns and provide reliable and empirical data for simulation and modelling of communities to better understand social dimensions and patterns (Gilbert 1999). Combining community and continuum concepts by using both spatial and social scale across a landscape provided the core of this ecological sampling and through the sampling framework (Figure 2.1) provided a conceptual basis for selecting a sample population in both catchments.

Operationalising the sampling model

Rural agricultural Australia has a diversity of populations and land-use practices ranging from pastoralism on properties the size of small European countries to intensive horticulture on properties the size of a 'pocket handkerchief'. To capture decision-making in landscape management, the research focus required two social catchments with similar social components to make a comparison between sampled populations in two hydrological catchments. The study required participation that reflected a broad range of interacting community sectors. In addition, to capture and reflect the processes of a complex adaptive system it was necessary to include some identifiable, but contrasting factors that provided an explicit insight into differences in the adaptive characteristics and capacity of each catchment. To some extent the social catchments identified themselves, both through the provision of funding, and through the convenience of proximity to accommodation. The Blackwood Basin Group suggested one of the catchments of the Blackwood River, the Katanning Zone, in south-western Australia as a research site. This catchment was selected, based on the support available within the regional centre to provide on-ground links and office support. The Condamine Headwaters in south-east Queensland, at the head of the Murray-Darling Basin was suggested by the Condamine Catchment Management Association as a catchment with comparable agricultural activity. The location of each of these catchments is shown in Figure 2.2 and Figure 2.3.

These catchments proved ideal comparative case studies with sufficient similarity, but explicit differences in the state of their environments. The Katanning Zone is considered by some to be the most salinised agricultural landscape in Australia (Beresford *et al.* 2001), and many consider the Condamine Headwaters to be in a reasonably healthy environmental state (Freebairn 2005). This environmental difference proved very useful for exploring differences in social commitment to landscape management.

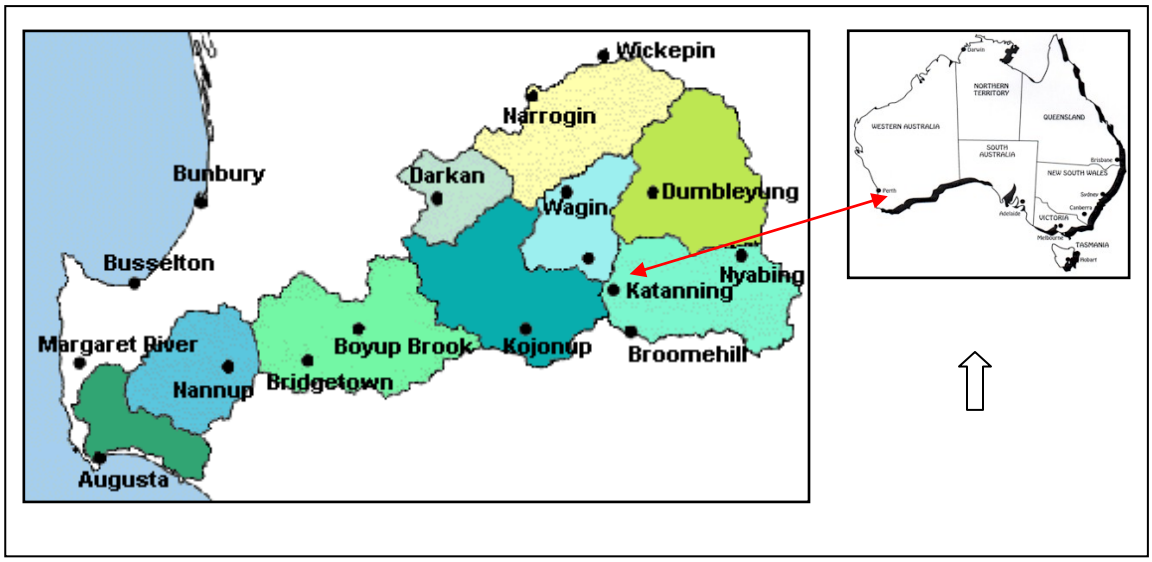

Figure 2.2 Catchments of the Blackwood Basin showing location of Katanning Zone in Australia (Blackwood Basin Group 2003)

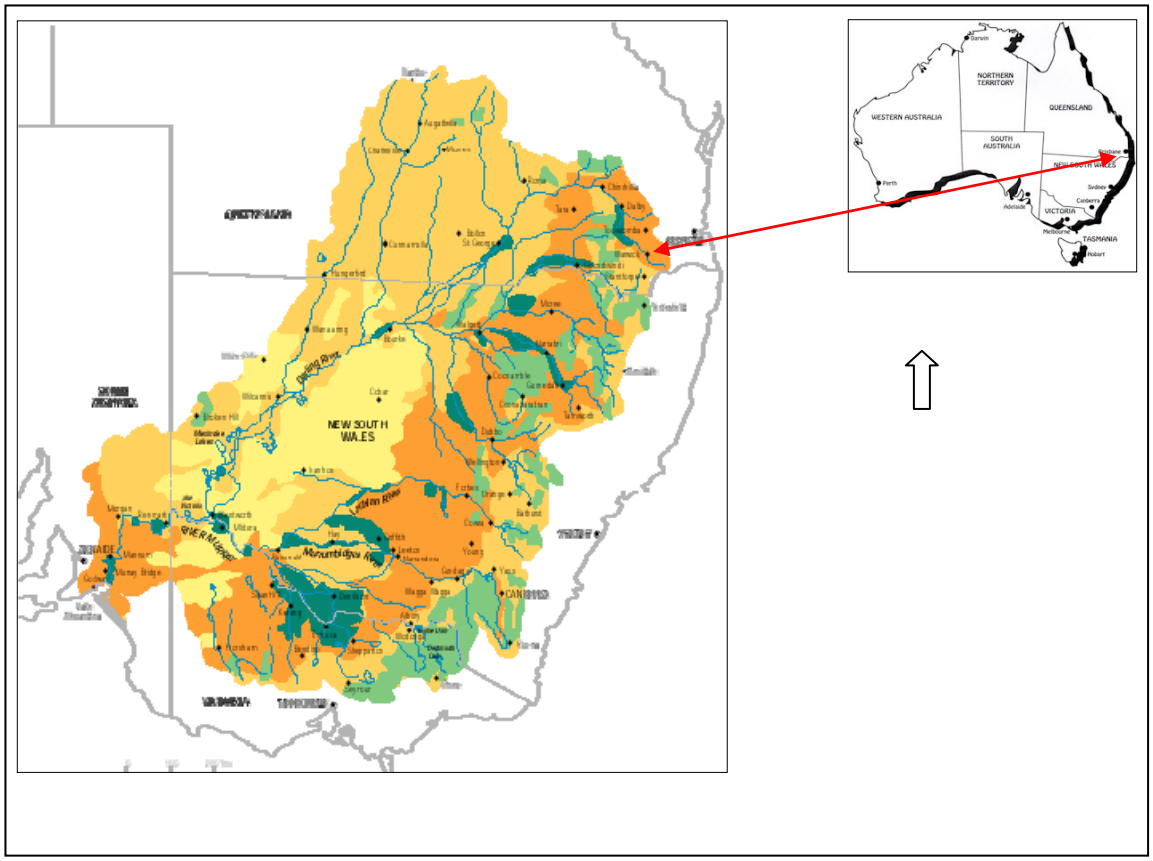

Figure 2.3 The Murray-Darling Basin with arrow indicating location of Condamine Headwaters in Australia **(Murray-Darling Basin Commission 2003)**

To provide detailed information on the biophysical and social features of each of these catchments, Geographical Information Systems (GIS) technology was used to generate maps for use by the participants in the research and to

provide an integrated approach to combining biophysical information with land-use and social practices in each catchment. I generated these two maps (Appendix 3 and Appendix 4) from information layers provided by the Blackwood Basin Group in Western Australia, and by Department of Natural Resources and Mines in Queensland. This approach provides landscape information on the density of settlement, the presence of conservation lands, the surface water bodies, roads and towns.

Katanning Zone

The town of Katanning forms the social, business and regional centre of Katanning Zone and associated catchments (15) in the south-east of the Blackwood Basin. Katanning is signposted as the “Heart of the Great Southern” and is located nearly 300 kilometres south-east of Perth in a gently undulating landscape. Five Shire Councils (Katanning, Kent, Broomehill, Woodanilling and Gnowangerup) contribute to the local decision-making in the catchment that stretches over 307 000 hectares (approximately 3 000 square kilometres). There are two other towns, Nyabing and Broomehill, in the catchment (Brockman 2001). Katanning has a population of over four thousand people and services around thirteen thousand people in the surrounding regions. The traditional custodians of this hydrological catchment are the Koreng, Kanaeng and Wilmen peoples of the Noongar (Beresford *et al.* 2001).

Figure 2.4 Landscapes of the Katanning Zone reflect the engagement of people with landscape management

Photographs in Figure 2.4 capture local engagement of the people with the landscape. Roadside signage signals local engagement with the environment, and extensive tree plantings and reserved remnant vegetation in the agricultural landscape indicate agriculture that includes biodiversity and landscape management concerns. Figure 2.5 shows a selection of photographs showing the fresh and salt water systems in the catchment.

The Katanning Zone has an annual rainfall of around 480 mm in a Mediterranean climate that is hot and dry in Summer and cold and wet in Winter. There are both salt water and fresh water systems present in the catchment that is part of the Granite and Gneiss geology of the Ancient Drainage systems of the Yilgarn Craton. Eleven land management systems have been identified with a total of 6% of the landscape impacted by salinity with a potential to increase to over 30%. Ten percent of the original vegetation remains, with over 80% occurring on private land. Soil acidity, water logging and wind erosion are significant land management issues (Brockman 2001).

Figure 2.5 Saltwater (1) and freshwater (2 & 3) systems in the Katanning Zone

Social issues that reflect the impact of rising salinity include deterioration of infrastructure such as buildings, roads and swimming pools in the townships and across the catchment. The area was first explored by white settlers in the search for a rail route between Perth and Albany in 1835. The shire's name is derived from "'Kartanup', the name given to a pool of sweet water from a stream near the town where three surrounding Aboriginal tribes used to meet" (Horwitz and Wardell-Johnson 1996 p. 40). This water and the availability of good grazing provided the basis for future settlement by sheep pastoralists who started supplementing their income through harvesting sandalwood in the 1840s.

Once the railway was opened in the 1880s, the siding of Katanning provided a site for F & C. Piesse's store, which provides a home to the visitors centre in Katanning today. Katanning has over the years milled wheat grown in the district, manufactured bricks and grown grapes for a very early winery in Western Australia (Horwitz and Wardell-Johnson 1996). The War Service Land Settlement Scheme in 1945 resulted in increased settlement in the area with

clearing for agriculture escalating the clearing of indigenous vegetation and transformation to farmed landscapes (Beresford *et al.* 2001). Figure 2.6 shows buildings constructed early in Katanning's history, as well as smaller towns. Avenues of indigenous trees were planted to line farm entrances.

Figure 2.6 Early white settlement transformed the landscape

Agricultural practice still has an emphasis on the production and processing of grain and livestock. Wheat, canola, barley and lupins are grown and exported. Sheep are a major part of the economy with about one million passing through the sale yards in Katanning annually (Beresford *et al.* 2001, Warne 2004). The West Australian Meat Marketing Cooperative Limited operating through an abattoir just out of town are the largest local employer and export to more than fifty countries around the world (Austrade 2005). Agricultural services such as crop spraying and information provision (consulting) are also agriculturally related employment in the town. There has been a steady increase in the production of grains and the slaughtering of livestock reflecting both regional trends and the success of industry in the town (Blake, no date). The district is considered a reliable and successful agricultural area with upgrading and development of agriculturally related facilities (eg. sale yards) and regular awards from agricultural production (Beresford *et al.* 2001, Katanning 2004).

Katanning hosted the annual Western Australian landcare conference in 2004 reflecting the district's long-term involvement and commitment to caring for the landscape. Early indication of decline in the health of the landscape was recorded by the local communities through the disappearance of marron, redfin perch and minnows from the waterways by the 1930s (Horwitz and Wardell-Johnson 1996). The impact of extensive clearing of native vegetation impacted on the water table, which resulted in rising salinity. By the 1980s people in the district were starting to plant vegetation to manage water in the landscape

which is now both critically affected by salt and extensively planted with a range of amelioration, habitat and production trees. People started experimenting with planting and taking advice from a range of experts (Beresford *et al.* 2001). Before long, their innovations and commitment to landcare were being recognised with national landcare awards. Today on average, Katanning farmers continue to plant approximately three thousand trees each annually, and the district is a centre of innovative agriculture and landcare practices (see Figure 2.7). In general people who live in the district are reasonably positive about their future despite the impacts of salinity.

Figure 2.7 Katanning Zone people are actively engaged with land-management in both urban and rural landscapes

The community living in the catchment includes a culturally diverse population with a well respected and locally active Malay Muslim community and other Asian people managing business interests in town. The hydrological catchment reflects a similar size and make up to the Katanning Statistical Local Area. This has provided a basis for describing the social characteristics of the district. There are a range of religions represented. About one third of the Statistical Local Area are Anglican, with similar numbers who follow Catholic traditions (Australian Bureau of Statistics 2000). There are a range of other churches in the district and a mosque that serves local people and migrant labourers working in the abattoir.

The Shire supports an international standard art gallery that forms a hub for local and visiting arts activities (pers comm. 2004 Shire Curator). The facilities provided through local sports centres and clubs reflects a diverse range of sporting activities including swimming. State and federal government services include a hospital, three kindergartens, three primary schools, a high school and Centre for Technical and Further Education. State and federal government agencies represent interests that include agriculture, conservation lands,

infrastructure services such as water and power, postal, health, defence and regional economic development (Warne 2004).

Condamine Headwaters

The Condamine Headwaters forms the catchment at the head of Australia's largest river basin, the Murray Darling. The mountainous and forested head gives way to numerous fertile valleys that support a diverse cropping and livestock industry. Soils are rich and rainfall is reasonably predictable. This scenic area has Warwick as a regional centre supporting a population of over twelve thousand people in a district of around twenty thousand people occupying over four and a half thousand square kilometres. Warwick is situated on the main inland highway to Sydney about 160 kilometres from Brisbane. There is only one local government making decisions for the Condamine Headwaters, which includes the small towns of Allora, Killarney, and Dalveen. The Traditional Owners of this rich and diverse landscape are the Kitabul and the Keinjen (Tindale 1940).

Figure 2.8 Landscapes of the Condamine Headwaters showing the mountainous Headwaters, diverse farmlands

Alan Cunningham, the explorer and botanist, first came to the Warwick region in 1827. Later in the 1840s the area became the first free white settlement for Queensland pioneering pastoralists. This area has provided an agricultural base for production of cereal, crops and livestock for farmers, pastoralists and intensive production. The sale yards in Warwick have an annual sale figure for sheep and cattle of $36 million (Warwick Shire Council 2004). Warwick has a number of horse studs and is a centre for national equestrian events (Warwick Shire Council 2005). Most of the income generated in the catchment (which is the equivalent area of the Statistical Local Area and the Shire Council boundary) is by retail trading (16.5%) followed closely by agriculture, forestry

and fishing (15.4%) and manufacturing (11.8%) (Warwick Shire Council 2005). The strategic location of the regional centre has attracted a large export beef abattoir employing over 500 people, a distribution centre for Woolworths, innovative manufacturing in natural medicines and innovative technology developers in environment and water quality monitoring equipment (amongst other industries) (Warwick Shire Council 2005).

Figure 2.9 Cultural heritage is an important part of the Condamine Headwaters. Early buildings in the city centre and homesteads on farms are conserved and valued

The population of the Condamine Headwaters is not as culturally diverse at that of Katanning Zone, but within the white population reflect a similar socio-economic representation. The Anglican Church has the highest membership, followed by the Catholic faith, Uniting and Presbyterian and Reformed Churches. The Shire supports a regional art gallery and library, as well as aquatic and equestrian centres. State and federal government services include hospitals, kindergartens, primary schools, high schools and a branch of the Toowoomba Centre for Technical and Further Education. State and federal government agencies represent interests that include agriculture and agricultural research, management of conservation lands, standard infrastructure services such as water and power, postal and health.

The Condamine Headwaters has an annual rainfall of over 700 mm with rain falling mostly between October and March. The Great Dividing Range rising to 1,400 metres forms the eastern and northern boundaries and twelve land management systems have been identified. The area falls within the southern part of the Brigalow Belt bio-region in an “intermediate climate zone between the moister coastal climate and the drier inland” (Condamine Catchment Management Association 2001 p. 17). Up to 70% of the remaining remnant

vegetation is classified as 'endangered' or 'of concern'. Land-clearing, erosion, soil conservation, water quality, and water management are the most important environmental issues. Social issues include the consequences of reduced agricultural production, chemical use, vegetation clearing, weed management and changes in land use.

Figure 2.10 Landscape management activity in the Condamine Headwaters embraces conservation and agricultural activity

People in the Condamine Headwaters are concerned about expected changes in agricultural production, and with the changes in the community make-up that reflects the proximity to the rapidly expanding metropolis of south-east Queensland (Brisbane and the Gold Coast).

The people who live in each catchment

The Australian Bureau of Statistics provided information on the socio-demographic population structures for each catchment (Australian Bureau of Statistics 2000, Australian Bureau of Statistics 2002). The geographical location and extent of the Statistical Local Areas used to collect census data was roughly equivalent of each hydrological catchment used to define the study sites. The following section provides brief summary descriptions of the total population as an indication of similarity between the two study sites.

Table 2.5 Age, gender and population for Katanning SLA (K) and for Warwick SLA (W) (includes East, West, North and Central)(Source ABS, 2000, 2002)

Age	K-♀	%	K-♂	%	K-Total	%	W-♀	%	W-♂	%	W-Total	%
<15	625	27.8	592	26.3	1217	27.1	2557	25.9	2375	23.7	4932	24.8
15-24	312	13.9	339	15.0	651	14.5	1346	13.7	1252	12.5	2598	13.1
25-39	552	24.6	543	24.1	1095	24.3	1865	18.9	2015	20.1	3880	19.5
		66.3		65.4		65.9		58.5		56.3		57.4
40-64	594	26.5	550	24.4	1144	25.4	2853	28.9	2791	27.9	5644	28.4
65-79	131	5.8	161	7.1	292	6.5	1006	10.2	1133	11.3	2139	10.8
80+	31	1.4	69	3.1	100	2.2	232	2.4	449	4.5	671	3.4
		33.7		34.6		34.1		41.5		43.7		42.6
Totals	2245	100	2254	100	4499	100	9859	100	10015	100	19864	100

The differences between the populations of Katanning and Warwick in relation to Indigenous and overseas origins, along with rates of employment and unemployment are shown in Table 2.6. Overall, there were more Indigenous people living in the Katanning area (6.1%) than in Warwick where Indigenous people totalled 2.3% of the population. There were more people born overseas living in Katanning (total 11.3%) than in Warwick (6.9%). While there were more women (6.4%) born overseas in Katanning than men (4.9%), the ratio was very close in Warwick (Men, 3.4%: Women, 3.5%).

A total of 46.2% of the population was employed in Katanning and 38.8% in Warwick. More men were employed in Katanning (26.4%) than in Warwick (22.8%) and more women (19.8%) were employed in Katanning than Warwick (16.0%). Overall, the population that were unemployed was greater in Warwick (3.6%) than in Katanning (2.5%) reflecting more or less equal numbers of women and men. While the population appeared similar in male-female ratios and in the types of industry people were engaged in, the numbers show slight differences in population make-up and employment totals.

Table 2.6 Population distribution reflecting country of origin, Indigenous origin and employment

	Katanning ♀	%	Katanning ♂	%	Katanning Totals	%	Warwick ♀	%	Warwick ♂	%	Warwick Totals	%
Total persons	2251	50	2255	50	4506	100	9908	49.6	10059	50.4	19967	100
Indigenous People	191	4.2	189	4.2	380	8.4	217	1.1	243	1.2	460	2.3
Born o/seas	221	4.9	289	6.4	510	11.3	677	3.4	706	3.5	1383	6.9
Employed	1190	26.4	893	19.8	2083	46.2	4547	22.8	3201	16.0	7748	38.8
Unemployed	75	1.7	36	0.8	111	2.5	445	2.2	275	1.4	720	3.6

The industry category indicates agricultural and other activity in each catchment. Table 2.7 shows that the top five industry categories in the two catchment comparisons were broadly comparative. While the primary industry in Katanning ranked highest, followed by manufacturing and retail, the order was slightly different in Warwick. Manufacturing employed the most people, followed by retail and then agriculture, forestry and fishing. These differences

amounted to a percentage point for each difference and thus unlikely to prove statistically significant. The health, community service and education sectors had the same ranking in both catchments. In all, the two catchments had almost the same percentage of people involved in these industries. This would seem to indicate that using the two catchments as a comparison was statistically appropriate.

Table 2.7 Comparison of Industry between two catchments

Industry (B19 ABS 1996)	Warwick Number	Katanning Number	Warwick Percentage	Warwick ranking	Katanning Percentage	Katanning ranking
Manufacturing	1203	325	15	①	15	②
Retail	1114	295	14	②	14	③
Ag, forest, fishing	1033	352	13	③	16	①
Health and Community Serv	713	154	9	④	7	④
Education	705	149	9	⑤	7	⑤
Totals	4768	1275	60.00		59.00	

Selecting participants

The sampling model (Figure 2.1) provided the basis for selecting participants to include in the survey. Social and geographical scale was used to ensure continuum and community concepts were accommodated in social and ecological terms. Social scale took into account micro, meso and macro social scales through the selection of participants that represented a range of organisations and institutions. Including participants living in a range of ecological landforms and distributions accommodated land use and landscape values.

The ABS census data provided a means of assessing the range of occupations and industry, the ethnic and gender composition and the age distributions in each catchment that required representation. The range of people contacted represented both geographical spread across each catchment, equivalent participants (as close as was possible) between catchments, and representative cross-section based on the people responding to the 2001 national census. In

addition, the three categories of community comprising the social catchment (communities of place, identity and interest) were included to ensure representation of a range of decision-makers that impact on landscape management. In many cases, these communities intersected to represent a participant based evaluation of a combination of community categories (community of place and identity, community of place and interest, community of identity and interest, community of place, identity and interest). The ABS census data provided a means of evaluating the representation of the sample population participating in the study. The conceptual framework for the sampling (Figure 2.1) shows the representation of this ecological sampling strategy.

The conceptual and sampling framework and ABS data provided the initial means of identifying participants but finding people to represent these categories required a different strategy. In the Katanning Zone, participants and their contact details were located through the Katanning Landcare Centre staff sponsoring the research; telephone books; the Lions handbook of community groups and businesses (Lions Club 2002); and through advice from people living in or working in the catchment. In the Condamine Headwaters, participants and their contact details were located through telephone books; the Southern Downs Pocketbook (Clarke and Clarke 2003); staff contacts at the Warwick Town Council; and from individual advice from people living in or working in the catchments. The focus and primary intent in using this strategy allowed the inclusion of participants that represented standard socio-demographic representation of each catchment in addition to the representation of three scales of social capital (micro, meso and macro). Thus, a combination of sampling methods was used.

Within the Katanning Zone there are 15 catchments, while the Condamine Headwaters has 7 catchments each with their own active catchment group. Sampling to include representation from each catchment ensured geographical spread that included a range of land uses and farming practices. A range of sampling strategies included:

- Accidental sampling occurred when I met people during the survey distribution phase who were not recommended by others, but were met by chance in either of the catchments and were prepared to participate;

- Purposive sampling was used to ensure that communities of identity and interest were included in the sample population as they were relevant to the research topic and provided key information;
- Snowball sampling allowed for local and expert input and recommendations;
- Dimensional and quota sampling ensured that smaller sectors of the population were represented (Sarantakos 1993).

When combined these sampling strategies provided an ecological sampling that captured comparable social catchments (cases or participants) in each of the landscapes in this study and overcame the limitations of each of the individual sampling strategies mentioned. In effect these strategies combined to use both community and continuum sampling to form an ecological sampling approach. This ecological sampling explicitly acknowledges the range of decision-making interactions outlined in the community definition that provided the framework for the sampling model:

- relationships of power
- coercive and collaborative relationships
- contributors to social decision-making applicable in local landscape contexts operating at three scales
- individual, community and society social scales
- communities of place, identity and interest
- the geographic diversity of landscapes and landuse
- continuum and community concepts
- a comparable paired replication in two hydrological catchments.

This sampling draws on biophysical and social descriptions of process in systems and captures the recurrent behaviours that structure complex adaptive systems.

Section three: the quantitative approach

The first phase of the research developed conceptual frameworks based on a literature survey of sense of place, social capital and environmental discourse. These conceptual frameworks provided the basis for questions used in a broad-based survey during the second phase to explore people's ties with the environment, social relationships within landscapes and the values of material and symbolic variables that contribute to decision-making.

The survey questionnaire

The survey questionnaire was developed during the second phase of the research to include representations from the three dimensions in this study: sense of place, social capital and discourses of the environment (Appendix 2). To provide key information on the people participating in the study a range of socio-demographic questions were designed to loosely correlate with information provided by the Australian Bureau of Statistics Census data (2000, 2002). This form of socio-demographic data was used to provide opportunities for comparison with other similar Australian studies.

To ensure that the participants viewed the survey as representing as closely as possible their own experiences and positions, the front page of the survey included a full colour photograph capturing familiar landscapes in each of the catchments. The photograph for the Katanning Zone catchment was a typical representation of the wheat belt in that part of Western Australia and was provided by the Co-operative Research Centre for Plant-based Management of Dryland Salinity (Appendix 2.1). The photograph on the front of the questionnaire distributed in The Headwaters catchment was taken by myself in the catchment and captured the full extent of land uses and landscapes (Appendix 2.2). The intent was that participants located themselves immediately in their own landscape to help focus the answers they provided through the survey.

In addition to the landscape context provided by the photograph, a catchment map (Appendix 3 and 4) generated through Geographic Information Systems layers provided a range of hydrologic, vegetation, infrastructure and cadastral information for participants to locate themselves physically. These maps were generated using MapInfo v6.5 from data kindly provided by Rob Baxter of the Blackwood Basin Group and through Melva Hobbs of the Queensland Department of Natural Resources and Mines. These maps were used by participants to record answers to a range of sense of place questions.

The questionnaire (Appendix 2) comprised four sections, the three dimensions in question and a fourth section collecting information for socio-demographic description. Sense of place questions used a combination of values identified through the literature that formed the conceptual framework, as well as a typology of tested values (Brown *et al.* 2001) as a focus for questions. The details for the conceptual basis and the development of the questions are described and discussed in detail in Chapter 3.

Social capital questions were derived from a conceptual framework that acknowledged the presence of local, regional, national and global scales as important in local communities. Further details on the conceptualisation and framing of questions is provided in Chapter 4.

Questions that provided information on discourses of the environment were derived through a conceptualisation derived from philosophy, politics and sociology. The rationale for the questions is discussed in Chapter 5.

Socio-demographic information was collected in order to describe the values held by the people sampled. These questions were expected to reflect standard and comparable variables such as gender, age, occupation and industry that would provide differentiation within a population. The survey included 551 variables over 22 pages, in addition to contact information, privacy and ethics information, options to receive newsletter updates and contribute input to the in-depth interview stage of the research. The self-administered questionnaire took on the average 45 minutes to complete.

The questionnaire (Appendix 2) was constructed to ensure that data were collected as scale based (0 to 5 with 0 = none and 5 = most) to meet the requirements of analysis through PATN (Belbin *et al.* 2003). A limited amount of nominal data was collected in the socio-demographic sections to provide information on population representation. This was used as presence/absence data for the quantitative analysis. In addition, an attempt was made to ask questions in a range of ways through a scale to provide a composite measure to capture an abstract position representing several relatively specific indicators

(de Vaus 1986, Mouton and Marais 1994). This index development was a way of representing the somewhat abstract ideological positions that represent discourses of the environment.

Fieldwork and research process

In order to generate direct knowledge and make contact with the people associated with the catchment two weeks were spent in Katanning during the first phase of the study (2003). During this time the distribution and collection of survey questionnaires took place. A further two weeks was spent in Katanning while conducting in-depth interviews in 2004. Desk space, a phone and other office supplies was provided by the Blackwood Basin Group in the Katanning Landcare office. This office is situated in the centre of town within walking distance of the post office and other facilities. This provided an easy means of contact for participants coming into town for shopping and other reasons.

Each visit included an interview with the journalist from the local newspaper, in Katanning (The Great Southern Herald) and in the Warwick area (Daily News) resulting in a story and photograph (Appendix 5). This helped keep in touch with participants as well as provide information to the general community about the research. Newsletters (Appendix 6) were distributed to interested participants and stakeholders following each visit providing limited and simple information on research results.

The fieldwork in the Condamine Headwaters was not conducted with the same intensity as that in Katanning as it was more difficult to find safe and affordable accommodation (both office and residential) for a similar length of time. In addition, the travel time from Brisbane allowed more frequent visits that lasted for as long as a week. This allowed more flexibility for the distribution and collection of questionnaires that was convenient both for research and for the participants.

How was the survey distributed and collected?

The questionnaire was distributed after prior contact through a face-to-face meeting or a telephone call had been made to describe the research and

request participation. Most of the questionnaires were personally delivered in the Katanning Zone study, and about half in the Condamine Headwaters catchment. Some questionnaires were mailed to those who were unavailable or uncontactable. Those questionnaires (about 20 in Katanning) mailed to people without prior contact had an additional cover letter that provided the same information as the phone call, and asked to contact Jill Richardson (Katanning Landcare Centre) for further information. In addition, a copy of the newspaper article published in the local newspaper was attached to provide further background information and local credibility. This provided participants with direct contact and the opportunity to ask further questions. This travel generated an intimate knowledge of the landscapes and the people participating in the study.

Each questionnaire was distributed with a stamped and addressed return envelope, a pencil, tea and coffee bags. The intent was to maximise response rates and ensure the questionnaire stood out from numerous competing surveys that the average householder receives on a weekly basis. Participants indicated they were selective about participating in surveys as they receive up to two requests per day. In addition, the motivation was to 'give a little' in return for the considerable commitment required in completing the challenging and somewhat demanding questionnaire. An added bonus was evident in the look of surprise and interest when the smell of ground coffee wafted out of the envelope once it was opened. It provided a clear invitation to investigate, and immediately participants considered the decision on the time and place to enjoy either the tea or coffee while completing the questionnaire.

In order to remind participants of the need to complete the questionnaire, a phone call was made asking of the time and place they would like the questionnaire to be collected. About half the questionnaires in Katanning were returned by mail, and the remainder were collected in person. Most questionnaires in The Headwaters catchment were returned by mail using the stamped and addressed envelope supplied with all questionnaires.

Meeting the ecological sampling criteria: What was the response rate?

In the Katanning Zone 95 questionnaires were distributed and 60 returned (63% response rate) and in The Condamine Headwaters, 113 questionnaires were distributed and 64 returned (57% response rate). Overall, the response rate was 60% with no one group in particular standing out as non-respondents.

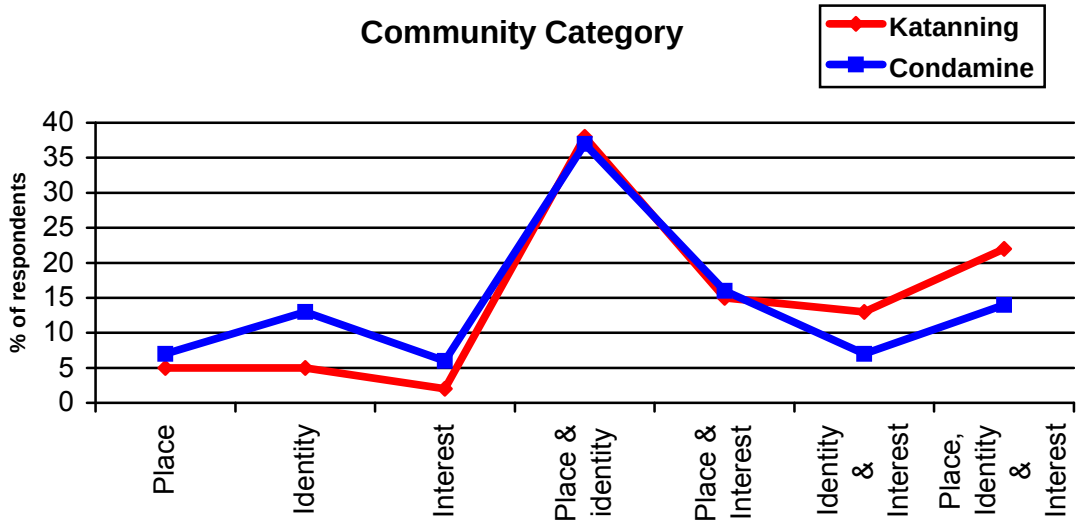

Figure 2.11 Response rate according to participant defined community sector

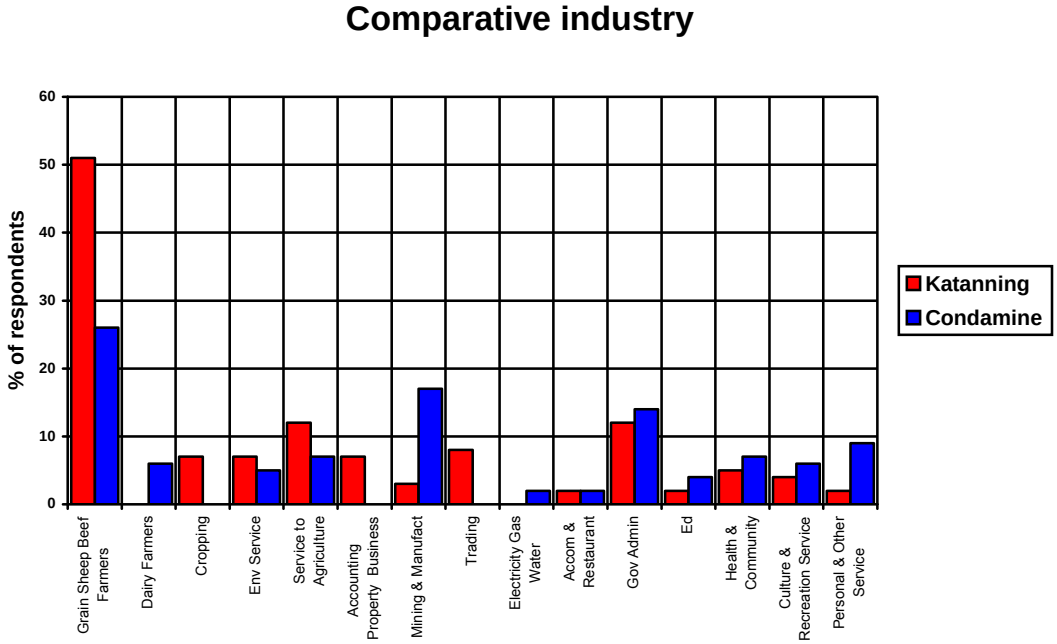

Figure 2.12 Response rate according to industry sector

There were no Indigenous representatives from either catchment population. A number of approaches to Indigenous reference groups and individuals were made and meetings held, allowing some introductions. I did intend to include the Traditional Owners from each catchment in round table discussions to explore the dimensions of sense of place, social capital and discourses of the environment, but time and convention conspired against including this critical element of the community. The meetings with the Traditional Owners and Indigenous Reference Groups provided insight and knowledge on traditional uses and knowledge of both sub-catchments. This provided a grounded perspective for framing the qualitative questions about Indigenous knowledge and its relationships with local and scientific knowledge. While only a limited insight, particularly from an empirical perspective, the information gleaned provided context within the tri-partite knowledge framework. While this is a clear limitation in capturing the full range of positions adopted, references by the participants to Indigenous knowledge in the interviews made the importance of this decision-making component of the population explicit. Transdisciplinary research that includes anthropology may well serve to authentically capture the discourses of Indigenous Australians in these catchments at some time in the future.

Though there are significant ethnic communities in Katanning, I was able to attract only limited ethnic representation. The ethnic people included in the Headwaters sample proved representative of the ABS census data. A significant portion of people interviewed made mention of the ethnic populations in Katanning Zone and provided an insight into the role of this sector of the community.

Survey data analysis

The responses to the survey established the participants' values associated with a range of elements in the catchments that represented both symbolic and material values in landscapes. Elements were classified, identified and named by each community in advance by consultation with people living and working in each hydrological catchment to provide concrete local representation of the abstract typology of thirteen categories developed and tested by Brown *et al.*

(Brown and Reed 2000, Brown *et al.* 2001, Brown 2005). This typology included generic representations for remnant bushland, production landscapes, home-paddocks, urban environments, community activity places, such as community halls, and national parks (details in Appendix 7). This typology of generic elements of landscapes represented sense of place values. In addition, the survey asked about types of social capital, the networks of social capital in existence and the scales at which this social capital occurs. Environmental discourse was explored through five quantitative questions each with six explicit response categories that portrayed ideological position, idealised practice and more concrete habits of practice in relation to the environment.

A multivariate approach using standard descriptive statistics as well as numerical taxonomy was used to analyse the data. Manly (1994) describes multivariate analysis as a means of considering with equal importance, several related and random variables simultaneously. Computer-based approaches such as numerical classification and multi-dimensional scaling have further developed standard approaches such as principal components analysis, factor analysis, discriminant function analysis and cluster analysis to provide a more statistically reliable outcome.

The patterns of both cases (representing individual participants in the survey) and variables that result from a single analysis expose diversity in populations (through the data) rather than a reductionist portrayal that excludes 'outliers'. This approach to analysis provides insight that relies on minimal assumptions in the weighting of variables, thus allowing structure that underpins social-landscape relationships to be exposed. Broad conceptual frameworks that captured a diversity of theoretical positions provided the breadth of detail for the operationalisation of sense of place values; expressions of social capital; and discourses of the environment through the survey questionnaire.

This application of numerical taxonomy provides a robust and process based validation of results that emphasizes characterization of sets of cases (that form social assemblages) and variable relationships (that form attribute clusters) rather than variables as causes. This is a new tool for the discovery of structure

in social data, and the exploration of emergence in complex adaptive systems (Wardell-Johnson 2005). This represents a “meta-theoretical shift” (p. 95) from inferential analysis that has been “under-used in social science” (Byrne 2002 p. 100).

Numerical taxonomy exposes the structure, critical variables and social tensions that may define difference (and similarities) between the value frameworks in social catchments. The process and results of the numerical taxonomy offered a rigorous exposure of the data structure that described and depicted patterns and acted as a focus for further heuristic exploration that provided explanation through qualitative strategies. This analysis exposed the structure of these social systems through the values (intrinsic variables) held in common by the participants, but included more conventional socio-demographic descriptors (extrinsic variables) in the evaluation. This allowed the description of social assemblages through the values they have in common free of the limitations of binary variables such as age, gender, occupation and industry. These extrinsic variables, however, gave social context to the exposed value frameworks.

Patterns derived through this analysis package (PATN 2.3) from the variable by case matrix were examined using numerical analysis approaches. Dissimilarity between cases based on variables associated with each of the three social dimensions was range standardized and quantified using the Bray Curtis metric: $D = \sum |D_{ik} - D_{jk}| / \sum (D_{ik}+D_{jk})$ (Bray and Curtis 1957) or the Gower metric: $D = (1/M)^* \sum |D_{ik} - D_{jk}| /$ RANGE (k) (Gower 1971). The Bray Curtis metric located patterns in the differences between variables recording the participant’s values and has performed consistently well in a variety of tests and simulations on different types of data (Faith *et al.* 1987). The Gower metric is basically “Manhattan distance that is range standardized” (Belbin 1993 p. 107). The matrix data from the survey was clustered using UPGMA (unweighted pair group arithmetic averaging) with Beta set at -0.1 (Belbin 1990). Under such conditions the clustering strategy is space-dilating and resists the formation of a single large group (Booth 1978). Groups of variables were derived using the Two-step metric: $D|0\text{->}1|R|0\times0$ (Belbin *et al.* 1984) also with Beta set at -0.1.

The association between case and variable groups and extrinsic variables was compared using Kruskall-Wallace tests. This statistic is a non-parametric equivalent of the f-ratio and based on average rank of each attribute (Belbin 1993b).

Semi-strong hybrid multidimensional scaling ordination (SSH MDS) aims to provide in few dimensions, an accurate representation of the resemblance between cases (participants) on the basis of their descriptive attribute profiles (values and socio-demographic variables). The dissimilarity matrix was visually presented through SSH MDS as ordinations with dissimilarity cut-off level at 0.9, (Shepard 1962, Belbin 1991).

The relationship of cases, value and socio-demographic variables, with the ordination axis was explored using principal axis correlation (PCC procedure in PATN) (Belbin 1995). The significance of correlation of each group of cases (social assemblages), and each value and socio-demographic variable were assessed using Randomization tests (with 100 permutations) and the MCAO procedure (MonteCarlo's permutations) of PATN, (Belbin 1995, Belbin *et al*. 2003). These vectors of statistically critical variables that are significantly correlated to the ordination axis and clustering expose the relative positioning of variables within the abstract space that represented the population sample to expose the tensions in values in the combined social catchments.

To expose patterns in the data each analysis presents results from a series of steps that identify affinities between cases and variables, evaluates the strength of affinities and portrays the cases in ordination space. The networks between the social assemblages are then located to indicate nearest neighbours. This provides a range of ways of evaluating and interpreting results from each analysis. Only one analysis was conducted for each set of visual portrayals, and all portrayals depict the same results. Table 2.9 shows the visual portrayals for the numerical taxonomy conducted through PATN.

Table 2.8 Visual portrayals of numerical classification using PATN

Analysis of similarities (ANOSIM) tables: row and column	◆ row ANOSIM shows the statistical difference between social assemblages (based on participants/cases) ◆ column ANOSIM shows the statistical difference between attribute clusters (based on intrinsic variables)
Dendrograms: row and column	◆ row dendrogram: similarity of participants to one another ◆ column dendrogram: similarity of intrinsic variables in relation to cases
Two-way table	◆ shows the strength of relationship (statistical correlation) between each social assemblage and each variable cluster
Minimum spanning tree (MST)	◆ shows the networks of participants' values according to colour coded social assemblages and network lines that indicate relative relationships. This portrays accurate representation of close objects.
Multi-dimensional scaling ordination (SSH MDS)	◆ shows the relationship in abstract ordination space between all participants based on the intrinsic variables in the analysis
Biplot vectors	◆ These vectors are portrayed as overlaid on the ordinations to show relative relationships between vectors with social assemblages and individual variables ◆ derived through principal axis correlation (PCC) which are the statistically significant variables identified through the Monte Carlo's permutations (MCAO) that evaluate the differences in values between participants ◆ statistically defined positive association emanates from the centre of the ordination space moving positively in the direction of the vector label while statistically negative association is in the opposite end of the ordination space. The negative association is not portrayed, but implicit in the visual portrayal.

Each of these visual portrayals exposed the patterns to provide a robust statistical basis for the interpretation of results (Belbin 1993a). Numerical taxonomy shows clusters, reliability of the clustering information, variables that are important in forming the clusters, and networks of values in the patterns depicting the two social catchments. This approach does not require a normal distribution of data, and is not dependent on *a priori* decisions about the importance of specific variables (i.e. dependent and independent variables) in defining the clusters, ordination or networks. The structures of the system are described through the co-ordinates of cases (the participants in the study) with variables within abstract dimensional space. Thus, the emergent properties[3]

[3] The properties of emergence are revealed only at particular levels of organisation and cannot be found in their constituent assemblies of subsystems or attractor domains (Keen, M., Brown, V. A., & Dyball, B., 2005, *Social Learning in Environmental Management*, Earthscan, London).

along with their strange attractors[4] are exposed (Byrne 1998, Lewin 1999). Numerical taxonomy is one of a range of tools available for the analysis of attitudes and behaviours in which the portrayal endeavours to reflect outcomes free of *a priori* assumptions that may cloud intrinsic patterns (Belbin 1993b, Byrne 2002, Johnson and Wichern 2002, Stevens 2002).

Further analysis using EXCEL was essential in order to provide descriptive detail of the socio-demographic attributes of social assemblages derived through PATN. This provided summary statistics of the values each social assemblage represents and the descriptions of social assemblages through their socio-demographic variables. In addition, Cronbach's Alpha (SPSS 11) was used to evaluate the reliability of statements representing discourse positions for the development of an index for discourses of the environment.

Acknowledgement of complexity and diversity through the ecological sampling and methodology of pattern analysis is more likely to portray free associations between nature and humans allowing interpretations to emerge, rather than imposing in advance *a priori* assumptions on human/nature interactions. The approach taken in this thesis provided the basis for explicit research questions to be developed for the qualitative research. These questions explored the outcomes of the multivariate analysis through in-depth face-to-face interviews with key informants representing the social assemblages defined in the quantitative analysis.

Section four: The qualitative methods

Ground-proofing of the multivariate analysis was conducted in the third research phase by exploring the details of results through semi-structured interviews with participants representing social assemblages. Once research and interview questions had been identified through the numerical taxonomic process, cluster analysis, ordination and statistically significant vectors in the quantitative

[4] Strange attractors follow a patterned geometric motion that remains within an identifiable phase state. Their behaviour in unpredictable but sensitive dependent on initial conditions. The resonance and correlation of their kinetic energy makes them difficult to measure but their bounded behaviour and characteristics remain within behavioural limits (Lewin, R., 1999, *Complexity. Life at the edge of chaos.*, Phoenix, London).

methodology of the first phase, participants were contacted and interviewed to provide depth and detail to the quantitative results. This approach changed the emphasis usually used in qualitative inquiry from explorative to confirmative ensuring a tighter focus for this form of inquiry. Qualitative research is often exploratory and usually ranges widely representing a limited sample population. This approach countered the more common limitations of qualitative inquiry (Sarantakos 1993).

The interviews were conducted to reveal a more complete depiction of the positions adopted in the various communities in the catchments, along with the reasoning behind the positions. The interviews provided an explicit insight that complemented the survey analysis results and illuminated adopted positions and interactions between people within landscapes. The outcomes of both the quantitative and qualitative analyses provided a rich source of information that formed the basis of the final conclusions for the research.

The semi-structured in-depth interviews included 15 key questions (Appendix 2), one of which (question 5) was abandoned because it was too difficult to answer (Appendix 8). Questions were not presented in number order, but rather as conversation and context directed. The questions were presented in their direct form then clarified and explained to suit the requirements and context for each respondent. The key questions related to participant's social and family relationships with the catchment as well as the way in which they valued elements of the landscape. A particular emphasis of questions pertained to establishing the domains of attraction that maintain resilience parameters of the complex adaptive systems they represent (details in Chapter Six).

These questions aimed to identify:

- similarity and difference between the identified groups of people (social assemblages) to establish the validity of using the conceptual categorisation of community sector (communities of place, identity and interest);
- the relationships between the three scales of social capital with environmental discourse;
- the approaches to environmental practice (through discourses of the environment) within each catchment;

- key community relationships (community of place, identity and interest) that influence policy and practice; and
- insight into the impact of policy development and implementation in the each catchment.

Interviews took between 45 minutes and an hour and a half, and were conducted at a time and place most suitable to the person being interviewed. People were selected for interviewing to represent as closely as possible each of the social assemblages (for sense of place, social capital, discourses of the environment, and an analysis of the synthesis of all three dimensions) identified through the multivariate analysis of the questionnaire data (Appendix 2). Twenty-four people were interviewed: thirteen in the Katanning Zone; and eleven in the Condamine Headwaters. These people also represented a cross-section of the population surveyed. Only one person was unavailable due to family commitments, and two others failed to arrive at the appointed time and place. Reasons given were the 'break of season', which entailed a priority being given to seeding.

Semi-structured interview technique was employed to allow both focus on research questions and to allow neutral probing into unexpected positions and contextual relationships. Language is the means to communicate the ideals, ideology and practice that integrates symbolic and material values and positions. Interview technique emphasized reflective listening to assist in clarifying and synthesizing unfamiliar and complex concepts but within the everyday world and language of the person being interviewed (Bolton 1987, Sarantakos 1993). This approach did not rely exclusively on the most widely held views as represented in the quotes provided by the participants. Rather, the approach here was to include both the most disparate with the most widely held views as a way of exemplifying both similarity and difference and thus portraying the diversity that underpins decision-making within the social catchments.

As the respondents being interviewed had already completed the questionnaire the interview comprised the second contact, so a degree of trust was already

established. The interviews were conducted one year after the survey was distributed. Contact between the survey questionnaire completion and the follow up interviews was maintained through the distribution of newsletters and through newspaper stories (Appendix 6 and 7). All those interviewed had requested a newsletter, though some could not recall receiving one through the mail.

Permission was provided through the provision of contact details and an outline of questions was provided in advance (Appendix 8). A micro, battery operated recorder was used to tape the interview and I made complete transcriptions of all interviews using a Dictaphone. Transcription time amounted to over 100 hours and nearly 300 A4 pages. Additional notes were spoken into the recorder just after interviewing to record any pertinent or interesting observations and conversations that followed the interview.

Analysis of qualitative data

This qualitative research used open, axial, and selective coding of semi-structured informant directed interviews (Cantrill and Senecah 2001, Yin 2003). Analysing the transcriptions was through value coding, colour coding and sorting of key questions. Further sorting grouped critical elements, emergent themes of research questions (the domains of attraction), and value frameworks in interviews (Sarantakos 1993, Yin 2003). This amounted to a top-down and bottom-up sorting strategy in which the imposed interview structure and the respondents had equivalent influence in the analysis process.

These key responses formed searchable and sortable tables that provided empirical qualitative evidence in the form of direct quotes associated numerically with the insights into the value frameworks of each of the social assemblages to correlate with (either confirm or contradict) the quantitative results in the study.

Conclusion

Survey research may be hampered by the failure to capture representative social catchments. This was countered through the development of an approach to ecological sampling that drew on both social and biophysical approaches to sampling design to capture representation of social catchments engaged in decision-making at a landscape scale in two comparative hydrological catchments. A paired comparison of survey data from two social catchments through an analysis using numerical taxonomy exposed the recurrent behaviours that form structure in complex adaptive systems drawing on observable and more intangible values and variables.

The results of this quantitative approach identified social assemblages and attribute clusters, and the statistically critical variables that give insight into value tensions amongst sectors of the community in each of these social catchments. In general, there was a reasonable representation of the population of each catchment in the quantitative, but a more selective representation in the qualitative phase. The breadth of the ecological sampling has been complemented by the detail of the qualitative approach and portrays the domains of emergent attractors in this complex adaptive rural Australian agricultural system. Knowledge can be built on, but only by acknowledging the power of local level relationships with nature in defining discourse and agency.

The interviews revealed a more complete depiction of the positions adopted in the various communities in these catchments, along with the reasoning behind the positions. A concrete insight complementing the survey analysis results was provided into value frameworks and interactions between people and landscapes. The outcomes of both the quantitative and qualitative analyses provided a rich source of information to form the basis of the final conclusions for this thesis.

These results provided a rich and explicit focus for in-depth semi-structured interviews of representatives from the social assemblages to provide detail that exposed the emergent characteristics and processes that drive and define the

complex adaptive rural agricultural social systems in this research. This methodology provides a new approach to defining participants in landscape-scale decision-making and provides a robust and process oriented approach that focuses qualitative research more effectively to capture a broader representation. This heuristic and explorative methodology exposes the interaction between symbolic and material elements that result in the recurrent behaviours that structure emergence in complex adaptive systems.

The theoretical conceptualisation, survey detail, results of the numerical taxonomy and qualitative analysis for each of the three dimensions (sense of place, social capital and discourses of the environment) are presented individually in the following three chapters (Chapter 3, 4 and 5). In Chapter Six, the data from these three dimensions was combined in a synthesis that explored the content and processes of a complex adaptive system through numerical taxonomy and qualitative analysis.

3

Sense of place

Introduction

Place provides a grounding of experience that binds people to the landscapes in which they live. This grounding is derived through thought, experience and identity established in and through place to form sense of place (Malpas 1999). Sense of place serves as a start to identifying individual and collective relationships that are an embodied and located interconnection with the environment. Place contains practices and also provides the means by which those practices will be practised (Malpas 1999). People interact with the landscapes in which they live forming a dynamic and explicitly linked socio-ecological process (Berkes *et al.* 2003). Landscapes are thus ecological systems that are subject to natural laws and are also places that are socially constructed and manipulated. These linked processes interact to form an explicit and irreducible sense of place.

Environmental issues are located and embodied in place, reflecting human conflicts over values, expectations, judgements and power relationships in

landscapes (Duane 1997). Sense of place includes values, meanings and symbols that may be exposed when the qualities of, and practices in a place are threatened during conflict (Brown 2005). The interconnection of agency with place suggests that place is both the locus of political acts as well as the frame within which the political itself is located (Malpas 1999). According to Cheng *et al.* (2003), "{p}lace is a powerful social influence in natural resource politics" (p. 89). By using place to embed natural resource attributes into a linked social-ecological landscape system, we are reminded that resources are part of a spatial and temporal context imbued with cultural and social meaning. Landscapes are imbued with meanings, history and community forming the sphere within which culturally based decisions and environmental impact occur.

Work with diverse community sectors involved with landscape management requires some understanding of the elements that form people's cognitive structuring of the environment, the extent to which such attributes are jointly held by the broader community and how these values can distinguish different sectors of a social catchment (Cantrill and Senecah 2001). Cantrill and Senecah (2001) go on to claim that there is an emerging recognition among social scientists that as people develop a sense of self, their perceptions of 'place' serve as a potent mediation of the degree to which they embrace conservation-oriented practices.

Sense of place may be reflected in value preferences or how specific places figure in discourse. The cognitions that underpin people's relationships with the natural and social world are quite powerful in the generation of responses to environmental policies and may serve to distance individuals from one another or from the agencies that develop policies for the use of natural resources (Cantrill and Senecah 2001). Stedman (2003) reminds that:

> it is crucial that we understand the importance of meanings and how they may change in response to physical landscape change (p. 682).

And also points out that:

> The physical landscape may change to such a degree that preferred meanings become untenable or are maintained only through active effort (p. 683).

There may still be agreement with the symbol, but the physical environment underpinning the values in question may have eroded and changed. Cultural variables and the associated meanings and values allocated in landscapes change slowly, sometimes lagging behind the changes wrought through human settlement in landscapes. This pervasive nature of symbolic values has particular implications for natural resource and land use planning with significant implications for policy developments and implementation in landscape management.

Macnaghten and Urry's (1998) wide ranging review of people's definitions of nature explored research and outcomes to state that "hierarchies of senses" produce different "structures of feeling" about different spaces inhabited by people:

> Much writing about the environment has not been sufficiently embodied,…has not addressed the complex, diverse, overlapping and contradictory ways in which people sense the world around them (p. 104).

Jeff Malpas (1999) goes on to place people as central in the landscape with:

> The land around us is a reflection, not only of our practical and technological capacities but also of our culture and society – of our very needs, our hopes, our preoccupations and dreams….the human relation to the land, and to the environing world in general is clearly not a relation characterised by an influence running in just one direction ….our relation to landscape and environment is indeed one of our own affectivity as much as of our ability to effect (p. 1).

These perspectives are also represented by Benton and Short (1999) within a broader European and Indigenous reference in their discussion of the development of environmental discourse in relation to landscape.

The process of decision-making in landscape management entails a constant negotiation between symbolic and material values of sense of place. This interaction constantly changes the shape of the lens through which landscapes are perceived and experienced. The complex structure of place resists simple categorisation or characterisation, encompassing both subjective and objective

elements. Studies in sense of place have included a diverse theoretical and methodological base concluding with 'no definite consensus on how to conceptualise and measure sense of place" (Kaltenborn and Bjerke 2002 p. 384). Beatley (2004) claims that:

> Sense of place or emotional connection to place, is a challenging concept to articulate, but one more important than we often understand (p. 21).

In locating people and landscapes in a study of sense of place, this research seeks to avoid abstracting people from their spatially embedded practices and the associated complex relationships. While significant research has been carried out on the concepts of space, time, memory and identity, it is through a sense of place that it is all integrated. This research for this chapter aimed to identity the way in which sense of place values direct, facilitate and constrain the decisions people make in the management of landscapes. This was achieved through the following research questions:

- What elements and scales are considered in theoretical and applied literature to comprise the concept of sense of place?
- What are the theoretical, dimensional and relational spaces of sense of place that may be developed as a conceptual model to operationalise empirical research?
- What questions and tools are necessary for describing sense of place values in a social catchment?
- How do sense of place values differentiate the three categories of the community: place, identity and interest?
- What sense of place variables can be identified as emergent characteristics?
- What sense of place processes are identified through the quantitative and qualitative approaches?

This chapter comprises three sections. The first reviews relevant theoretical and applied literature to develop a conceptual model that integrates elements and scales of sense of place. This model was developed to serve as a means of

operationalising sense of place for survey (quantitative) and qualitative exploration. Quantitative, survey-based analysis that evaluates and analyses sense of place forms the second section of this chapter. In the third section, the results from the numerical taxonomy provided the basis for heuristic exploration in a focused qualitative inquiry. Both the quantitative and qualitative results were explored to identify the role sense of place serves in forming emergent characteristics and processes. This chapter forms an explicit basis for and link to the next chapter that explores relationships between people (social capital) that develop in association with the development of sense of place.

Section One: Development of a conceptual model

Comparative frameworks for sense of place

The literature on sense of place draws on a range of disciplinary contexts with different emphases. Six contexts have been drawn on in this thesis to develop a conceptual framework for the study of sense of place:

- Environmental philosophy explores the concepts of space and place as they have evolved in relation to Western philosophical traditions in particular (Malpas 1999).
- Environmental psychology is the study of the transactions and interrelationships between human behaviour and the environment (natural, managed, built and social environments) in relation to other social and biological sciences and environmental professions. The focus is on environmental attitudes, perceptions and values (De Young 1999).
- Architecture and planning examine place as a functional and aesthetic cultural expression of landscapes that might be either urban or rural. Sense of place is examined in relation to the impact of urbanisation and the concepts and practices of bioregionalism.
- Sociology uses the concept in relation to the symbolic meanings of place setting and relative influence on the social components of interaction between people. Sense of place is used to provide context for individual and collective identity.
- Anthropology focuses on the cultural influence of symbols and geographic location on day-to-day life (Brown 2005).
- Human geography emphasises holistic phenomenology to focus on individual construction of a sense of self through the development of place meanings (Dixon and Durrheim 2004).

The focus for research on sense of place has ranged from a located and specific relation of 'home' to the more abstracted relationship with wilderness and the meaning of nature (Manzo 2003). In general, the rich theoretical approaches focus on the significance of meanings and experiences in places through descriptive and qualitative expression. The specifics of sense of place studies often reflect the vocabulary of Romanticism and the harmonising of social and environmental concerns (Seddon 1997, Manzo 2003).

Broad definitions

Sense of place is an overarching concept that includes the notion of place that is socially constructed in a dynamic interaction with the natural world and natural forces. Both philosophical and empirical dimensions emerge to capture the tangible and intangible, the symbolic and material elements in the process (Kaltenborn 1998). Both phenomenological[5] and cognitive[6] approaches are used to investigate the role of sense of place in landscape decision-making (Cheng *et al.* 2003).

Sense of place emerges in relation to other people in conversation in which the discourse and symbols in common are confirmed (Brown 2005). The phenomenological[7] literature explores the meanings for and experiences people have in places through descriptive and qualitative heuristics focusing on the ontological nature of place considered fundamental, irreducible and inseparable from existence (Manzo 2003). Positivistic approaches[8] focus on observable behaviour of people in place so the breadth of landscape values capture the

[5] Phenomenology is the analysis and description of interaction in everyday life assuming individual creativity rather than behaviour caused by social forces (Abercrombie, N., Hill, S., and Turner, B.S. (1994). *Dictionary of Sociology*, London: Penguin).

[6] Cognitive psychology assumes that any "interaction between an organism and its environment changes not only its overt behaviour …but also its knowledge of or information about the environment" (p. 134) This interaction affects both the present response and future orientation to the environment (Bullock, A., and Trombley, S. (2000).The New Fontana Dictionary of Modern Thought, London: Harper Collins Publishers).

[7] Phenomenological sociology: analysis and description of everyday life assuming individual agency has an important bearing (Abercrombie, N., Hill, S., and Turner, B.S. (1994). *Dictionary of Sociology*, London: Penguin, Bullock, A., and Trombley, S. (2000). The New Fontana Dictionary of Modern Thought, London: Harper Collins Publishers).

[8] Positivism: "a doctrine….characterized mainly by an insistence that science can only deal with observable entities known directly to experience" (Abercrombie, N., Hill, S., and Turner, B.S. (1994). *Dictionary of Sociology*, London: Penguin, p. 322).

complex relationships between people and place through a broad environmental meaning. The notion of place and the concept of sense of place are not limited to "geographic space or the distribution of socio-economic activities" (Kaltenborn 1998 p. 172).

Cantrill and Senecah (2001) posit that a sense of place is socially constructed "upon an edifice of the environmental self" (p. 188) that, in itself, is a product of discourse and experience in and through specific places. So, although the social construction of place is clear, there is a clear recognition of the contribution of the physical landscape in the development and evolution of a sense of place (Kaltenborn and Bjerke 2002, Stedman 2003, Brown 2005). The interaction of a setting and individual contribution is the point at which "undifferentiated space becomes place" when it is endowed with a particular value (Tuan 1977, Kaltenborn 1998).

Meaning and thus value in different places are formed through individual and collective human interactions and involvement with places. Places thus vary in size and scale, and in the way they are understood and represented. They can be directly or indirectly experienced. Sense of place is linked to the particular spatial characteristics and properties of the physical landscape developed in relation to the meaning and value created by individual and collective social agents (Kaltenborn and Bjerke 2002). Sense of place is not intrinsic to the physical setting itself, but is defined by the subjectivity of human interpretations of places and constructed through experience with it (Cheng *et al.* 2003, Stedman 2003).

According to Seddon (1997), sense of place encompasses the specificity of the vocabulary of Romanticism. Manzo (2003) warns that there are both positive and negative relationships with place, and that the notion of place should not be romanticised or idealised. Sense of place is a subjective relationship between people and the landscape that is multifaceted and saturated with meaning in which the material values are inseparable from the intangible and symbolic values (Cheng *et al.* 2003).

According to Gesler (1992):

> Place is therefore a process whereby the reproduction of social and cultural forms, the formation of biographies, and the transformation of nature ceaselessly become one another at the same time that time-space activities and power relations ceaselessly become one another (p. 743).

The elements of sense of place

Much of the literature on sense of place differentiates between several elements of sense of place. Manzo (2003) differentiates between sense of place, place attachment, place dependence and place identity. Others such as Stedman (2003) include place satisfaction as part of the empirical basis of inquiry. The broad definitions make the diversity and range of approaches explicit but the range of elements and conceptualisations is diverse, exhibiting both duplication and contradiction. The heuristic approach in this thesis attempts to include a broad range of possible elements within a conceptual framework to define the bounds for the survey questionnaire and qualitative inquiry. Sense of place is defined by three interacting elements (identity, attachment and physical landscape) that include both symbolic and material values that link across three social scales (the individual, collective and society). The elements of this conceptual framework are developed through interactions within a series of conceptual pairs and mediated through identity, memory and temporal scale (Figure 3.1).

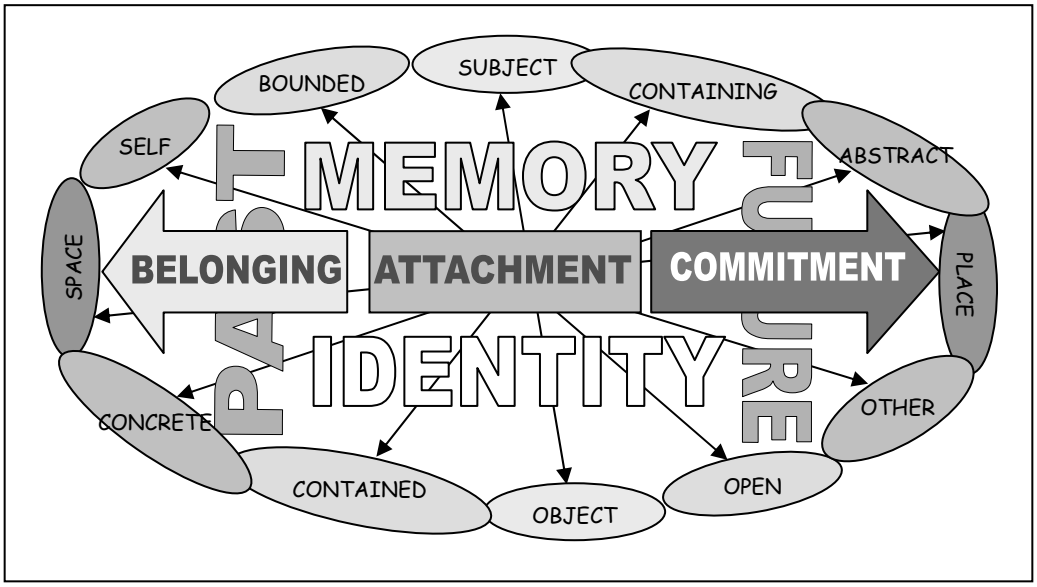

Figure 3.1 A working framework defining the conceptual pairs contributing to the development of sense of place after Malpas (2000) and Kaltenborn (1998)

The scales and elements that comprise the conceptualisation of sense of place used in this research was an attempt to represent a range of theoretical and empirical approaches. These scales and elements are defined and discussed in this section.

Three distinctive, but interacting elements of sense of place: identity, attachment and landscape are defined and identified in the literature on sense of place. In this section each of these three elements was explored theoretically and empirically to develop a heuristic means of framing questions for survey and interview. To provide a context for exploring the implications of sense of place for landscape management and decision-making, the political[9] sphere was considered as an important interaction of power. The second element, attachment, is shaped by relations between groups over time. The strength and form of attachment reflects notions of meaning in sense of place that influence decisions in the use and management of places in the landscape. The third element in sense of place is the landscape itself, which is imbued with symbolic

[9] Political: this approach encompasses "political values and attitudes wider than intimated by the more formal political system, and to some extent upholding it….. A political culture is largely formed by the political system, but it depends for its persistence and vitality on the support of other social institutions" (Bullock, A., and Trombley, S. (2000).The New Fontana Dictionary of Modern Thought, London: Harper Collins Publishers, p. 660).

and material meaning that develops in relation to experience and memory within these cultural and political expressions.

Identity

Identity comprises relationships that develop as an interaction linking the self, others and the landscape. The identity of a place is determined through a complex of physical and abstract factors that reflect a negotiation of subjective, intersubjective and objective structures to form sense of place. These three relationships are explored conceptually through: the self and others; the self and the environment; and the self and agency in politics of place.

The self and the other

Identity can be construed as a relatively stable set of personal characteristics that form a self-image. Though stable over time, the psychological construct and relation with social identity is an interaction of the various elements that contribute to identity. These elements interact dynamically with places and other socio-cultural environments and may change over time (Bullock and Trombley 2000). Thus, identity forms in relation to other people out of a complex set of actions and attitudes tied to the context of certain places, practices and a relatively stable psychological construct. This subjectivity derives from three distinct notions in the interdependence of objectivity[10] and subjectivity[11]: 1) self-subjectivity; 2) objectivity; 3) and other-subjectivity. The idea of the self and 'the other'[12] is a reflection of the relation between the conceptual pairs of subject and object and the intersubjective pairing of the self and 'the other' (Malpas 1999). In relation to sense of place, this involves two perspectives:

1. The subjective involves judgement and assessment of objective qualities in relation to meaning and personal value.

[10] Objectivity – in which everyday action and human agency is independent of social construct (Bullock, A., and Trombley, S. (2000).The New Fontana Dictionary of Modern Thought, London: Harper Collins Publishers).
[11] Subjectivity – in which everyday interactions of and between social agents is dependent on and defined by the social reality (Abercrombie, N., Hill, S., and Turner, B.S. (1994). *Dictionary of Sociology*, London: Penguin).
[12] 'The Other' is "the perceiving, conscious, meaning-conferring other person who helps, or forces, the conscious subject to define his own world-picture and view of his place in it" (Bullock, A., and Trombley, S. (2000). The New Fontana Dictionary of Modern Thought, London: Harper Collins Publishers p. 620).

2. The objective reflects the qualities of places such as landscapes and buildings and community features (Beatley 2004).

The subjective and objective perspectives used together allow the post-structural acknowledgement of the interactions of power in the construct of meaning and identity (Foucault 1980), as well as the objective reality of concrete and observable objects that construct a landscape (Bhaskar 1978, Wasserman 2004).

The self and the environment

People gravitate towards environments that are congruent with their concept of self, and the process of interaction modifies both place and self (Manzo 2003). People develop personal relationships with places to give order and meaning to their lives (Kaltenborn 1998). Thus, the sense of place becomes a grasp of self as well as a grasp of the environing[13] world itself. This grasp permits and facilitates a possibility of understanding or knowledge in the context and embeddedness of place. Subjectivity and objectivity in sense of place interact through construction and constraint. This subjective and objective spatiality reflects the structure of place and represents the interdependence of tangible and intangible elements within a broader and encompassing topographical notion (Malpas 1999).

Place identity forms in a relationship with social identity through a process of identification, cohesion and satisfaction in a socialising process. This interacting dynamic of the social with the physical worlds of the self has implications for the development of sense of place and also for the places themselves (Uzzell *et al.* 2002). The social is given expression in and through place within the ordering of space and time so that sense of place is a concept constructed and structured by both the social and the physical environment (Malpas 1999). Foucault discusses this ordering of social space to indicate the need for explicit consideration of specific values:

[13] Environ: "to form a circle or ring round; surround; envelop" (Macquarie, L.P.L. (1981). *The Macquarie dictionary*, Sydney: Macqurie University, p. 601). Malpas (1999) uses this frequently to alert the reader to the importance of the environment in modifying human relationships with place.

> We live inside a set of relations that delineates sites which are irreducible to one another and absolutely not superimposable on one another (Foucault 1986 p. 23).

The self and agency: The politics of place

Reciprocal confirmation between an agent's concepts of a place, the order established through inherited and constructed material, and sensory practices constitute meaningful action in place (Sayer 2000). Agency reflects both "the subjective manner in which people construct social reality" (p. 366) and the resulting patterns of action and interaction arising from objective action (Ritzer 1996). This interaction of micro action at the individual level with macro structures that shape socio-political public space in a larger societal context influence the dynamics of people's relationships with places (Manzo 2003). The objective ordering of objects that make sense of different concrete and sensory experiences into a social reality provides the grounding of agency within a determinative and embodied spatiality. Sense of place is thus tied to concrete agency of capacity to act, as well as being subject to the possibility of being acted upon. This relationship changes in accordance with social scale constituting dynamic and non-linear interactions between concrete and abstract representations and interpretations of place:

> The less a place is encompassed by our capacity to act or to react, the more abstract must be our grasp of that place (Malpas 1999 p. 171).

This is further intensified by the political imperatives of "science-derived rational environmental realism" coupled with instrumental notions of human alienation from other species that further abstracts and colludes to reduce agency within the place scale (Macnaghten and Urry 1998 p. 1). Expert and centralised decisions about resource management embedded within larger institutional or political frameworks obscure the qualitative and less tangible symbolic values of place, thus marginalising local agency (Brown *et al.* 2001). Conflicts over competing uses, expectations, behaviours and meanings reflect the convergence of social and political processes, the biophysical dimensions and processes, and social and cultural meanings in place.

Contemporary Australian developments in regional governance reflect the reaction of communities at local scales (politics of place[14]) to the abstractions of politics of interests[15] in formal political processes. These abstracted political processes fail to recognise the moral and historical symbolic meanings of local context and identity (Macnaghten and Urry 1998, Cheng *et al.* 2003).

These forms of governance exemplify the relationships between individual, community and social scales of people living in places, and people making decisions about places at different decision-making scales. The contesting interaction between the formal political processes in politics of interests and the on-ground local level politics of place have evolved to express a need for greater contribution to equitable and democratic decision-making. These new expressions of collaboration in participative democracy have the potential to transform the historical mismatch in the implementation of globally sensed and developed environmental policy with locally integrated and sensed environmental commitment and care (Macnaghten and Urry 1998, Cheng *et al.* 2003). These transformations and developing interactions indicate that place and identity provide critical agency that does not evolve and result from the top-down provision of information alone. Reliance on notions of risk and moral panic have failed to account for the local sensing of environmental issues. Local sensing of environmental issues frequently contrasts with those of global issues (Macnaghten and Urry 1998, Cantrill and Senecah 2001). Innovative solutions to environmental issues and the implementation of globally derived policy depend on individual agency and the local scale in combination with a developed sense of place.

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[14] Politics of place are the place-based collaborations that centre on problem solving and on-ground actions supported by a broad range of community sectors with an emphasis on trust building in local context (Cheng, A.S., Kruger, L.E., and Daniels, S.E. (2003). "Place as an Integrating concept in Natural Resource Politics: Propositions for a Social Science Research Agenda", *Society and Natural Resources*, 16: 87 - 104).

[15] Politics of interests are formal political processes including the legislative arenas that centre on approving or opposing single issue policy positions favoured by coalitions of interest groups (Cheng, A.S., Kruger, L.E., and Daniels, S.E. (2003). "Place as an Integrating concept in Natural Resource Politics: Propositions for a Social Science Research Agenda", *Society and Natural Resources*, 16: 87 - 104).

Sense of place may be contextualised as the development of individual identity emerging from the interaction between social, cultural and biophysical meaning and values. These interactions reflect agency in social and political processes between local and more abstract scales (Cheng *et al.* 2003).

Attachment

The notion of attachment in sense of place contributes to the formation of identity on the individual, collective and cultural levels (Dixon and Durrheim 2004). The notion includes dependence, satisfaction and other complex, interdependent bondings between people and the landscapes in which they live (Kaltenborn 1998). Though often expressed through individual identity, attachment is shaped by the history of relations between groups (Dixon and Durrheim 2004). Attachment reflects the way meaning has developed in sense of place and influences preferences for landscape management and use that is specific to concrete places (Kaltenborn and Bjerke 2002).

Form and strength of attachment

Research conducted by Eisenhauer *et al.* (2000) found that reasons for attachment reflected interactions at certain locales between family and friends that result in social ties. The elements that were important in place attachment included features and characteristics of the natural environment, familiarity, recreational activities and issues relating to consumption, and economics relating to a locale. Attachment develops a 'tensile strength' showing an interdependence of economic and social activities (Cantrill and Senecah 2001). People who have a use-oriented relationship with place are more likely to find a substitute to that place making forged commitments fragile and conditional (Tall 1996, Brown *et al.* 2001). People with attachment to place have strong emotional bonds that reveal a sense of ownership, pride and respect for places forming intrinsic connections. These people describe places in terms of personality and also visit places repeatedly, establishing rituals and traditions of use (Brown *et al.* 2001). These factors all contribute to the development of attachment to place, and time while often used as a measure, depends on individual circumstances and the interplay of these factors.

Landscapes of attachment

The landscape provides a basis for the development of social networks, cultural values and history that establish personal, collective and cultural attachments (Kaltenborn and Bjerke 2002). It is posed that sense of place develops through attachment over time in three phases beginning with belonging, developing into attachment and resulting in commitment (Tall 1996, Kaltenborn 1998). Emotional attachment to places reflects the meaning, history and values of communities forged in association with economic and other material values. This attachment influences management and response to management actions. Assessing rational uses and economic considerations is not sufficient for understanding the perceptions people have of management decisions and actions because the less tangible phenomena associated with attachment in sense of place are of linked significance (Eisenhauer *et al.* 2000).

If positive emotional bonds develop between people and the landscapes in which they live, attachment may evolve. Attachment is part of the process that includes identity formation within landscapes to form sense of place, a notion that serves to identify the symbolic and intangible relationships with place along with the more obvious material and tangible components that define people's relationships with the landscapes in which they live.

Landscape

The third element in sense of place is the landscape itself, which is imbued with symbolic and material meanings that develop in relation to experience and memory. Landscapes and natural places contribute in their own right to the development of sense of place (Kaltenborn and Bjerke 2002). Physical features combine with the imprint of human occupation to form a cultural construct of meaning. This meaning expressed in ambiguous and pluralistic terms evolves at different scales in places nested within landscapes.

Valuing spaces

Landscapes are imbued with different meanings depending on social framing and practical uses. Landscapes are represented as a means to control or limit territorial spaces. These contrasting meanings may also represent differentiated

forms of spatiality in heterogenous diversity (Gesler 1992, Malpas 1999). Landscapes comprise the sum of interconnected and nested places representing distinctive characteristics in abstract and concrete form of tangible and intangible values (Seddon 1997, Malpas 1999).

People actively shape landscapes, and their interaction is a conscious process that provides a sense of continuity that converts homogenous space to explicit place when imbued with specific and distinct meaning (Manzo 2003). While space is inextricably linked to place, it is place that encompasses a locale or 'environing' situation. Space is tied to the general notion of dimensionality that works in a conjunction of material preconditions of actions and through constitutive meanings located in place. These must be understood within the natural landscape of weather and sky and the human ordering of spaces and resources in the landscape, but also through people's individual and communal narratives. Space frames freedom while place requires concrete obligations and limitations. The differentiation of forms of spatiality with associated directionality frames the boundaries where space ends and place begins in a continuum of concrete and abstract (Malpas 2000).

Memory and time

Foucault (1986) differentiates celestial space, internal space (of dreams and more intrinsic values), and heterogeneous spaces of utopias and 'heterotopi' as "nurtured by the hidden presence of the sacred" (p. 23) and as yet not entirely desanctified. The 'nesting' of places forms the directional location of place that connects time with memory. Subjectivity is embedded in place in a spatialised and embodied objective activity that forms the past, is interpreted through memory and informs the future (Malpas 1999). According to Beatley (2004):

> Landscapes and places are embedded with memories, and the nature of those memories affect how we value and treat places (p. 33).

Personal and collective history contributes to place building and committing to place. Place in turn nurtures public memory, framing civic identity and engagement with civic life (Kaltenborn and Bjerke 2002, Beatley 2004). These

connected relationships work together to realise and frame the diverse ways of being in and of the landscape and natural world (Macnaghten and Urry 1998). Malpas (1999), writing from a philosophical perspective, makes place explicit in relation to the connected components of space, time, memory and identity. A sense of place is formed over time, maintained by memory and constitutes a significant component of identity (Malpas 1999).

Social conventions that prevail in society and the personal beliefs pertaining to identity and individual belief about the nature of the world and how space is typically organised develop, are maintained and re-configured in relation to a range of memories (Malpas 1999). According to Tall (1996), a "weak sense of the past encourages a weak sense of place" (p. 112). At the same time, social forces start to override the importance of environmental conditions in framing a sense of place the longer a person has lived in a place. Social relationships, including conflict, are influenced by the residues of past relationships with people as well as with the landscape (Cantrill and Senecah 2001). The past defines place and in turn is dependent on place in the way it is reflected, thus capturing time in an embodied and spatialised feature of the landscape (Malpas 1999). Landscapes reflect both internal and external representations of social and political fact with broader implications for use, management and meaning (Manzo 2003).

Places are represented in abstracted terms through relative locations, arrangements of components of landscapes, map locations and represented identities as though they are static backdrops of activity and experience (Malpas 1999). In reality landscapes constitute the location and locus of the social and the cultural.

Place, meaning and culture

Embedded in the physical landscape we find personal and cultural history in which the social is ordered. Symbolic narratives and cultural constructs cannot be prised apart from the physical substrate (Malpas 1999, Seddon 1997). According to Seddon (1997):

> An environment becomes a landscape only when it is so regarded by people, and especially when they begin to shape it in accord with their taste and needs (p. 111).

Landscapes are cultural constructs that are viewed and defined through a reading of the land, dialogic representation, perceptions, work and use, and the evaluation of the values of functionality, aesthetics and morality (Seddon 1997). Landscapes provide us with our dreams, thoughts and feelings and constitute our character and identity (Schama 1995). Meaning attributed in landscapes is interpreted and constructed by people in particular contexts and locales rather than representing inherent properties of nature (Kaltenborn 1998). Defining cultural landscapes and the values allocated to different elements in those landscapes offers insights into the influence of dominant political cultures on the appearance, meanings and uses of space (Manzo 2003). The politics of place intersects with the politics of interest negotiating the development, allocation, maintenance and re-configuration of values in landscapes.

Places as political

Sense of place is mediated by both the physical and social context of landscapes but in relation to difference with other landscapes. This differentiation is especially important in the regulation of landscapes and the activities of the people that inhabit those landscapes (Cantrill and Senecah 2001). Control over space is a major condition of the exercise of power and domination and provides the preconditions of surveillance and the powers of the surveilling (McHoul and Grace 1993, Foucault 1980, Sayer 2000). An understanding of emotional relationships that people have with landscapes includes both contextualised and politicised components (Manzo 2003). This defines the frame within which ideals, ideology and practice delimit the political sphere.

The historically contingent delimitation of regional landscape scales is relative to the moral projects and visions of the *status quo* and represents the links between moral construction of landscape meaning and the power of influence in shaping geographical space and control (Whitehead 2003). Sense of place serves “to shape personal choices and behaviours such as conservation and

improvement" in landscapes (Beatley 2004 p. 30). Traditional approaches to resource planning have been to match human demand with environmental capacity (Brown *et al.* 2001). Explicit assessment of the full range of symbolic and material values in a landscape allows sense of place to act as both encouragement and constraint on human activities beyond the limited notions of capacity.

The construction of scale provides the vehicle for moral power and plays an active role in shaping an ethics of land management and sustainability in regional governance frameworks. This form of agency in landscapes represents the politics of interests to exercise a moral responsibility that can collude to displace the local context of politics of place. This collusion constructs landscape scale, value and form, moral reasoning and discourse, and the definition of moral responsibility within wider scales of action and engagement (Whitehead 2003). Moral conduct thus defined within landscapes and environing locales constitutes the moral framework of socio-ecological conduct and values exposed at the intersection of ecological and social spaces (Whitehead 2003). Sense of place can be appropriated to provide legitimacy to sets of subjective and evaluative criteria to form externally derived authority (Seddon 1997). Place is a powerful social influence in contemporary natural resource politics, and trust[16] is a key component of the moral geography of place making (Cheng *et al.* 2003, Entrikin 2003).

Place is contextualised as a process of interaction between groups in local, regional and global scales. Cheng *et al.* (2003) claim that in general, organised interest groups, commodity industries, elected representatives and scientific and resource specialists have dominated natural resource politics. This approach in policy has tended to assign and advocate general and abstracted place meanings that have marginalised and even ignored the nuanced meanings of local voices of individuals and groups acting within the politics of place.

[16] Trust forms a key element of social capital and is covered in some depth in Chapter 4.

The location of these interconnected landscape elements and values set within defined and narrow place meanings serve to legitimise the power of the s*tatus quo* and dominant groups that invariably represent captured[17] communities, commodity industries as well as scientific and resource specialists (Cheng *et al.* 2003). This has significant implications for the management and use of landscapes and forms the negotiation of production, empowerment and containment in power relations between communities of place and identity and communities of identity and interest that are currently negotiating in new forms of regional governance in Australia.

Using sense of place

People's relationships with the landscapes in which they live are dynamic and operate on both conscious and subconscious levels. Places become meaningful in the way they represent symbolic life events in the dynamic interaction of construction and reconstruction of identity. The realm of nature can form a temporary escape from daily routines and settings and serves therapeutic needs in people (Manzo 2003). Identifying these symbolic relationships people have with landscapes can represent complex feelings and experiences and reveal a uniqueness of meaning and value assigned to places that is not easily transferred even to other identical biophysical settings (Cheng *et al.* 2003). Interpreting and understanding processes becomes difficult if the specifics of the environmental setting are ignored (Uzzell *et al.* 2002). This process of allocation of value and meaning emerges as a result of interactions between landscape, identity and attachment in social and political processes (Cheng *et al.* 2003).

In essence, sense of place is a process that gives meaning and order to social existence within landscapes. Sense of place research thus captures the

[17] **Captured** communities are those who have been part of a process and work more or less within the frameworks of accepted practice (Winter, I. (2000). "Social capital and public policy in Australia", Melbourne: Australian Institute of Family Studies). Examples include the participants who are nominated by government or who have represented their communities over time. They are in contrast to **critical** communities who are generally outside new governance processes and have an active voice, or make an active contribution to decision-making that impacts on landscape management. Examples include those who work in the private sector providing advice in land management (chemical use, crop choices) and those who are not generally part of the 'landcare' community but have an active voice in the way decisions are made.

relationships between people and the landscapes in which they live and serves a range of application ends. In this research sense of place has been explored in two different approaches reflecting either as:

- landscape values as expression of community, or,
- community as expression of landscapes.

Research into sense of place in landscapes suggests three rationales:

- planning and management of natural resources in landscapes
- policy development that includes a range of perspectives including governance and community, governance and natural resource management and management for the conservation of biodiversity
- issues of social and environmental impact.

These three loose categorisations of research explored further in this thesis reflect a layered approach in which each layer addresses primarily:

- theoretical issues in relation to social structure through the expression of social and political relations, or landscape structure as an expression of social relations,
- applied uses in relation to environmental policy development, environmental planning and management, and environmental impact.

The process of sense of place reveals a place-related context for resilient communities and landscapes that cannot be considered apart from the central interaction between landscapes and people (Uzzell *et al*. 2002). In addition, consideration must be couched within the explicit acknowledgement that sense of place represents different contexts and values for people and should be used with caution (Seddon 1997). People's experiences in place shape environmental values and meaning in landscapes (Brandenburg, 1995). The connections people have with landscapes extend well beyond use values and resist easy definition, categorisation and measurement. The intersection of the elements of identity, attachment and landscape reveal complex processes and relationships that are not easily categorised "with regular demographic variables" (Brandenburg and Carroll 1995 p. 391). Developing conceptual boundaries for the theoretical construct and empirical research in sense of place depends on the explicit integration of symbolic and material values.

Socio-demographic variables allow description but do not serve to define sense of place values.

Using theory to develop conceptual boundaries for sense of place

To use sense of place as an approach to exposing connections and values allocated within landscapes, Cheng *et al.* (2003) proposed six necessary considerations in research for strategic decision-making grouped at three connected and interacting social scales:

Individual:

- People's perceptions and evaluations of the environment as expressions of place-based self-identity.

Individual and collective interaction:

- People's perception and evaluation of difference between places in the landscape in which place is part of a relationship between social, cultural and biophysical values (as opposed to place as an assemblage of individual biophysical attributes).

Collective interaction in the process of social identity formation:

- Emergence of place based social groups (communities of place and identity) that negotiate in the allocation of significant social and cultural meanings around a place.

Collective interaction in the process of place identity formation:

- The evaluation of landscape management and resource management proposals influence the identification with and of social groups around places and in landscapes. This results in differentiation between communities of place, identity and interest.

Collective interaction in the process of collective identity formation primarily focused in the social catchment scale:

- Group identity is formed around the exercise of power in influencing outcomes that results in distinction between subject from subjugated and captured from critical communities.

Collective interaction across institutional and geographic scale:

- Abstracted notions of landscape and management issues developed and maintained at international and global scales interact at the local scale to mediate and define the valuing of landscape elements and issues.

Cheng *et al.*'s (2003) six propositions raise the importance of considering the relationship of people with landscapes within a nested framework of social and geographic scale and a diversity of places that form a landscape.

The elements that configure a person's cognitive structures for the environment can be distinguishing attributes for groups in a population. These structures are critical in identifying community concerns in land use. In a study examining the relationship between 'self-schema' and 'environmental awareness, Cantrill and Senecah (2001) use sense of place as a foundational construct. Their study assumes the importance of the human dimension of ecosystem management. They claim that as people develop a sense of self, place serves as a mediator for the degree to which commitments to solving environmental solutions are embraced. Cognitions people use to relate themselves to the natural and social world are quite powerful in the generation of responses to environmental policies and may serve to distance individuals from one another or the agencies that manage the use of natural resources (Cantrill and Senecah 2001). Stedman (2003) asserts that:

> Attempts to manipulate the landscape in the service of attachment will fail if meanings are not considered. Empirical inquiry…helps to systematise important theoretical statements about the interplay between the physical environment, human behaviour, symbolic meanings, and sense of place (p. 683).

People value different elements of the landscapes in which they live according to a range of attachments based on emotions, relationships with other people and activities. Eisenhauer *et al.* (2000) report that recreational activities were the most prevalent type of use associated with the special places in their study despite the fact that the associated communities frequently engage in production and commercial activities in the same places. They indicate that environmental features and the characteristics of a place, along with the activities conducted with family and friends were the key factors underlying emotional attachments to the places in their study, but that the activities people conduct in a place are largely independent of the reasons for considering places special.

The results of a study by Uzzell *et al.* (2002) suggest that place-related social identity may be differentiated through either collective social relations, or

individual and collective relationships with place. These relationships may form an important dimension of environmental attitudes with significance for the planning of environmentally sustainable policies. The authors advocate that any long-term environmental behaviour strategy has to be located in the relationships that exist between people in the community and the relationship between those people – individually and collectively – and their environment.

Stedman (2003) attempted to link development and change with threats to biophysical systems through the symbolic meanings attached by people to particular environments. Structural equation modelling was used to test three models of the relationship between the physical environment and the development of sense of place:

- the direct effects model assumed that attachment and satisfaction emerge purely as a function of landscape setting
- the meaning-mediated model assumed that symbolic meanings were mediating variables in the development of sense of place
- the experiential model assumed that experiences are the foundation for meanings ascribed in landscapes.

The results of testing these three models indicate that place attachment is complex and is only revealed through the indirect effects of symbolic meanings. Stedman (2003) found that the meaning-mediated model demonstrated best fit. Thus, meaning characterises attachment, which may remain intact despite environmental deterioration and degradation. Landscapes make a strong contribution to the construction of social meaning.

The concepts of landscape and therapeutic landscapes are given definition in writing on matters of human health by Gesler (1992). Landscapes are influenced by physical and built environments, and are a product of the human mind and of material circumstances that reflect both human intentions and actions and the constraints and structures imposed by society. Gesler (1992) claims that to interpret therapeutic landscapes it is necessary to use notions of symbols and symbolic landscapes. These concrete and abstract forms express meaning and represent cultural landscapes revealing the interconnection between the social and spatial in therapeutic spaces.

Theoretical exploration of sense of place reveals explicit values in elements of landscapes and explicit social relationships that reveal the connections between people living in and embodied in landscapes. These explicit values and relationships are used in applied research in political contexts of management and critiques of management of society and landscapes.

Using applied constructs to develop conceptual boundaries for sense of place

Reasons for attachment to place were explored by Eisenhauer *et al.* (2000) in Utah to establish the stakeholders' attachments to public lands and to understand the influences on emotional attachments to special places. They concluded that familial and kinship relations were the most important elements of place attachment. This was followed in importance by features of the environment, familiarity with place defined through ownership and recreational values. Economic and consumptive values were the least important in the ranked values. The authors claim a combination of factors are probably involved in the development of attachment and commitment to place. These include:

- personal experiences at places
- broad, non-locally based cultural influences
- the embedding[18] nature of local community orientations to public lands.

This indicates that the social capital that develops in communities is an important factor in embedding commitments in place.

Kaltenborn (1998) framed sense of place as an empirical construct to study the impact of resource use and other environmental impacts on people living in an archipelago to the north of Norway. Natural and cultural histories must be understood in conjunction to establish the development of place meanings.

Four types of values were examined in Kaltenborn's (1998) study of wilderness value:

[18] Embed: "to fix firmly in a surrounding mass" Macquarie Dictionary, 1981, p. 586).

- existential value, which is knowing that a place exists even if there is no ready access to it
- use value, which provides concrete use and access to a place as a resource
- testament value, which acknowledges potential use of future generations
- option value, which judges a place in relation to alternative resource choices.

The study concluded that it is possible to measure sense of place empirically but that it is not a sufficient predictor for environmental perception. Wilderness concepts are relative and dependent on social and geographic location, and environmental impacts affect aesthetic, cultural and symbolic meanings as well as individual and instrumental meanings.

Kaltenborn (1998) demonstrated that sense of place affects how people perceive environmental conditions and that it is useful for predicting reactions to impacts and the potential for commitment to implementing environmental solutions. He went on to warn that relationships with landscapes are not distinct but complex. These results combined with Kaltenborn's three phases of place attachment depicted in Figure 3.1 gives a good indication of the usefulness of sense of place in defining relationships of commitment across landscapes.

In exploring the concept of 'geographic discounting' in communities in national forests in Alaska, Brown *et al.* (2001) argued for the explicit and rationally defensible integration of environmental values in land use decisions and policies. They drew on three different theoretical traditions to explore the way in which landscapes are evaluated to represent spatially linked but explicit place values:

- social utility, in which places represent usefulness or value for human purposes
- cohesiveness perspective, where values are meta-sociological constructs for facilitating coordinated activity
- social discourse perspectives, in which evaluative judgements are the result of interpretation of social phenomena and represent the emergent properties of communicative action.

The elements that emerged from Brown *et al.'s* (2001) research combine to reveal discrete values in linked socio-ecological landscape systems.

Brown and Reed (2000) claim that the results of their study "suggest that a forest values typology can be operationalised to measure the relative importance of different forest values held by members of the general public" (p. 247). They concluded that forest values are all linked but that the thirteen values measured represent distinct domains that resist further reduction. They also indicate that both material and symbolic values were selected. Their results show that "non-commodity values such as aesthetic, life sustaining, and biological diversity" were allocated more importance by participants in their study in both frequency and mean sum (Brown *et al.* 2001). Their findings demonstrate the importance of including explicit symbolic relations in addition to more evident and easily tested material relationships to place.

Brown *et al*. (2001) advocate the empirical concept of landscape value that was tested to provide a quantitatively testable typology representing a range of social, environmental and ecosystem values in natural landscapes (Brown and Reed 2000). This typology of thirteen categories reflects utilitarian, aesthetic and other abstract values (recreation, historic, cultural, learning, life sustaining, biodiversity, the future, intrinsic, therapeutic, spiritual, aesthetic, subsistence and economic) indicating that humans are active participants in the landscape – thinking, feeling, and acting – leading to the attribution of meaning and the valuing of specific landscapes and places. People receive information from both observation and experience, which leads to perception which is in turn mediated by the socio-cultural context in which the person exists and the individual's personal utility functions.

People are likely to associate a range of values with a given landscape, but the mix of values and how these values are weighted will be different between individuals. The typology of landscape values captures a range of meanings represented in landscapes reflecting the interaction with identity and attachment in forming a sense of place. Sense of place is a social construction formed by human-landscape interactions and may be linked to physical environments with

particular attributes. Brown and his colleagues concluded that place, community and scale matter in the process of environmental valuation.

In a further study in this field, Brown (2005) claims that qualitative data collection, while rich in context, is often limited in size and scope, requiring "an operational bridge" (p. 19) to connect explicit places with their underlying perceptual rationale for ecological planning and resource management purposes. After focusing on preference-based values, as opposed to social obligation or biophysical function, Brown (2005) claims that "a distinguishing feature of conservation planning and analysis techniques is that they are expert driven, developed by those with biological or ecological training…few techniques explicitly provide for the inclusion of what is variably identified as 'traditional,' 'local,' 'Indigenous,', or 'folk' knowledge" (p. 31). He goes on to point out that people have a range or intensity in how they value different elements of the landscape and it is dependent on an individual's interests and relationships with the landscape.

Research into the social aspects of environmentalism has traditionally given primacy to the socio-demographic correlates of concern for and willingness to solve environmental problems (Hannigan 1995, Pakulski *et al.* 1998, Tranter 1999). Contradictory findings indicate that social factors do not exert a uniform effect upon environmental perception. This lack of consensus indicates that perceptual processes beyond the mitigating influences of socio-demographic factors may contribute to and drive perceptions of the environment and relationships with landscapes (Cantrill and Senecah 2001). Kaltenborn and Bjerke (2002) studying the way in which landscapes are valued and place attachment occurs in a region of Norway found that "place attachment does influence management preferences specific to a concrete place…{the} effect is considerably stronger than the effect of age, gender and education" (p. 385). The results of their study indicate that "environmental value orientations and place attachment represent a more fundamental or basic antecedent to preferences than specific functions or use of the landscape" (p. 395) but call for future research to include a focus on functions along with meaning in specific landscapes.

A conceptual model for sense of place

A conceptual model in this research developed from theoretical and empirical literature provides the means for sense of place to be operationalised for quantitative and qualitative analysis. This model attempts to synthesise and combine a wide range of perspectives to accommodate a range of social scales and practices within a landscape. This model presents place as an open region within which a variety of elements can be distinguished and assembled so as to allow the construction of a single complex structure. Sense of place may be explored within three social scales: the individual, the collective expressed at the community scale, and society. Sense of place develops and evolves in each of these three scales through a dynamic interaction between the three key elements of identity, attachment and the physical landscape. Over time the processes that define sense of place can result in an evolution from belonging, through attachment to commitment to caring for landscapes (Kaltenborn 1998, Sayer 2000). Thus, 'topographical' objects of inquiry (in this case hydrological catchments) are properly understood through the interrelation and interconnection of a typology of distinct, irreducible, but interrelated symbolic and material values.

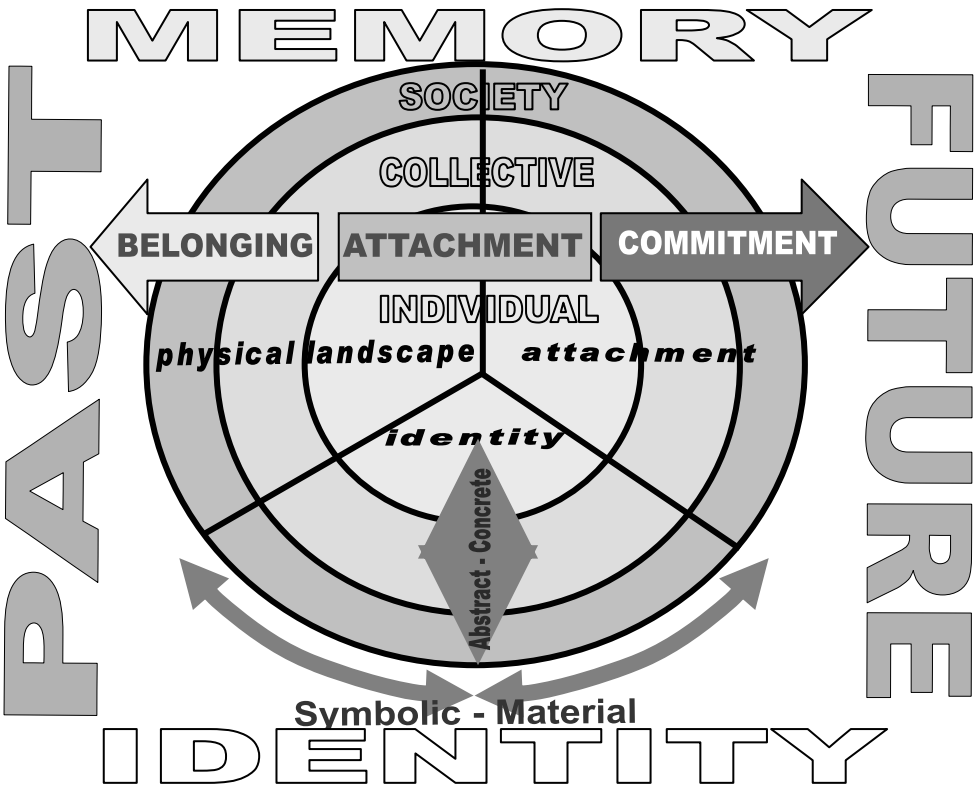

Figure 3.2 A conceptual model combining the elements, scales and values in sense of place

Sense of place can be grasped and understood in a multiplicity of ways and presents interpretive problems for analytical perspectives frequently used in both phenomenological and cognitive strategies (Kaltenborn 1998, Malpas 1999). The high degree of exploration used in much research into sense of place exposes the field as evolving in theoretical proposition and conceptual development (Kaltenborn and Bjerke 2002). Empirical heuristic research requires a broad conceptual base to capture the diversity of identity constructs, communities and landscape values contributing to an understanding of sense of place. This conceptualisation depends on the explicit understanding of the theoretical, dimensional and relational space of elements and scales that form sense of place.

Section Two: The quantitative exploration

The methodological approach for sense of place analysis

To understand how sense of place contributes to value frameworks for decision-making, two social catchments were explored and defined to include a range of

social and geographical decision-making scales. This research is based on a population sample that reflects both scale of social engagement in the catchment and the virtual worlds of landscape value. A range of people were contacted to represent both geographical spread and a representative cross-section of people responding to the 2001 national census. In addition, three categories of community were included to ensure representation of a range of decision-makers that impact on landscape management. This social catchment includes communities of place, identity and interest to capture the interactions between politics of place and politics of interests. In many cases, these communities intersected to represent a combination of community categories in both individual and collective form.

By basing myself in each of the catchments during the survey period, and during the follow-up interview period I was able to make a constant comparison of conceptual frameworks with the expression of ideals and observed behaviour in the context of the actual landscapes (Cheng *et al*. 2003). This observation of the use of landscapes, state of the ecological environment, agricultural and other economic practices allowed me to explore the voices and rich, layered place values that are not always included in formal political processes of decision-making but that are critical to how sense of place is developed, maintained and re-configured in the face of change.

The survey questions for sense of place

Sense of place in both catchments was explored in two phases. The first phase used survey questions based on the typology of place values developed and tested by Brown *et al*. (2001), which included utilitarian, aesthetic and more abstract values. This typology used specific places as examples for the Katanning Zone and Condamine Headwaters respectively (see Appendix 7).

Survey questions for sense of place collected information on frequency of visits to each of the thirteen different kinds of places using a scale of 0 = never to 5 = everyday. Other questions required a rating (0 = none, 5 = most) for the way in which each place is valued in relation to work, social life and spiritual life respectively. A further question with the same scale collected information on the

rating of commitment to maintaining the values of each place. These questions collected information that differentiated the way people use and value different places in the landscape. The rating of commitment established the differences between symbolic and material place values, as well as the relationship between place use and place value.

Length of residence in a catchment was gauged through a tick box categorisation in time intervals (Appendix 2). This provided a means of assessing the hypothesis presented by Kaltenborn (1998) that there is a relationship between length of residence in a place, and commitment to maintaining and restoring place values in a landscape.

Participants were asked to mark the location of each of the typology of place values on a GIS (Geographical Information Systems) map developed for each catchment that was attached to the survey questionnaire (Appendices 3 and 4). This provided a contexted means of evaluating place values in relation to place of residence, as well as a whole-of-catchment context for participants completing the questionnaire.

While these survey questions did not reveal direct information on identity and attachment, they provided explicit information on the different ways in which a range of places in landscapes were valued in both symbolic and material senses. This provided some information on the silenced and subjugated values in landscape management and presented some critical information on the way in which different community categories value places in the landscape.

Summary statistics

Length of residence in the two catchments varied. More participants had lived in the Katanning Zone for less than five years and for longer than 20 years (Figure 3.3). More Condamine Headwaters participants had lived in the catchment for between five and twenty years than in Katanning Zone. Length of residence in a place is considered to be an indication of attachment and belonging in a landscape (Kaltenborn 1998, Beatley 2004).

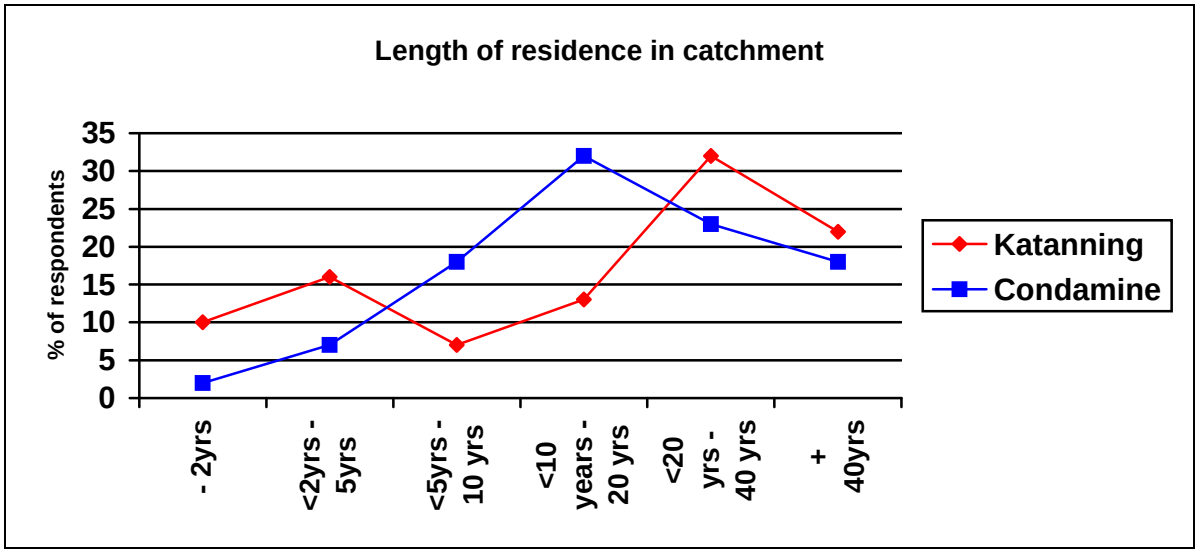

Figure 3.3 Comparison between Katanning Zone and Condamine Headwaters of percentage of respondents and length of residence in the catchment

Using places

People with attachment to place visit places repeatedly, establishing rituals and traditions of use (Brown *et al.* 2001). The survey asked participants how often they visited each of the different places they had chosen as representation of each of the thirteen landscape values in the typology developed by Brown and colleagues (2001).

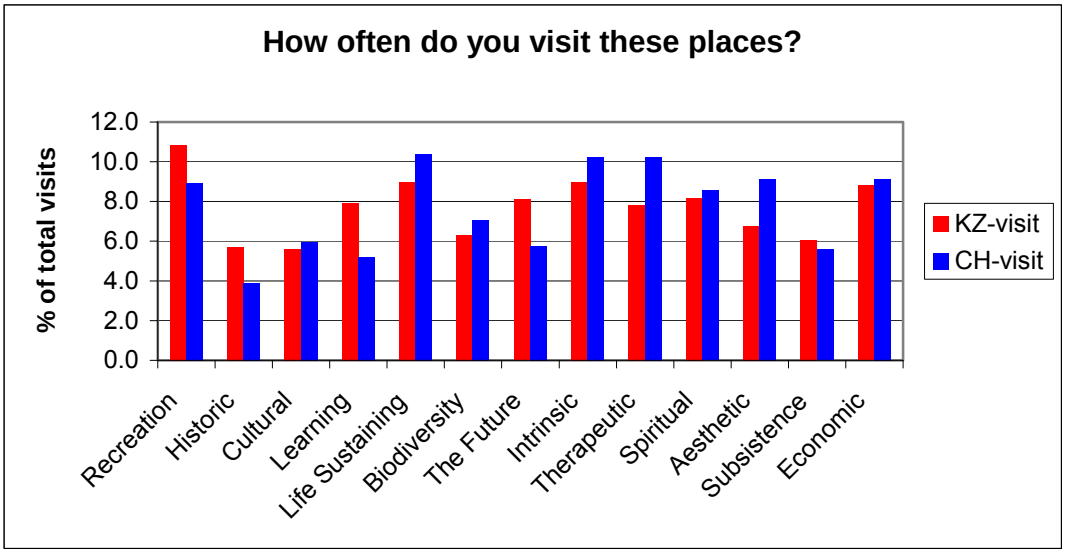

Figure 3.4 Histogram showing frequency of visitation to different places in the landscape

These scores presented as percentages of the total of all typology representations are presented in Figure 3.4. Participants in the Katanning Zone

visit places of recreation, history, learning, the future and subsistence more often than do those of the Condamine Headwaters. This result is consistent with Eisenhauer, *et al.* (2000) who reported that recreational activities were the most prevalent type of use associated with the special places in their study despite the fact that the associated communities frequently engaged in production and commercial activities in the same places. In addition, the people in the Katanning Zone are engaged in active landscape management across a range of landscape values in solving the problems they encounter as a result of rising salinity levels and other forms of environmental deterioration. This is reflected through their places of learning and the future.

Participants in the Condamine Headwaters more frequently visit places in their landscape that represent aesthetic values and this may indicate attachment to the aesthetic and more intangible values of the beauty of the landscape in which they live. Economic values score lower than do the social and more symbolic elements, but are scored similarly in both catchments. Places that reflect cultural and biodiversity values are slightly more visited in the Condamine Headwaters than in the Katanning Zone.

Numerical taxonomy revealed this typology of landscape values to comprise three distinct clusters of values (Figure 3.5). This clustering of values is a useful way of discussing diverse symbolic and material place values in a cultural exposure:

- The first cluster of landscape values consists of social values that include a set that reflects social, cultural and human capital: recreation, historic, cultural and learning values.
- The second cluster of landscape values consists of two sets of landscape values that might pertain to more intangible concepts relating to symbolic representations of wellbeing and the future and include in one half, life sustaining, biodiversity and values of the future, and in the second half intrinsic, therapeutic, aesthetic and spiritual values.
- The third cluster of landscape values (economic) pairs subsistence with economic values in a distinct and statistically different framing of values.

These three distinct groupings of values are referred to respectively as social, symbolic and economic landscape value clusters. In assessing these three sets of landscape values against the elements that comprise sense of place it would seem feasible that the landscape values in Brown *et al.'s* typology adequately reflect a diverse representation of values in each element of sense of place (landscape, attachment and identity).

Economic values are more similar to symbolic values than to the set of social values (Figure 3.5). The set of social values resist statistical fusion with the other two sets of values for longer. These landscape value clusters offer a unique insight into how the policy of landscape management can be more effectively developed and implemented to accommodate social and cultural values in rural agricultural Australia. These results reflect the necessity of considering economic, symbolic and social value frameworks explicitly.

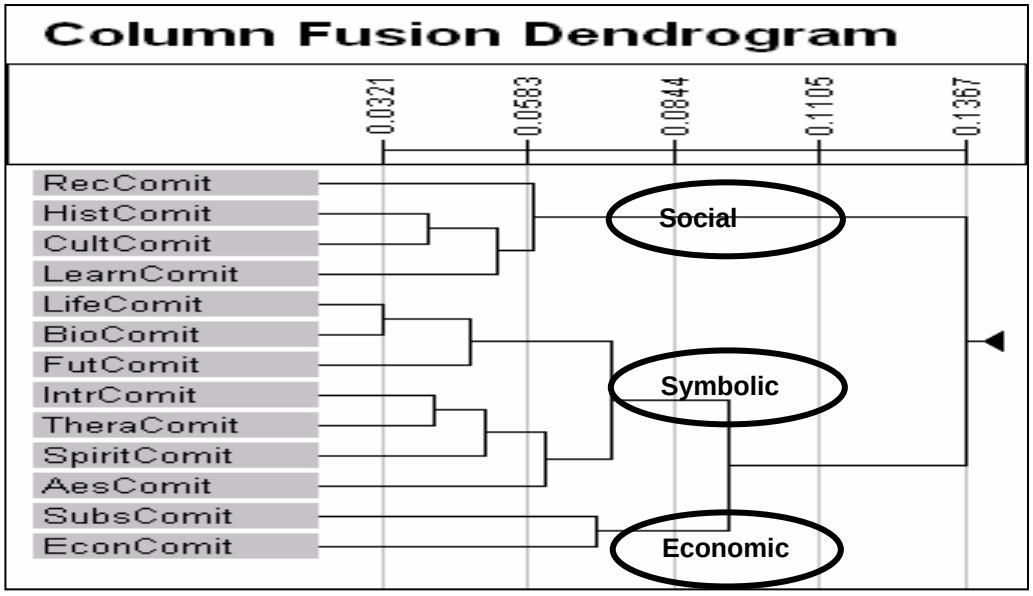

Figure 3.5 Dendrogram showing the landscape value clusters from both catchments (Bray Curtis, UPGMA Beta, –0.05)

The dendrogram (Figure 3.5) establishes the importance of considering landscape values in three explicit value framings. Each of these value framings relates to participant's work, social and spiritual life. Table 3.1 shows the relative ratings of each of the landscape values in relation to importance to these three intersecting life activities.

Table 3.1 Percentage importance of places to work, social and spiritual life (KZ = Katanning Zone; CH = Condamine Headwaters)

Scale: 0 – 3 = low importance | 15.1 – 18 = high importance

	KZ- work	CH-work	KZ - social	CH- social	KZ-spiritual	CH-spiritual
Social Landscape Value Cluster						
Recreation	8.1	7.1	**17.7**	**12.3**	9.3	**10.2**
Historic	5.6	5.9	6.5	7.2	6.2	4.0
Cultural	4.9	7.4	6.9	**10.2**	6.8	5.8
Learning	**13.3**	9.4	**10.5**	6.7	6.4	4.0
Spiritual Landscape Value Cluster						
Life sustaining	**10.7**	**11.2**	7.3	8.8	8.7	**10.2**
Biodiversity	7.4	8.0	5.6	6.9	9.3	8.8
The Future	**10.2**	4.4	5.9	5.3	7.3	5.6
Intrinsic	6.3	7.1	7.8	8.1	9.1	**10.0**
Therapeutic	6.5	**10.3**	7.3	9.3	8.3	**10.6**
Spiritual	7.0	7.7	8.6	8.3	**10.0**	**11.5**
Aesthetic	4.9	5.3	5.8	8.6	7.8	9.8
Economic Landscape Value Cluster						
Subsistence	4.8	6.2	4.0	2.3	4.8	4.6
Economic	**10.1**	**10.0**	5.9	6.0	6.0	4.8

Work life

In the Katanning Zone, learning values in the landscape were most important to work life while life sustaining and the future values rated as more important than economic values. In the Condamine Headwaters, life sustaining values, therapeutic and economic values were all important.

Social life

In relation to social life in Katanning Zone, recreational values were rated most important followed by learning values. Recreation values were also most important to the social life of Condamine participants followed by cultural values.

Spiritual life

Spiritual values were most important to both Katanning Zone and Condamine Headwaters participants, but were followed by biodiversity in Katanning and therapeutic in the Condamine. Recreation and intrinsic values were equally important to the spiritual life of people in both catchments.

When comparing the two catchments, recreation values rated higher in Katanning Zone than in the Condamine Headwaters with the exception of the

spiritual values. Historic and cultural values were rated higher in the spiritual values to people in Katanning Zone, but comparatively lower in the social and work sense for Condamine participants. Learning values were rated much higher for Katanning Zone participants than they were for Condamine participants while life sustaining values were not as highly rated by Katanning Zone participants.

Biodiversity values were rated more important to participants' spiritual life than to either work or social life, and in Katanning Zone, particularly so. Place values that related to the future were more important overall to Katanning Zone participants than to Condamine Headwaters participants while intrinsic values were more important to Condamine participants, particularly in the spiritual sense. The landscapes in the Condamine Headwaters clearly offered greater therapeutic and aesthetic value to residents than did the landscapes of the Katanning Zone. Spiritual values were most important to spiritual life of participants, but rated well in both the work and social sense in both catchments. Subsistence values were rated more important to Katanning Zone in relation to work and spiritual life and less important to social life. In the Condamine, participants gave a higher rating to subsistence values for their work life than for their spiritual life, and a much lower rating for their social life.

Both catchments allocated high ratings to economic places in relation to their work life, and somewhat less but similarly in their social life. In contrast, economic values were more important to Katanning Zone participants than to Condamine participants in relation to spiritual life. These results confirm those of Brown *et al*. (2001) whose study demonstrated explicit symbolic relations in addition to more evident and easily tested material relationships to place in landscape management.

By using a comprehensive typology of landscape values to capture the sense of place elements of attachment, identity and landscape, these results indicate that economic values are not necessarily the most important drivers for decision-making in landscape management. Social and symbolic value sets are rated as important and must be used in conjunction with economic landscape

values for planning and the implementation of policy for people in local landscape contexts. These results provided a focus for qualitative inquiry conducted with participants as a follow-up to the survey.

Valuing the landscape

Commitment to values

In an effort to gauge difference between behaviour and attitude, a comparison was made between frequency of visiting different places in a landscape (Figure 3.4) and participants' commitment to maintaining the values of those places (Figure 3.6). While scores for visiting recreational places was similar for both catchments, higher scores indicated a greater commitment to maintaining those values in Katanning Zone. Visiting cultural sites was similar, but higher scores for commitment to maintaining those values indicated more value to people in the Condamine Headwaters. Commitment to maintaining historic values in Katanning Zone did not reflect the rates of visiting of these sites (there were lower scores indicating less commitment). This was in contrast to the higher scores for commitment to maintaining economic values compared with lower rates of visitation to places allocated with economic value.

In the Condamine Headwaters, higher scores indicated that there was greater commitment to historical and cultural values than was exhibited through visitation rates, in contrast to economic sites that held lower rates of commitment than was reflected in visitation rates. Places with intrinsic, spiritual, therapeutic and aesthetic value held similar scores for commitment and visitation rates but there were higher scores for commitment to maintaining the spiritual values in sites than was evident in the visitation rates.

This indicates that frequency of visitation to a site with a particular value is not a clear indication of commitment to maintaining the values of those sites.

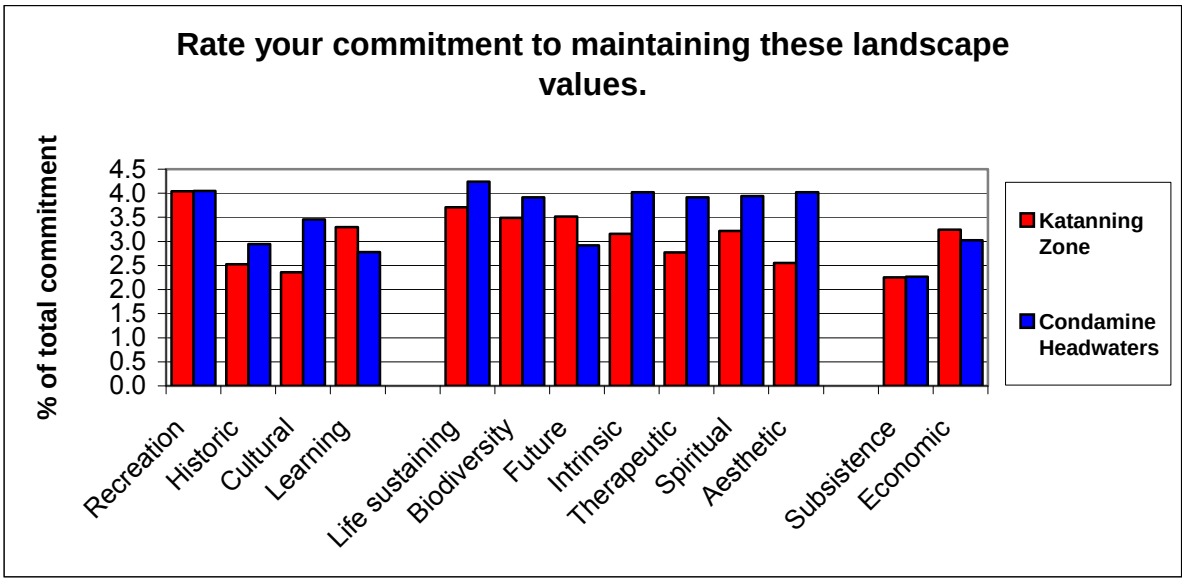

Figure 3.6 Histogram comparing commitment to maintaining values in both landscapes

In Katanning Zone there appeared to be more commitment to maintaining the values of learning, the future and economic places than in the Condamine Headwaters. This was in contrast with the historic, cultural, life sustaining, therapeutic, spiritual and aesthetic values that rated higher scores for commitment in the Condamine Headwaters. Recreation and subsistence values scored similar ratings. It is essential that intervention strategies that encourage the adoption of different land management practices in rural Australia consider that the economic values are not necessarily the most important drivers to action. Results of a pilot study in a catchment just north of Katanning Zone confirms these results, indicating that aesthetics "was likely to be a significant factor" (Bicknell 2005 p. 4).

The synthesis through numerical taxonomy

The data sets providing information on commitment to place (intrinsic variables) and socio-demographic descriptors (extrinsic variables) from both catchments were combined and then analysed through numerical taxonomy to show clusters, reliability of the clustering information, variables that were important in forming the clusters, ordination and networks in the two social catchments. In keeping with the heuristic and explorative methodology, this approach did not require a normal distribution of data, and was not dependent on *a priori*

decisions about the importance of specific variables in defining the clusters, ordination or networks. All variables and cases were equally accommodated within a range-standardised structure, thus allowing statistically defining patterns to emerge unimpeded by weighting. The figures presented in this section represent a single result in the numerical taxonomy presenting a range of statistical perspectives and insights into structure.

In using the PATN multivariate analysis package (Belbin *et al.* 2003), patterns of all participants (participants/cases clustered to form social assemblages) and variables (attribute clusters) were portrayed representing a simultaneous analysis. This was done through a series of steps that identified affinities between participants and variables, evaluated the strength of those affinities and portrayed the participants in ordination space. The networks between the social assemblages were then located to indicate nearest neighbours (in terms of the intrinsic variables representing landscape values) portrayed through a minimum spanning tree.

The cluster analysis produced five groups of people (social assemblages) clustered according to the similarities in their commitment to different values in the landscape. The clustering relationships between participants are shown through the row dendrogram (Figure 3.7) and a two-way table (Figure 3.8).

Evaluation of statistical difference between each of these social assemblages was carried out through analysis of similarities using the analysis of similarities (ANOSIM) evaluation option in PATN. The distribution-free nature of this test allowed consideration of 0 response values. Table 3.2 shows the degree of statistical difference between social assemblages in the ordination. Numbers of less than 0.05 show statistical significance. Each of the five social assemblages were statistically different from one another.

Table 3.2 Row ANOSIM (SA=social assemblages)

	SA 1	SA 2	SA 3	SA 4
SA 2	0.00			
SA 3	0.00	0.00		
SA 4	0.00	0.00	0.00	
SA 5	0.00	0.00	0.00	0.00

The row fusion dendrogram (Figure 3.7) shows clustering of participants into five social assemblages (identity numbers down left hand axis: b/B-Blackwood, w - Warwick)

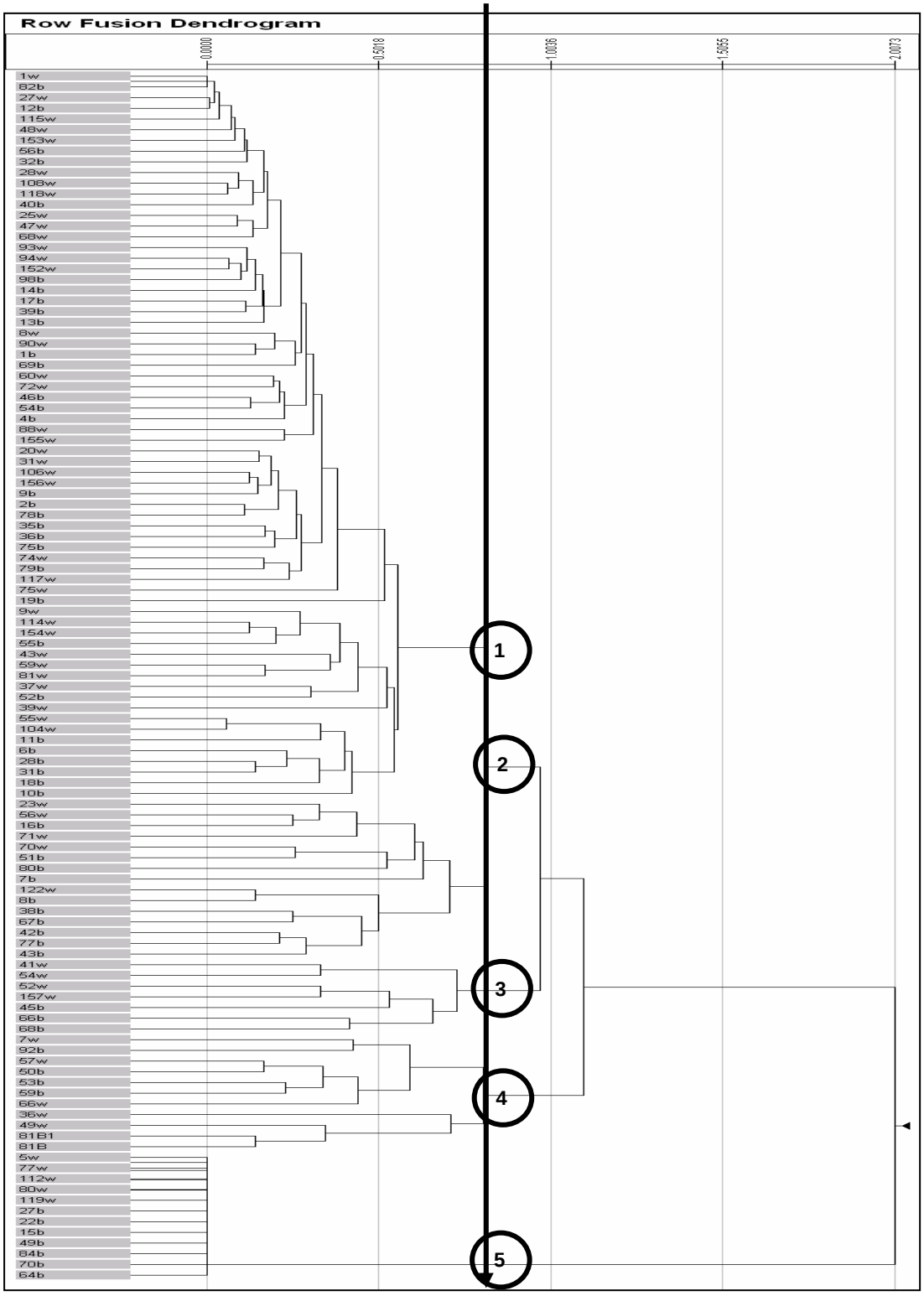

Figure 3.7 Row dendrogram showing clustering of participants into five social assemblages (Bray Curtis, UPGMA Beta, –0.05)

The two way table (Figure 3.8) shows overlay of groups of participants and groups of variables (landscape commitment) defined through cluster analysis. This portrays the results of the numerical taxonomy to show similarity between participants in each of five social assemblages and correlation with the variables that drive the clustering of landscape value sets and social assemblages shown in each of the dendrograms (Figures 3.5 and 3.7). The significance of colour (see the legend in the top left hand corner of Figure 3.8) pertains to strength of relationship between intrinsic variables (commitment to landscape values across the top of the table) and participants (down the left hand side of the table). Black is the highest degree of correlation showing most affinity between participant and landscape value and white shows no correlation.

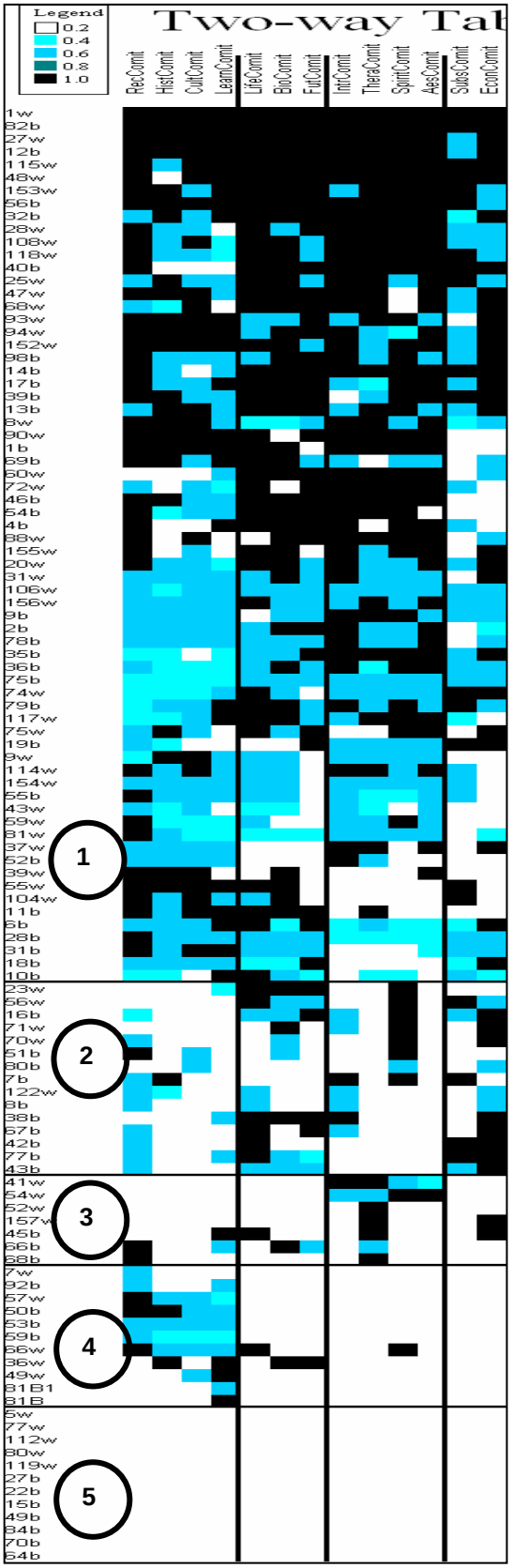

Figure 3.8 Two way table showing clustering of respondents into social assemblages and the relative correlation with commitment to landscape values (Bray Curtis, UPGMA Beta, –0.05)

Social assemblage 5 was distinct in having a low commitment to any landscape values, while **social assemblage 4** had little if any commitment to landscape value clusters pertaining to symbolic and economic sites/places. **Social assemblages 2 and 3** had sparse commitment to any landscape values, (although in effect each of these assemblages was statistically different and cannot be conflated to one assemblage). **Social assemblage 1** comprised most of the participants in both catchments and showed a reasonable and somewhat uniform commitment to all landscape values.

The minimum spanning tree shown in Figure 3.9 gives a graphic portrayal of the difference in valuing of elements of the landscape between social assemblage 5 (pink) and the other participants.

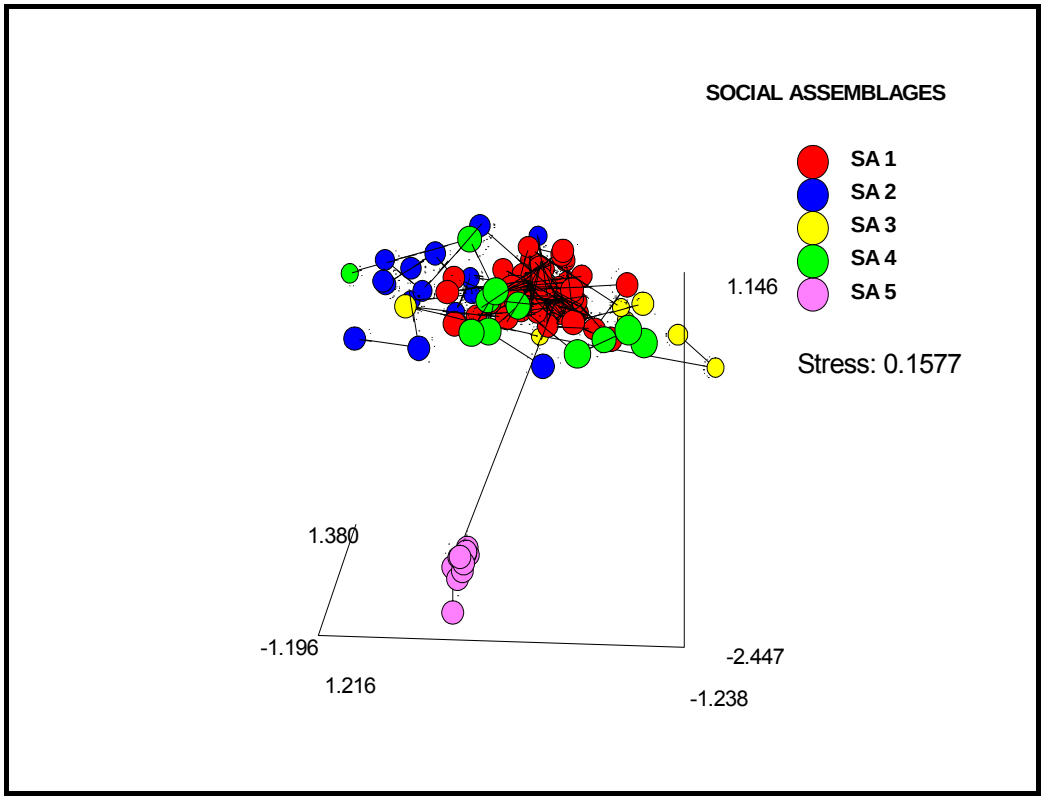

Figure 3.9 Minimum spanning tree showing social assemblages grouped in abstract relational space (axes in 3 dimensions indicated by numbers in ordination space) and linked through lines showing relationships and degree of similarity according to commitment to valuing places in the landscape. (Bray Curtis, UPGMA Beta, –0.05)

The social assemblages showed a mix of both catchments (total n=113). To identify the composition of the social assemblages, percentages for the socio-demographic variables (extrinsic) were calculated. This provided socio-demographic descriptions for each of the social assemblages that were defined by their commitment to maintaining landscape values defined through the numerical taxonomic approach.

Social assemblage 1: RED - The committed majority

This social assemblage represented 60.2% (n=68) of the total participants, with a slight majority representing the Condamine Headwaters (54%). This group showed a strong commitment to maintaining most place values but with less emphasis on the social values and lower rates for subsistence and economic values. Most people had lived in the catchment for between 10 and 20 years identifying themselves through the survey as belonging to communities of place and identity. There were more men than women in this social assemblage and most were Australian born, working as farmers or professionals. Grain, sheep and beef was the most distinctive industry in this group.

Social assemblage 2: BLUE

Two thirds of this social assemblage were from the Katanning Zone (67%) and in total they represented 13.3% (n=15) of the total participants. This group showed stronger commitment to life sustaining, biodiversity and economic values, and identified as belonging to communities of place and identity. This group was predominantly female, and members of the assemblage had lived in their catchment for more than 40 years. These people were mostly Australian born and worked as professionals or with livestock (other than beef and sheep), with dairy farmers included. In addition, people working in personal services, and cultural and recreational industries made this group distinctive. There were no grain, sheep and beef farmers represented in this group.

Social assemblage 3: YELLOW

This small social assemblage made up 6.2% (n=7) of the total, with equal representation from the Condamine Headwaters and the Katanning Zone. The

distinctive characteristic of this group of people was their strong commitment to therapeutic values in the landscape. These people were mostly male and had lived in the catchment for between 10 and 40 years and represented the 40 to 64-year age group. A range of occupations were represented, including farming, the professions and associate professions, as well as trades and related work. They worked mostly in the grain, sheep and beef industry.

Social assemblage 4: GREEN

The people in this social assemblage (9.7%: n=11) were almost equally distributed between both catchments. This social assemblage valued recreational, historic and learning values above the other landscape values, and had generally lived in their catchment for more than 40 years. There was a mix of ethnicity and cultural heritage but most were between 40 and 64 years old. These were mostly retired and professional people, as well as people involved in the grain, sheep and beef industry.

Social assemblage 5: PINK

This distinctive social assemblage is portrayed clearly in the minumum spanning tree as distinctly different to all other social assemblages (Figure 3.9). It comprised a total of 10.6% (n=12) of all participants, with slightly more in the Katanning Zone than in the Condamine Headwaters. These people showed no commitment to maintaining any landscape values even though most of them had lived in their respective catchments for between 20 and 40 years. In total they represented the age bracket of between 40 and 64 years and were mostly farmers with some professionals working in retail and government administration. There were more males than females in this group.

The tensions: Critical vectors in commitment to place values

Evaluation of statistical significance in the clustering and ordination was conducted using four analyses: ANOSIM (Table 3.2), Kruskal Wallis significance testing, Principal Axis Correlation through r-values and Monte Carlo's permutation tests of significance through MCAO (details in Chapter 2). The significant variables drawn from both intrinsic (landscape values) and extrinsic (socio-demographic data) variables that contribute to the clustering,

networks and ordination are shown in Table 3.3. Only the statistically significant variables resulting from these evaluations are shown in Table 3.3 and represented as the critical vectors in Figures 3.10 and 3.11. These results indicate that the other variables (in this case extrinsic socio-demographic variables) were less important in defining composition of the social assemblages.

Table 3.3 Variables showing statistical significance in driving the clustering of variables and cases

Variable	Variable short name	Range of values	Kruskal Wallis: value between groups	r^2 values derived from Principal Axis Correlation (Pcc)	p derived from Monte Carlo's permutations (MCAO): p = 0.005
Commitment to Recreational values	RecComit	0 - 5	47.1	0.3	p < 0.001
Commitment to Historic values	HistComit	0 - 5	51.6	0.2	p < 0.001
Commitment to Cultural values	CultComit	0 - 5	60.0	0.2	p < 0.001
Commitment to Learning values	LearnComit	0 - 5	45.2	0.3	p < 0.001
Commitment to Life sustaining values	LifeComit	0 - 5	48.1	0.2	p < 0.001
Commitment to Subsistence values	SubsComit	0 - 5	34.0	0.2	p < 0.001
Commitment to Biodiversity values	BioComit	0 - 5	47.9	0.2	p < 0.001
Commitment to Intrinsic values	IntrComit	0 - 5	49.2	0.4	p < 0.001
Commitment to Aesthetic values	AesComit	0 - 5	69.1	0.3	p < 0.001
Commitment to Spiritual values	SpiritComit	0 - 5	37.9	0.3	p < 0.001
Commitment to Therapeutic values	TheraComit	0 - 5	66.4	0.5	p < 0.001
Commitment to Future values	FutComit	0 - 5	39.2	0.2	p < 0.001
Commitment to Economic values	EconComit	0 - 5	34.1	0.3	p < 0.001
Industry: Dairy Farming	DairyFarm	0 / 1	15.1	0.1	p < 0.001
Communities of place and identity	Place&id	0 / 1	15.2	0.1	p = 0.003
Occupation: General Manager	GenMan	0 / 1	12.2	0.1	p = 0.008
Community of place and interest	Place&Int	0 / 1	7.7	0.1	p = 0.03
English speaking	English	0 / 1	8.9	0.1	p = 0.04
Industry: Retail Trade	RetTrade	0 / 1	6.7	0.1	p = 0.05

A selective portrayal of these statistically significant variables are shown as vectors in the abstract ordination space of the social assemblages (Figures 3.10 and 3.11). This provides information on the association between significant variables in relation to individual participants and social assemblages. The positive relationship between variable and participant is in the direction of the variable name, emanating from the centre of the ordination space. Negative association is in the opposite direction of the variable name from the centre of the ordination. In other words, communities of place and identity (variable name

Place & Identity) (Figure 3.10) were almost diametrically opposite to communities of place and interest (variable name Place & Interest) indicating that there was a negative association between these two community categories (self-identified community identity). In contrast, communities of place and interest had a strong relationship with people engaged in retail trading (variable name Retail Trading). There was an indication that people working as General Managers (variable name General Manager) had low commitment to recreational values (variable name: Recreation).

In general, most landscape values were considered worthy of commitment by distinct sectors of the population and not by others (Figure 3.10). These critical vectors indicate that some sectors of the population valued places in the landscape differently to others. The occupation of General Manager, for example, had a negative association with many landscape value variables indicating low commitment to a range of places in the landscape. General Managers in this study were invariably those who managed people in the public sector (government agencies) and in the private sector (businesses providing information and resources for agricultural management). The socio-demographic descriptions of the social assemblages show that some of these people had lived in the catchment for over 20 years, while others had lived in the catchment for less than 5 years. This shows there was not a clear link between length of residence in the catchment and commitment to maintaining landscape values.

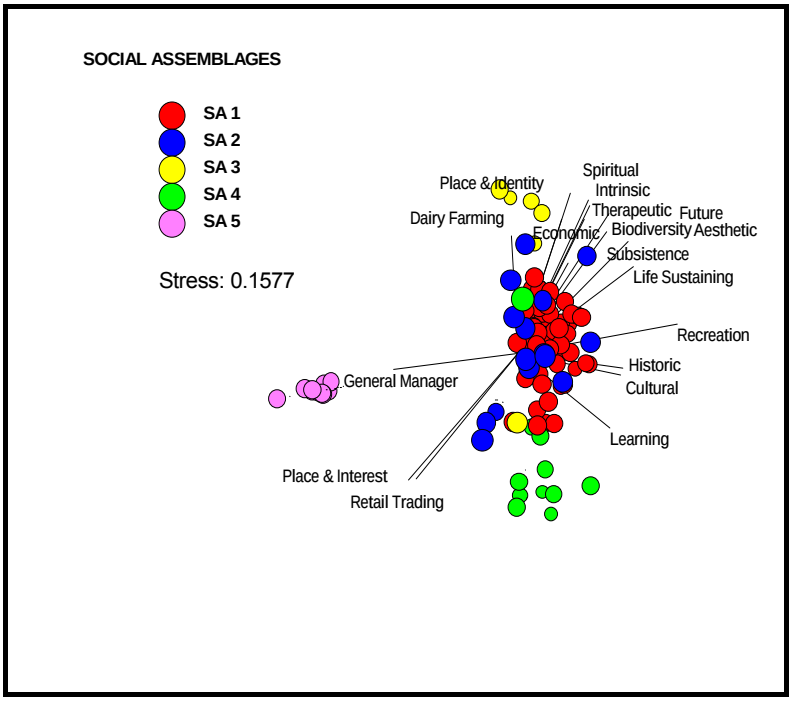

Figure 3.10 Ordination showing association of statistically critical vectors (Bray Curtis, UPGMA Beta, –0.05, PCC, MCAO)

Further exploration of the ordination space in relation to statistically critical vectors revealed the relationship between individual place values and socio-demographic descriptors. Most landscape values were positively associated with Social Assemblage One (Red) while some landscape values such as economic, were associated with other social assemblages.

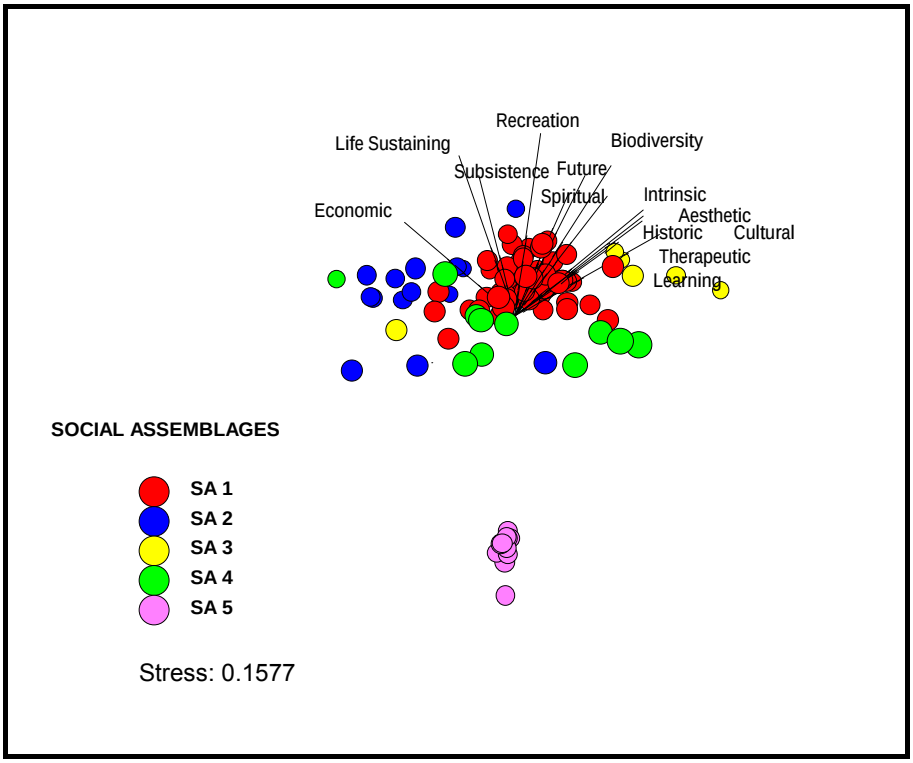

Figure 3.11 Ordination showing distribution of statistically critical vectors relating to commitment to landscape values (Bray Curtis, UPGMA Beta, –0.05, PCC, MCAO)

Commitment to maintaining all landscape elements representing the typology was statistically and negatively associated with social assemblage 5 (also strongly associated with the occupation of General Manager, and somewhat with communities of place and interest, and the industry of retail trading). This indicates that this group of people did not have commitment to the landscapes in which they lived.

Discussion

The attempt to define a sense of place through the typology of discrete and distinct landscape values developed by Brown *et al. (2000)* has exposed a number of interesting results and insights. The way in which landscape values clustered in the ordination process indicated three different sets of values: social landscape, symbolic landscape and economic landscape. These results confirm work done by Brown *et al.* (2000) that these values are not reducible, but the dendrogram of values (Figure 3.6) shows how these values may be clustered. Each of the thirteen landscape values in the typology proved statistically critical in defining the clustering in this ordination. This provides

further evidence of the usefulness of each value, and more particularly of the importance of considering sense of place values as a critical means of identifying diversity in landscape values in any rural community.

Each of these three domains of human relationships with landscapes is shown to be integrated in symbolic and material context through their value to participants in their social, work and spiritual life. Symbolic values are more difficult to capture empirically and are potentially more marginalised than material and tangible values but both these forms of landscape value are more useful as descriptors for sense of place elements (identity, attachment and landscape) than are socio-demographic descriptors. Brandenburg and Carroll's (1995) cautioning in relation to the usefulness of socio-demographic categorisation is constructively acknowledged by using these variables in the numerical taxonomy to provide social context and descriptive power for the ordination of landscape values that form intrinsic sense of place values in the analysis. Experiences through life activities shape environmental values and meaning in landscapes and provide a better insight into sense of place than socio-demographic descriptors.

There was an indication that different categories of community value elements of the landscape in a distinctive way. Indications are that landscape values allocated at the national abstracted policy scale are very different to the local contexted applied scale. The interactions between micro action in local contexts with macro structures that shape socio-political land management policy and the moral account of sustainability (Ritzer 1996, Whitehead 2003) provide the political context for interaction between the social scales of politics of place with politics of interests (Cheng *et al.* 2003). The critical vectors show the sharp contrasts between communities of place and identity practising politics of place, and communities of place and interest practising politics of interests. Duane's (1997) explicit identification and definition of these interacting social scales provides the political interactions identified by Cheng *et al.* (2003) with an effective operationalisation of social scale for the assessment and evaluation of sense of place. The results reported here expose the differences in commitment to maintaining landscape values between these categories of community in a

social catchment, thus exposing differences in political imperative and the interaction of power across social scale. This has implications for the evaluation of the state of a landscape and for the way in which landscape-based environmental solutions are framed and implemented.

Of particular interest was the way in which biodiversity values were clustered with the less tangible and symbolic landscape values within the symbolic landscape domain. While it might be assumed that participants did not understand the notion or concept of biodiversity, it might equally be claimed that their understanding or conceptualisation falls outside traditional scientific rationales and categorisations of biodiversity. In addition, the sampling framework included a full range of community categories across a social catchment and socio-demographic representation to ensure that both professionally trained people involved in landscape management and others with less formal education were represented. This result offers an insight into the way in which biodiversity values are allocated and understood in relation to a more complete range of landscape values that includes both symbolic and material values interacting across social, symbolic and economic domains. This clustering of landscape values has implications for the way in which economic incentives are offered for conservation of biodiversity on private and agricultural lands in Australia.

Within a social catchment, defined in the broad sense of the definitions presented in this thesis, there are significant contrasts in perception of association with place and valuing of elements of place. Sense of place defined through this simple approach gives a clear indication of likely commitment to place, and thus provides the framework through which approaches to a range of landscape management issues should be presented. Claims that “government agency staff don’t ask what we will find useful before they put the documents together” from the farming community and counter claims that “farmers aren’t using the information we have put together for them” from agency staff reflect the contrast in the values that underpin community self-definition, valuing of the landscape and relationship with place.

A sense of place is the way in which people link themselves both materially and symbolically with the landscapes in which they live. The typology of landscape values tested by Brown and his colleagues (2001) provided a useful and accurate means of differentiating between social, symbolic and economic landscape values. These values form three interacting elements that comprise sense of place: identity, attachment and landscape. These three sets of landscape values allocated within landscapes have an impact on how people frame their relationships with land, and these cannot be generalised or limited to any one simple approach. Acknowledging sense of place as an important contributor to decision-making allows the integration of biophysical values in landscape management with the social dimensions that bind people to place and explicitly defines the kinds of commitment people are likely to make to their landscapes. To understand the way values are framed and how commitment is derived, and to explore further the construct of communities within social catchments, an explicit set of qualitative questions was developed. These questions were to test the outcomes of the numerical taxonomy and to extend the results in order to provide insight into the more evident and subtle deep structures (Eoyang 2004) that are more difficult to construct from standard quantitative survey methods.

Sense of place: from content to process

The interaction between communities of place and identity and communities of place and interest indicates a difference in value sets that relate to contexted local knowledge and abstracted scientific knowledge. Sense of place can thus be further explored through a qualitative inquiry into the relationships between these two forms of knowledge, in addition to Indigenous knowledge, which is less obvious (or possibly subjugated) in these catchment contexts.

The three value sets that emerged from the clustering and ordination of landscape values reflect values differentiated in the concept of the triple bottom line[19]. The use of this concept allowed further evaluation and exploration of the values identified through the numerical taxonomy in qualitative approaches

[19] Triple bottom line concepts are discussed further in Chapter Five (Environmental discourse) and again as a process of complex systems in Chapter Six.

through the concept of the triple bottom line. The triple bottom line allows the opportunity to link social landscape values with social values of sustainability and symbolic landscape values with ecological values of sustainability. This would perhaps draw a long bow from the location of biodiversity within the larger set of symbolic values, or may possibly provide the opportunity to test this result in relation to the other sustainability values. Economic landscape values that include subsistence values correlate neatly with the third triple bottom line value, economic sustainability.

Ground-proofing the results of the quantitative analysis and further explorative research into sense of place through qualitative approaches thus draw on the structure exposed through the numerical taxonomy. This allows a different perspective on sense of place to be tested and emergent characteristics and processes to be exposed.

Section three: Qualitative inquiry into sense of place

The third phase of the inquiry into sense of place was conducted through a semi-structured interview process with individuals that reflected the values and characteristics of the social assemblages identified through the numerical taxonomy. The landscape values typology used in the survey coupled with the qualitative approach reflects a philosophy that explores connections and distinctions that arise "through the relations between and within the constituents of space" in which symbolic and material meanings work in conjunction (Sayer 2000 p. 109). This links the symbolic and material relations people have with the landscapes in which they live, reflecting a sense of place beyond the physical. Kaltenborn (1998) claims that identification of a sense of place is a useful indicator of commitment to restoration of degraded landscapes.

The research and interview questions

Statistically critical results from the numerical taxonomy were developed into interview questions that used the conceptualisation of sense of place in the local context of social catchments in both the hydrological catchments.

This qualitative exploration is reported through three sections each focusing on the interacting elements of sense of place: identity, attachment and landscape. Each of these sections includes direct quotes in the form of empirical evidence, and a short discussion that extends the results to include insights gained through the explorative heuristic approach and provides context within the conceptualisation developed for sense of place. The first section uses direct quotes from the participants to exemplify the sense of place element of identity. Identity is comprised of relationships that develop between the self, others and the landscape. To provide a context for exploring the implications for landscape management and decision-making, the political sphere was included in the content of the interviews. The second section provides insight into the element of attachment, which is shaped by relations between groups over time. The strength and form of attachment was assessed for contribution to meaning in sense of place, which has an influence on decisions in the use and management of places in the landscape. The third section reports on participants' perspectives on landscape as an element of sense of place, particularly in relation to experience and memory within cultural and political expression. The interview questions are presented in Table 3.4 to show their connection with the research questions.

Table 3.4. Relationships between interview questions and research questions.

Research question	**Interview question**
Is there a relationship between commitment to place and length of residence / association with place? Is there a relationship between length of residence, identity and attachment in sense of place?	Did you grow up in this catchment/ area?
How is attachment to place mediated by acceptance and inclusion by communities of place? Is there a relationship between sense of place and identity with place and identity and community? Is there a relationship between sense of place and attachment to place and attachment to community?	Do you have members of your extended family living here? What sorts of groups are you involved with?
How does the state of the landscape impact on sense of place, and the maintenance of commitment to sense of place (thus strong sense of place)?	What do you feel about this landscape?
How do people express the landscape values within which they frame their sense of place? What landscape values are likely to be expressed in open-ended questions about the landscape?	Is there any part of the landscape that is more important than any other part, and why?

Identity

Sense of place may be contextualised as the development of individual identity that emerges from the interaction between social, cultural and biophysical meaning and values. The development of identity reflects individual agency in social and political processes. To capture the way in which participants expressed and framed identity as individuals in relation to other people, the landscape and within processes of decision-making in land management, a series of quotes from participants in both sub-catchments indicates perspectives in Table 3.5.

Table 3.5. Participants' quotes showing formation of identity

THE SELF AND THE OTHER
"…so I fixed up all the fences and fixed up the shearing shed and put my sheep in there, and then I find I'm a farmer…no planning whatsoever…a lot of people have just accepted me here as just one of the folk…"
"we all have work clothes….we're definitely farm people. There's an openness and honestness, an enjoyment of that space of getting out and getting your hands dirty and contributing."
"if you're a farmer, you're going to look after your country well, because that's where you're going to get your bread and butter. You're not going to let it go down the drain unless you're a person that's just come into the district and you've got great ideas of making quick money."
"they buy out on poorer ground really because of the cultivation. Nobody knows how to do it. They would sooner have a block of grass country with a few trees so they can sit under them and drink their beer. They don't want to do any fencing or anything." {about 'treechangers'}
"people who are retiring are coming into this area with big bags of money…its taking away the viability of the other farmers because if the rates keep following that….we're saying to the local government minister is that you're losing your primary production land….{to} housing"
"I think today's landowner probably hasn't got the same closeness to the environment as their grandparents would have had."
THE SELF AND THE LANDSCAPE
"…it's really about the land in a sense…I sort of set my goal to walk through a forest of trees out there before I die…I help to do the environment a bit of a favour…"
"I could just see this little tinge of green across this paddock that I ploughed up and seeded with barley, …made me feel something special and that's what started me off to become a greenie"
"I'm fairly indifferent to it I have to admit because its just a means to an end in many ways. I've become kind of fond because I have been here for a while and I've developed a familiarity with it and there are things about the landscape that I like….I feel quite lucky to be here but overall if I walked away tomorrow I wouldn't miss it, I just feel lucky to have experienced it."
"I just wanted to bring the children into the country, more than I wanted to go farming."
"when I come out here, physically I feel everything else drop away…it energises me. I have just got to go and sit outside and listen to the trees…and it energises me for being a better teacher the next day or having a clearer mind to work on my own research and my own ideas"
"I feel very much part of the Murray Darling Basin, I feel privileged to live at the Headwaters, most certainly I really like being a riparian landholder. Its really grounding, there's something quite emotional in that."
THE SELF AND AGENCY: THE POLITICS OF PLACE.
"one of the first things we did as a catchment was to do our farm plans. And, then we started putting our catchment plan together. We work together and although you've got farm boundaries, there's no such thing as boundaries when it comes to water lines so a lot of us have actually taken contour banks through our neighbour's fences and dropped it in his dam. So we are working together."
"When I was on the {local} advisory board here….we wanted the board…its only a local one with irrigators and non-irrigators and riparian landholders and we wanted them to draw up a map for the heights for the floods, the highest flood on different sections of the creek and we told the Natural Resources Department and they didn't have time for those sorts of things"
"I'm extremely proud of {the area I live in} because of what the farmers here have all achieved and you know when you look across the valley and you can see the tree-line…"
"knowing the enormity of fixing it {the salt affected landscape}, I think you go through that grieving process… I think a lot of them {farmers} don't ever take that next step….so its more exciting for me now that I have been through that grieving process and its more accepted to say its an enormous problem… pleasure to see farmers who try and work with it the best they can and are really just doing amazing things with what they've got"
"the flow-on effect is obvious. What we do here physically and in this catchment area in Queensland is really really important and I don't think our state government has been very wise in their dealings with the rest of the country."
"it's the government land that's not being looked after and they are trying to grab more land. They can't manage what they've got."
"…but the group doesn't exist anymore, funds dried up. If you put in ongoing maintenance things don't stay level in my opinion, they continue to improve, on a low plane, plus other people go there…" {a broader sense of ownership and attachment develops}

People develop and re-configure their sense of identity based on what they do in a landscape and how this relates to what people around them are doing. This may be as a form of contrast: 'a greenie' in a traditional farming community; or, in solidarity: a 'farmer' in the same community. A sense of identity can be formed in relation to 'the other'. In rural Australia this might be in response to the perceived values of urban Australia couched in value-laden phrases such as: "work clothes", "getting hands dirty", and, "openness and honestness".

Communities of place and identity are more likely to form and express their identity in relation to 'the other' than are communities of identity and interest, who form their identity primarily in relation to landscape. A good example is of land being sold to public servants, retirees or those cast as 'the other'. They are considered not to be serious about farming or stewardship in land management. They are prepared to farm on 'poor ground', 'grass country' because they don't know how to cultivate. This seems to act as a divide casting both commitment and engagement as the means of identifying with place and forming an 'authentic' rural identity. All quotes from the first part of the table (3.5) on identity, the self and the other, except the final one came from communities of place or place and identity. All quotes in the second part of the table (identity, the self and the landscape) came from communities of place and interest or communities of identity and interest. This demonstrates the perspectives from Beatley (2004) that subjective judgements and assessments developed in local community and landscape contexts (communities of place and identity) reflect meaning and personal value, while objective values reflect the qualities of places such as landscapes and material representation in a more abstracted sense (communities of place and interest).

Individual agency and the political climate of resource provision play a supporting role in the configuration of identity in these situations. Sense of place is contingent to some extent on the bonding of communities of identity with place. Manzo (2003) commented that this interaction was potential as a micro-level action that may interact with the macro structures that shape broader socio-political scales and have the potential to develop meaningful action by

communities of interest in local contexts and overcome the problems of abstracted relationships with landscapes mentioned by Malpas (1999). This interaction between micro and macro scales by communities of place and interest depends to a certain extent on resources supplied by government agencies (at the abstract scale) applied to the process of description and definition of geographic space (such as catchment management plans, flood management mapping etc.). These activities serve as an important means of generating identity and attachment that lead to the development of bonding capital between communities of place, identity and interest. When resources are withdrawn by government, existing relations of identity with place generated by communities of identity and interest (such as government agency staff and business) dissipate and the forms of identity that are generated by each of the three sectors of community change, thus changing sense of place. Links between contexted and abstracted communities that facilitate commitment to place are broken and landscapes endure the activities of politics of interests which can result in the subjugation and subjection of communities of place. These results confirm Macnaghten and Urry's (1998) and Cheng's (2003) insights into the potential to reduce agency through intensified political imperatives of abstracted forms of knowledge and the failure to recognise symbolic meanings of identity developed through moral and historical local contexts.

All three sectors of community (place, identity and interest) develop identity in relation to the politics of agency as the politics of place and politics of interests intersect.

Attachment

The development of relations between groups over time shapes attachment (Dixon and Durrheim 2004). The strength and form of attachment reflects notions of meaning in sense of place influencing preferences and decisions in the use and management of places (Kaltenborn and Bjerke 2002). Table 3.6 shows a collation of participants' comments in relation to attachment in sense of place. The first column provides statements by participants that show how the

development of group membership constitutes and develops attachment. The second column uses quotes from people who have developed a strong attachment and demonstrates the form this attachment has taken. The third column uses quotes as visual symbols of participants' activities that develop attachments in landscapes. Both sub-catchments and genders are represented.

Table 3.6 Participants quotes showing attachment in sense of place

Attachment: The role of groups	**Form and strength of attachment**	**Landscapes of attachment**
"maybe we should be looking at kids and get them thinking the long term. Of course lots of teachers here are only here two years then gone, so the teachers aren't doing that follow-up either"	"farming for me is good. I suppose it does really because I knew how it was years ago and we used to have nice fresh water creeks and all trees along and at least now I can see we've got salt tolerant trees growing, at least the trees are back there now, it looks better"	"places {are} starting to look good…we're able to crop on the areas that we couldn't twenty years ago"
"if you had come out {here} fifteen years ago, you would have seen large salt scalds, a lot of paddocks wind blown and since then, a lot of them have been dealt with, a lot of farmers are no-tilling and its just a pretty good looking catchment"	"last year was the first time we hadn't planted any trees in fifteen years…..the trees are big enough now, you know five years and those areas are sustainable and you are repairing the land"	"I look at the bush and I love it. The birds, the trees, the agricultural landscape. What I like is the windbreaks of trees and native bush but not where there are hundreds and hundreds of acres with not a tree, not a shelter, windblown, sheep are stressed"
"its just such an enormous problem. Its just a huge battlefield out there. You see little wins that farmers have and its so exciting to see farmers just making a go of it"	"there's lots of bird life, trees, nature at work. It gives me a reward to see that lush new fenced off part of the property that preserves some of the bushland area and it's encouraging to see how it's come back to life since we kept all the grazing animals out of it, and see all the trees there"	"to keep the tax man happy with my farming development here, I call myself an apiarist. I've got about twelve beehives and that money goes into my farming business"
"I found I was getting some self-sown trees, so through the landcare centre here I got some advice and started to farm York Mallees for eucalyptus oil which I plant about five thousand every year…I get a bit of a kick out of watching things grow"	"probably what's important is where I can see that I've done some work, where I've planted trees or where I've done something"	"I like walking along the banks and we go fishing and very often the most enjoyable part of the fishing is getting a shady bank on the side of the creek"

Communities of identity maintain attachment to place through both commitments to place and acceptance and inclusion by communities of place.

In the quotes provided in Table 3.6, communities of place and interest, or identity and interest talk in abstracted terms of 'them' (the farmers) and 'us' but this is couched in relation to and in context of landscapes rather than other people. This applies equally to the use of landscapes in a recreational sense to people who often do not relate to landscapes in a more concrete commitment sense. In contrast people of place and identity (e.g. the apiarist) who are developing a sense of attachment have come to this point through the consolidation of their stewardship activities through their involvement with other people of place.

Formal and informal association through groups formed in places facilitate personal connections that drive commitment to landscapes, and are fostered by local level organisations with capacity and social capital to develop and maintain links so they become institutionalised. This 'tensile strength' mentioned by Cantrill and Senecah (2001) shows the interdependence of economic and social activities that reduces the substitutability of place that Brown *et al.* (2001) and Tall (1996) claim makes commitment in landscapes fragile and conditional. Staff in government agencies and business people in general are likely to retain community of identity links with strong emotional bonds and intrinsic connections after leaving or moving on from a place of work if they have developed an attachment through direct involvement with local communities of place through landscape management. Communities of identity and interest do not always form a relationship of attachment with place that entails commitment across the triple bottom line because the place-based work of stewardship does not extend over periods of time sufficient to develop social relationships that move sense of place from belonging to attachment and commitment. This has implications for management approaches developed by people with abstracted relationships to landscapes.

The situation of communities of place that did not develop sense of place that includes an expression of commitment is not the same as that for communities of identity and interest. There were a few farmers (communities of place and identity) who had lived in their hydrological catchment for an excess of 40 years who did not score high rates of commitment to maintaining any part of the

landscape. Reasons for this can only be drawn from brief discussion held during the delivery of questionnaires, and appears to be linked to their potential to hand over their properties to their children. Many of these farmers had invested significant amounts of time and money into innovative land management and amelioration strategies, but this was directly linked to the resale price that increases as land management practices accrue economic value.

Description of the landscape is a means of both defining and of allocating values. There was an acknowledgement of intrinsic connection in holistic values expressed by some participants. The welfare of sheep was linked to the presence of trees, and of belonging and connecting in landscapes in an active stewardship sense. Work in specific places in the landscape was an important relationship with the development of attachment in sense of place. This is in addition to Malpas' (1999) and Seddon's (1997) position that symbolic narratives and cultural constructs are an integrated part of the social ordering of physical landscapes in which sense of place becomes a socially constructed "edifice of the environmental self" (Cantrill and Senecah 2001).

Local attachment to the landscape comes through local input into issues of identification, funding provision/acquisition, project management and instigation. Values allocated in sense of place were directly correlated with amelioration intervention activities in the Katanning Zone but less so in the Condamine Headwaters. This sense of stewardship Kaltenborn and Bjerke (2002) identify as personal, collective and cultural attachment. This was found to be a significant factor in the development of attachment, and aesthetics appears through this thesis to play a strong part in developing this attachment.

Sense of place is defined by and in turn defines identity and attachment in landscapes. People develop bonds with places in the landscape and often this is in relation to other people. Attachment is consolidated through active engagement in landscapes. Farming is a distinctive agency-driven interaction, and co-operation with others confirms and consolidates values resulting both in

belonging in landscapes and belonging in communities. The interdependence of subjectivity and objectivity (Malpas 1999) thus generates a sense of place that is integrated through objective and concrete realities and the subjective judgements that develop in relation to meaning and personal value. This reality is a stark integration of post-structural admissions of the role of subjective, relative value and power (Foucault 1980) with the objective realities (Bhaskar 1978, Wasserman 2004) upon which this power is exercised.

There is clearly a mutually confirming interaction between symbolic values in landscapes and more material values. The symbolic and social sets of values in landscapes are often the means for engaging people in landscape management that in turn result in the economic values being maintained. This interaction requires ongoing attention to ensure that communities of identity and interest develop attachment and potentially commitment to place through interaction with engaged communities of place. Attachment is tangible through the social interactions between politics of place and politics of interests in landscapes. Where this interaction is developed and maintained there is an increased likelihood of maintaining resilience.

Landscape

Landscapes and natural places contribute in their own right to the development of sense of place (Kaltenborn and Bjerke 2002). Landscapes encompass the experiences that form memory and meaning in the third element in sense of place. Attachment is directly linked with the way in which elements of the landscape are valued and represented through cultural and political expression in the enactment of power. The valuing of space to become place exemplified through the first section in Table 3.7 provides an insight into how elements of the landscape are valued. Quotes from participants in the second section of this table show how memory and time contribute to the ideal, and how the ideal forms possibility. The third and fourth section of the table show how landscapes serve to represent meaning and cultural imperatives which in turn lead to specific landscape practices such as the moral ethic of landcare.

Table 3.7 The value in elements of the landscape and of sense of place

SPACES VALUED
"Mostly the remnants…" {inspire me}
"I look at the bush and love it….potential for the future" … {landscapes fixed up or cared for}… "gladden me"
"some of these are social and some are spiritual {groups}…there are two different ways of looking at it. Physical, and with the other side of things, spiritual. Its special for yourself I suppose, giving an idea of the big picture."
"basically I've got two feelings {about the landscape}. I think it is fairly good in terms of the number of trees around, but, on the other hand, if you look at some of the ridge tops that are just bare…they should have been left untouched"
{two framings of landscape: symbolic, less tangible, and economic, production linked} "in some governments it is not valued as much {aesthetic} and it is more and more important that you balance those two"
"I think probably some parts are more attractive…"{landscape that is more important than others}…"I suppose as a whole to have the place functioning well is important to me and I think if there are parts that need extra work in terms of landcare, you pick those parts and work on them, but as a general rule, I feel that the whole farm is important."
{religious persuasion influences the way you think about where you live?} "increases my commitment. There are different themes, but is part of the big picture. It's what we stand back and have a look at and how we apply it."
"its very attractive, mountains around, the flats which are normally green and interspersed with cropping with the animal farming around, and the river is important"
"the most obvious thing for me is the mountains maintaining that sort of relationship between the trees and what we've got left of remnant forest and natural habitat. The creeks are probably number one, and the riparian zone of the creeks."
"the natural remnants and forests are what I would consider the number one. A visual landscape."
MEMORY AND TIME
"around here is quite good really, just a shame that the salt sort of moved in, but as you remember it years ago, freshwater creeks" {Katanning Zone}
"just growing up from a kid and you can look down there and see all the nice green trees and that along the creek and over the years you can see them all dying and now they're all coming back again. It just sort of makes you feel better 'cause you can always look back and see what you could have done to try and stop that area" {Katanning Zone}
"the landscape is very important and it wouldn't have changed in the last fifty years" {Condamine Headwaters}
"its very ordinary country…its very poor country. When I was young and I thought I could turn the world over, but its time to move on." {Condamine Headwaters}
PLACE, MEANING AND CULTURE
"aesthetic, here you specially think of non-farming communities, where you can get a lot of external funding"
PLACES AS POLITICAL
"younger people see what is happening, they see the aesthetics are getting more important, political pressure, in terms of the numbers game that is pushing them towards {landcare}"

Aesthetics is a blend of pleasing visuals and economic productivity. A religious ethic links symbolic and material values in landscapes with productivity and the moral of land as a gift to be cared for. Participants (represented by quotes in Table 3.7) with particular religious commitment raised these perspectives explicitly as an aesthetic perspective of landscapes. Sense of place is mediated through discourses of the moment, such as aesthetics and the moral judgement of stewardship in landscapes (such as the landcare ethic), as much as of

productivity. These judgements change over time in relation to external factors and norms and belong in certain contexts. This representation of landscapes is people-centred rather than representing inherent properties of nature, as Kaltenborn (1998) found, and these perceptions act as mediation for engagement with conservation-oriented practices (Cantrill and Senecah 2001).

People relate, often nostalgically, with what a landscape used to be like and use that memory as a benchmark for what they expect it to look like and how it is going to be restored. Changes in meanings do not necessarily reflect changes in the state of the landscape (Stedman 2003) but memory and nostalgia may act to direct restoration in a situation of environmental decline. Participants' childhood memories (expressed as quotes in Table 3.7) show the strength of vision that guides reclamation of the future. This requires a commitment in both directions, to memory and the future, to be successfully integrated into commitment. There was a stark contrast between the Condamine and Katanning visions and future ideals perhaps in part resulting from the extreme decline and explicit attention in Katanning Zone that has opened a new experience and acknowledgement – the corner-turning point. This makes the relationship between time (memory) and generational difference critical in locating the tension between sustainability and viability within diverse sets of place values.

The social, symbolic and economic sets of values identified in the numerical taxonomy are of more importance at some stages of people's lives than at others. New eyes can see new solutions for old problems. Old eyes can see new problems through old solutions. Both have value in linking memory with the present and the future. While much literature has been devoted to the detail of socio-demographic change (such as aging of populations) in rural locales (Cocklin and Dibden 2005, Gray and Lawrence 2001), a focus on social diversity and the role of generational transition in place allows a re-enchantment with place through the re-integration of diverse place values and thus the potential maintenance of resilience.

The surprising and unexpected nostalgic aspect that contributed to sense of place in landscape terms, was the acknowledgement by white rural Australian participants that Indigenous communities value place. This acknowledgement has implications for a greater recognition of diversity in landscape values and confirms McIntyre-Tamwoy's (2004) comments that categories that are defined and valorised by land management 'authorities' favour a scientific expression that subjugates local agency and meaning. While not explicit in this set of participants' quotes, this perspective is explicit in Chapter Seven in the exploration of the relationship between three knowledges. Knowledge is inseparable from the explicit context of place. Relationships with place are often expressed particularly through the intrinsic symbolic expressions of attachment, in the form of perceived Indigenous forms of attachment to and knowledge of place.

While the qualitative expression of these social catchments appears to limit the range of landscape values to economic and aesthetic, the cultural dimensions are implicit and the full typology of place values were acknowledged when explicitly sought in the survey and in the GIS maps that accompanied the survey. This gives cause for concern in the silencing of some values, such as the social and symbolic that are clearly significant but not often included explicitly in landscape policy and planning in the abstracted activities of politics of interests.

Conclusions

Sense of place values direct, facilitate and constrain decision-making in landscape management. The elements and scales that comprise a conceptual model for sense of place were synthesised from theoretical and empirical literature to serve as a model for the heuristic exploration of this social dimension of landscape management. The interacting elements of identity, attachment and the landscape draw on conceptual space pairs (Figure 3.1) and develop in the spatial and temporal scales of community, knowledge and landscape to contribute to the development of a sense of place. These elements and scales capture the empirical dimensions of communities acting within landscape scales (social catchments) to effectively operationalise

empirical research. The tools necessary for an empirical exploration were given objective form in concrete expression of observable material values as well as less tangible and subjective expression of symbolic landscape values.

A transdisciplinary heuristic approach integrated the results of quantitative exploration using numerical taxonomy that exposed structure, relationships and critical variables, and qualitative approaches to draw out the less obvious non-linear relationships that structure resilience. While it is easy to assume contrasts between different community sectors in the way values frame decision-making based on intuition and observation, the results of the numerical taxonomy present definite and conclusive evidence. These varying values must be accommodated early in planning for management or change to ensure success in implementing solutions to landscape issues. In addition, the explicit acknowledgement of contrasting abstract and contexted value frames should provide the first point of discussion in any negotiations that involve social catchments (communities of place, identity and interest) involved in landscape-based management. This acknowledgement should provide the frame of reference necessary to appropriately acknowledge, integrate and represent the range of perspectives necessary for effective and successful policy implementation in landscape management. Defining a sense of place is most effective through the use of social catchment scales that accommodate the interaction of both material and symbolic values in landscapes.

Three sets of values in landscapes, the social, the symbolic and the economic, form nested place values that are not reducible from the sum of a landscape. We cannot be conclusive in a claim that economics drives decision-making in landscape management. Social and symbolic relationships with place have a significant mediating impact in the process.

On the whole, commitment to place is generated over time in place, but is explicitly mediated by expectations of the future and the development of attachment through stewardship activities. Place includes identity in community self-definition if commitment is physically engaging.

Social and symbolic values need to be considered in an integrated context with economic values allowing symbolic and intangible meaning (such as aesthetics) to mediate commitment. Communities of place and identity are more likely to express an integration of aesthetic with economic values using memory as a means to restore degraded landscapes. Communities of identity and interest are more likely to relate to landscapes in abstract contexts without reference to contexted social relationships that are binding to place through stewardship activities. This raises the issue of defining sustainability that applies in more abstract senses but might be more appropriately framed with triple bottom line concepts of viability and resilience in the local place-based context of community and knowledge.

When politics of place intersect with and integrate at the local scale with politics of interests, then an integrated and developed sense of place reflects both attachment and belonging across a social catchment. Landscapes and sense of place have a process orientation. People develop sense of place in a process that integrates values, events and results. It is dynamic.

The critical vectors exposed through the numerical taxonomy showed distinct contrasts in both catchments for commitment to the maintenance of landscape values. People working in different industry and occupation sectors, and differentiated by community identity valued elements in the landscapes reflecting the contrast between abstracted (communities of place and interest) and contexted (communities of place and identity) sense of place (Figure 3.9, 3.10 and 3.11). In contemporary policy approaches that advocate devolution of funds to regional bodies that include local scale input, these differences have the potential to cause significant conflict. Adaptive management processes (Lee 1992, 1993, 1999) require interaction and integration that transcend the simple solutions that have limited potential in implementation. The social dimensions of landscape management form only part of a complex and dynamic system, but are a critical consideration in implementing solutions in rural, agricultural landscapes.

The concept of sense of place provides an important insight into the diverse ways in which values and meanings are articulated and negotiated, but that are often silenced in the decision-making process in natural resource management (Cheng *et al.* 2003). If we are to be successful in fostering broader participation, sense of place is important. According to Seddon (1997):

> although it cannot provide a clinching argument, the concept of sense of place can at least help to stimulate reflection about the nature of both the cultural and physical context (p. 141).

Sense of place provides an insight into the thematic elements (social, symbolic and economic landscape value sets) that contribute to perceptions of the local social and natural landscapes. The thematic tools provided through sense of place provide symbolic tools for restoration and viable management with a minimum of resistance from communities of place and identity that comprise the civic community that is active in implementing decisions in landscape management in these social catchments.

Linking sense of place with social capital, and discourses of the environment

Sense of place and elements and scales that comprise sense of place can be those factors that locate as different and indicate the divisions between communities of place, identity and interest that make up a social catchment. Brown *et al.* (2001) contend that a positive sense of place, defined by value, is only partly sufficient as a condition for strong attachment to place and must be complemented by community social capital. According to Cantrill and Senecah (2001), social relationships and personal experiences tend to connect people to a place often more strongly than relationships to the actual environment, making sense of place a reflection of preferences located through the discourses of that place.

The social identities that arise out of local settings are predictable and stable only if the local patterns of discourse support the associated view of that identity. Cantrill and Senecah (2001) claim that “symbolic transformations of the natural world into interpretive contexts for environmental policy and personal

action play a pivotal role in environmental advocacy" (p. 186). Links may be identified through the meanings and values assigned in local landscapes, and through the collective agreements about such meanings that are negotiated and renegotiated in frameworks of environmental discourse. Eisenhauer *et al.* (2000) go on to contend that cultural networks of beliefs that underpin understandings of the environment define, constrain and embed communities to place.

These positions contend that in order to establish a clear understanding of the factors that result in a sense of place through which people show a commitment to the landscapes they are connected to, it is necessary to understand both the social capital that supports relationships with place and the discourses that define and constrain practices in the landscape.

4

Social Capital

Introduction

Social capital is frequently referred to as the glue that holds society together (World Bank 1998, Stone and Hughes 2002, Productivity Commission 2003). In making use of a complex systems framework to integrate this concept into a broader framing of people's relationships with the landscapes in which they live, I distinguish social capital as an interactive force that shows dynamic characteristics. Social capital is a process that reflects innovation, adoption, consolidation and stagnation followed by cyclic renewal through innovation (Holling 2001). In addition, social capital has a range of coupling forms in which individuals, communities and society are linked (Marion 1999). The characteristics of social capital can move from one phase of a complex adaptive cycle to another showing conservative, hierarchical and consolidative characteristics of social capital alternately with creative and horizontal bridging forms.

A complex systems framework provides an alternate defining of social capital that potentially includes simultaneously both hierarchical and horizontal (bridging and bonding) forms of social capital rather than a linearly oriented spiral. A key to exploring social capital through the adaptive cycle perspective (Holling 2001) requires consideration of temporal and spatial scale in the strategies for including people and defining the boundaries of a social catchment. Social capital can provide an insight into the parameters in which adaptive capacity and the ability to self-organise comprise the emergent characteristics of resilient rural agricultural social systems.

So, rather than glue, which implies a static and fixed state, the form and process of social capital is a dynamic force that interacts with other social dimensions forming, maintaining, and re-configuring a set of emergent characteristics that structure the relationships people have with the landscapes in which they live. These socio-ecological systems are comprised of interacting social and ecological components that are resilient in the face of perturbation.[20, 21]

This conceptualisation of social capital places an emphasis on relationships and values as factors that might explain dynamic structures and adaptive behaviour (Field 2003). The approach used in this thesis explores examples of social capital at different phases in this complex adaptive cycle as evidence of this proposition. Social capital, as an intrinsic and intangible resource, needs to be framed within a process orientation to capture the outputs as implications and

[20] Perturbation: a force of disturbance in a system that impacts on the usual functioning within phase state parameters. This might be any event that could force change. Change is dramatic if it results in a phase state shift or less dramatic if the system is resilient enough to absorb the change and continue functioning within the pre-existing parameters of the phase state. Parameters of phase space describe "the fluctuation of a system whose concentration of constituent variables is not altered by outside forces" (Marion, R. (1999). *The Edge of Organization. Chaos and Complexity Theories of Formal Social Systems*, London: Sage p. 18).

[21] *Complex systems* theory includes the notion of slow and fast variables that contribute dynamically to maintaining resilience in systems. Resilience is achieved when a system is able to self-organise following perturbation through memory that allows adaptation. These systems can be identified through emergent characteristics that are not exhibited by individual agents but comprise a unique entity created by non-linear interactions (Marion, R. (1999). *The Edge of Organization. Chaos and Complexity Theories of Formal Social Systems*, London: Sage; Holling, C.S. (2001). "Understanding the Complexity of Economic, Ecological, and Social Systems", *Ecosystems*, 4: 390 - 405).

impacts, rather than describing the content which might limit the exploration of the concept to cause and effect (Midgley 2000).

The concept of social capital is used by a diverse range of disciplines for an equally diverse intent. The concept has evolved out of a broader conceptual framework of capital and may be distinguished from natural, physical, human, cultural and economic capital. Early exploration of the concept was free ranging between metaphorical and tangible representations. Over time a theoretical boundary in relation to the other capitals has developed. This indicates an inter-relationship between the various forms of capital and the way in which these forms of capital accumulate (Schuller *et al.* 2000).

Understanding the way social capital is formed, maintained and re-configured goes some way to explaining why "the same amount of economic and cultural capital can yield different degrees of profit, and different powers of influence to different actors" (Siisiäinen 2003 p. 190). Social capital forms a critical "multiplication effect" on the other forms of capital (Siisiäinen 2003). Some forms of social capital may reduce transaction costs in other forms of capital. By locating social capital within this broader framework of capital, it becomes possible to specifically explore the importance of symbolic forms of capital and of 'non-monetary' forms of power and influence (Portes 1998, Siisiäinen 2003). In this way the intangible resources of community, the shared values and trust that support collective action in daily life affecting the outcomes of social behaviour, are integrated into the broader conceptual framework of capital (Field 2003, Ostrom and Ahn 2003).

Social capital plays an important role in determining access to the resources required in situations where diverse issues challenge society's capacity and will in problem solving. The concept of social capital provides a heuristic device to explore theoretical components of capacity and will in society. The outcomes of social capital give tangible form to discussions about the process and application of social capital (Portes 1998, Field 2003).

While a sense of place gives an indication of the range of values that frame relationships and commitments to landscapes, this understanding hinges

heavily upon the social relationships people have with one another within these places. Social capital forms an explicit component of a complex and adaptive linked social-ecological landscape system. In order to develop, social capital shares with sense of place a requirement for context or shared locality (Lacy 2000). A focus on social relationships contributes to an understanding of the way in which people act within landscapes. These social relationships are formed and made explicit through the development, maintenance and re-configuration of social capital. Individuals relate to one another at a range of scales within these two Australian landscapes to form a set of characteristics that may not be accurately measured by simply summing the responses of individuals (Woolcock 1998).

This chapter aimed to identify the way in which social capital supports, maintains and reconfigures social values. These values direct, facilitate and constrain the decisions made in individual and collective action in landscape management. Social capital was explored through the following research questions:

- What elements and scales are considered in theoretical and applied literature to comprise the concept of social capital?
- What are the institutional forms and social scales at which social capital facilitates decision-making in landscape management?
- What forms of social relationships operate across and within scales of decision-making in social catchments?
- What social capital variables can be identified as emergent characteristics?
- What social capital processes can be identified through the quantitative and qualitative inquiries?

This chapter explores the origins and contemporary form of social capital through the theoretical literature and draws on the results of empirical studies to construct a conceptual model (Section One). This model forms the basis for

empirical[22] heuristic assessment of social capital, first through a survey-based quantitative analysis (Section Two), and then through an in-depth interview-based qualitative study (Section Three). The discussion draws on direct quotes to identify form and function of social capital. The results, interview quotes, discussion and conclusions provide an insight into the social relationships that frame sense of place and set the social bounds to explore the prescriptive norms of environmental discourse that delimit decision-making in landscape management. The results of this inquiry into social capital will reveal the discrete emergent characteristics that comprise the processes maintaining resilience in these systems.

Section one: Development of conceptual model

A short history of social capital

The contemporary understanding of and term for social capital was generally identified by Jane Jacobs, Pierre Bourdieu and Jean-Claude Passeron and is generally attributed to Glenn Loury from the late 1970s. Pierre Bourdieu (1986) provided the first systematic analysis of social capital that he defined as:

> the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalised relationships of mutual acquaintance or recognition (p. 248).

While this is widely believed to be the first explicit portrayal of this form of capital, the theoretical origins, according to Wall *et al.* (1998) can be traced to nineteenth century scholars. According to Woolcock (1998) the early intellectual history of capital that included norms of cooperation as a necessary part of physical and economic capital can be traced back to the Scottish Enlightenment. These early descriptions of social capital equated with wealth and economic forms of capital that were used for further generation of wealth. Contemporary frameworks of social capital encompass inquiries into the mobilisation of economic, political, cultural and social resources in an effort to

[22] Empirical: "an empirical statement or theory is one which can be tested by some kind of evidence drawn from experience" (Abercrombie, N., Hill, S., and Turner, B.S. (1994). *Dictionary of Sociology*, London: Penguin, p. 142). In this case, empirical evidence is drawn from the experiences within the *social* catchments in the study through both quantitative and qualitative inquiry.

understand social cohesion and integration (Wall 1998) in addition to and bounded by natural, physical and human capital.

Three contemporary theorists are recognised as contributing to theory and knowledge about social capital. Bourdieu (1985) places an emphasis on strategies for maintaining or changing positions in social hierarchies while Coleman (1988) links economic rationality with human capital. Putnam *et al.* (1993) investigate a broader scale in this seminal work in Italy to make connections between social capital and civic responsibility.

Social capital is the transformation of human interactions and social networks to incorporate resources that cannot exist outside the broader social context of community. The process of social capital plays a functional role in outcomes that are important for individuals and social groups at a range of scales and are likely to interact with and re-configure prescriptive frameworks of practice (Wall 1998).

A framework of capitals: placing the social

Bourdieu (1986) differentiates three forms of capital presented in three fundamental guises. Economic capital is convertible into money and institutionalised in the form of property rights. Cultural capital develops within the family sphere and is built upon by human capital to form a non-economic means of acquiring qualifications, employment and status. This form of capital is sometimes convertible into economic and may be institutionalised. Social capital is comprised of social obligations and connections that may be converted into economic capital. Social capital is frequently expressed through and relies on the dominant Western discourse of capitalist economics for its metaphoric power (Farr 2004).

Flora and Flora (1996) differentiated capital further to classify three concrete forms of capital from social capital. The first of which encompasses water, soil, forests, biodiversity and scenery as environmental capital. This differentiates between environmental capital that holds material value and natural capital with symbolic value (Flora and Flora 1996). According to Pretty and Ward (2001) natural capital is partially a public good and rarely has a market value.

The second form of capital is physical capital (Flora and Flora 1996) that includes physical infrastructure, financial capital, tools and equipment that might form as an outcome of social capital. The third is human capital that is specifically defined to include individual human skills, ability, experience, training and knowledge (Bullock and Trombley 2000). This form of capital reflects and consolidates to a large extent the social and cultural capital of the family of origin.

Social capital as a form of capital is a collective resource derived through some form of group membership (formal or informal association in family, community or society) and can result in differences in the control of social capital thus yielding different degrees of profit and different powers of influence to individuals. Social capital through the symbolic expression of capital is a perception arising from internalisation through introjection [23]. It can have a 'multiplication effect' with positive or negative influence on other forms of capital. This symbolic capital depends on practice and communication to be effective and exists and grows only in 'intersubjective reflection'[24] (Siisiäinen 2003 p. 193).

Symbolic capital assumes an ideological function that defines the legitimate basis of social position and cannot be institutionalised, objectified or incorporated. Symbolic capital conceals the arbitrary distribution of other forms of capital amongst individuals in society through the allocation of legitimacy and social position (Siisiäinen 2003). Symbolic power is used by the *status quo* to make explicit the implicit values of a position (converting knowledge to truth and influence to power) and thus transforming from potential to actual. Actors in this

[23] Introjection is a "primitive and early unconscious psychic process by which an external object or individual is represented by an image which in turn is incorporated into a psychic apparatus of someone else" (Macquarie, L.P.L. (1981). *The Macquarie dictionary*, Sydney: Macqurie University, p. 931). Loosely, introjection is an imposition and internalisation (both conscious and unconscious) of a concept or image through cultural norms and values, which is then incorporated as 'truth' and regarded as normal.

[24] Intersubjective: In which meaning is negotiated and created through an active process through language and actions. It is a local cultural creation of interpretation and negotiation between players to reach consensus on meaning (Bullock, A., and Trombley, S. (2000).The New Fontana Dictionary of Modern Thought, London: Harper Collins Publishers, Abercrombie, N., Hill, S., and Turner, B.S. (1994). *Dictionary of Sociology*, London: Penguin).

negotiation of power form and represent voluntary associations and thus embody the differentiation between the *status quo*, subjugated and subject groups[25]. Social capital forms part of the enactment of power and the distribution of sectoral interest within a conceptual framework of conflict.

Social and cultural capital are thus expressed and enacted through symbolic capital and differentiated from human, natural, physical and economic capital.

Disciplinary contexts for social capital

Social capital is used by a range of disciplines and is referred to in the literatures of sociology, economics, political economy, political science and anthropology (Productivity Commission 2003). According to Woolcock (1998) this forms seven distinct fields including social theory and economic development, family and youth, education, community life, work and organisations, governance and "general cases of problems of collective action" (p. 196). This diversity of use has emerged as a result of a lack of acknowledgement and inquiry into the influence of norms and institutions in explaining economic life in the nineteenth century. The consequences are a subsequent divide in the literature between two approaches to explaining and exploring social capital: the utilitarian, the political economic approach and a sociological approach (Woolcock 1998). The emphasis of this thesis is within a sociological framing that has a focus on the analysis of the social determinants of human motivation and the features of social organisation that include social networks, norms of reciprocity and practices of exchange, and relations of trust in social life (Field 2003).

This sociological approach inquires beyond the economic aggregations of cooperation based on self-interested individual processes of decision-making to focus on the social components of community and society and includes a broad range of interacting scales and contexts (Fine and Green 2000).

[25] Guattari (2000) identifies three collective players in the enactment of power. S*tatus quo* groups that impose power lead to the development of *subjugated* groups who have a collective form of expression as a result of this external force. The third, *Subject* groups, develop around a collective form of commonality that arises through reaction to other groups (Guattari, F. (2000). *The Three Ecologies*, London: The Athlone Press).

Broad definitions of social capital

As a consequence of the diverse uses and framings to which social capital has been applied, a broad range of contesting definitions have developed. Social capital is embedded in social structure and theoretical consensus considers the core conceptualisation to be the personal connections and interpersonal interactions based on shared norms and values (Woolcock 1998, Field 2003). Social capital "expresses the sociological essence of communal vitality" (p. 185) and represents "social resources, capacities or potentialities" (Siisiäinen 2003 p. 184). In short, social capital is seen as a resource that facilitates cooperation between groups of people that might involve family and friends, formal and informal associations within communities, and formal and informal institutions such as professional, religious, political and educational groups. Critical definitions of social capital include notions of values, social networks and outputs. [26]

Social capital has outputs that may be physical in the form of tangible infrastructure, or enduring social systems that facilitate particular practices in response to issues in communities and society. These outputs may be achieved with a minimum of repetition and negotiation if facilitated through social capital. Social capital is recognisable as either form or outcome through the connectedness of social networks and groups, norms of reciprocity and practices of exchange embodied in everyday social practice, and relations of trust (Pretty and Ward 2001). Social capital results from a dynamic process that operates through social networks based on norms of reciprocity that ensue from practices of exchange and depend on relations of trust.

The roots of social capital

Early theorists explored practices and developed theories of social interaction that have been combined by contemporary researchers into the concept of social capital. While it is possible to understand in a general way each of the

[26] Critical: about questioning the assumptions on which 'common-sense knowledge' that manifest through social phenomena are based. This approach emphases the role of power, assumes a degree of inequality and expects that praxis should be linked to research. The notion of value-free research is rejected in this approach (Bullock, A., and Trombley, S. (2000). The New Fontana Dictionary of Modern Thought, London: Harper Collins Publishers).

three interacting and interdependent elements (1: social networks, 2: norms of reciprocity and practices of exchange, and 3: relations of trust) of the process that leads to the generation, maintenance and re-configuration of social capital, it is important to explore the theoretical definitions that define each distinct element. Woolcock (1998) points out that the limited critical attention given to the ontological status, conceptual and intellectual history of social capital can result in weak theoretical and empirical claims. He calls for modest empirical expectations and resultant theoretical claims.

Wall, Ferrazzi and Schryer (1998) outline their portrayal of social capital as emerging from four central roots. The first root of "value introjection" includes Durkheim's notion of a moral order that forms the basis of economic transaction (Durkheim 1984) and Weber's vocational sense of duty and obligation reflected in the context of professional activity (Weber 1947).

The second root is based on Weber's notions of enforceable trust (Portes and Landoldt 2000). This element of social capital makes the distinction between formal and substantive rationality[27] and looks at motivations to override individual desire in favour of collective interests in which short-term sacrifices will provide long-term advantage to both individual and community.

The third root outlined by Wall, Ferrazzi and Schryer (1998) is derived from reciprocity transactions explored and developed by Simmel and the Exchange theorists. They emphasise the utilitarian nature of social transactions that may augment social positions and lead to improvements in economic circumstance (Simmel and Wolff 1964, Simmel 1978, Ritzer 1996).

The final root stems from Marx and Engels' descriptions of class and the development of class-consciousness in response to external powers or threats (Ritzer 1996,)Wall 1998).

[27] Rationality: about understanding people's reasons for action based on the relationship with desires and beliefs. This position in comparative sociology is informed by and delimited by the notion of irrationality (Bullock, A., and Trombley, S. (2000). The New Fontana Dictionary of Modern Thought, London: Harper Collins Publishers, Abercrombie, N., Hill, S., and Turner, B.S. (1994). *Dictionary of Sociology*, London: Penguin).

Each of the three theoretical elements (1: social networks, 2: norms of reciprocity and practices of exchange, and 3: relations of trust) of social capital provide a distinct operationalisation to expose both form and output of social capital in each catchment community. Not only do these theoretical elements of social capital interact but the sum of their parts provides the form by which the process of social capital operates. Each of the three elements of social capital: connectedness of social networks; norms of reciprocity and practices of exchange; and relations of trust will be discussed conceptually. This will define social capital as the social relations that distinguish people's relationships with landscapes, contributing to a sense of place.

The elements of social capital

Social networks

Social networks are systems of personal relationships that evolve into discrete groups and expose patterns of communication in society. The groups that comprise membership of social networks usually have something in common and operate with their own sets of social norms and levels of obligation (Abercrombie *et al.* 1994, Productivity Commission 2003). These networks expose the structure of social reality at the micro, meso and macro scales corresponding with the ties that form between individuals, groups and institutions (Ritzer 1996, Field 2003).

Exploring social networks provides a focus on the patterns of ties that link members of society. These social processes are more than the sum of the attributes of individuals and provide an insight into the regularities in how people and groups behave. The dynamic of power is evident in the activities within social networks and can change the dependence relationships in norms of reciprocity. Activity within networks is thus a function both of actors pursuing their interests and of the constraint applied by the norms in social structure (Ritzer 1996).

Social networks enable cooperation between people at the micro scale and with other groups at meso and macro scales. At the micro scale action is embedded in concrete personal relations and structures of relations. Network members have varying access to resources. At the macro scale, systems are structured with some components dependent on others in a stratified form (Ritzer 1996). Stone and Hughes (2002) discuss three forms of networks that reflect the operation of trust and reciprocity at three scales. At the micro scale, informal ties build relationships between family members, close friends and neighbours. At the meso scale, generalised trust and reciprocity enables links and networks between local people and civic groups to form generalised relationships. At the macro scale, trust in institutions characterises networks formed through relations with institutional systems and ties to power in institutional relationships. This provides the basis for social cohesion in which people collaborate with people they know personally at micro and meso scales, but also with people they do not know directly at macro scales (Field 2003).

Social networks are formed through links between individuals, group members and groups. These links form ties that are usually symmetrical in content and intensity, forming boundaries to clusters in social networks and differentiating transitive social networks. The differential distribution of resources available across a social network results in the dynamic interaction of coalition and conflict between individuals, within groups and between groups. These ties are embedded in the structure of larger networks providing criteria for the context of exploration and analysis (Ritzer 1996).

The relational ties between network members provide for the transfer of currency within networks. These relational ties may be based on transactions; communication; instrumental relations; sentiment; authority or power; and kinship (Schuller *et al.* 2000). Social networks are facilitated through horizontal and vertical links. Horizontal networks are based on and result in reciprocity and cooperation and vertical relationships based on authority may initiate dependency (Rice 2001).

Social networks are dynamic in the informal and semi-formal linkages between individuals and groups and when dealing with culture or agency[28]. Networks tend towards static in formal organisations and institutions showing less flexibility indicating systemic stability (slow variables) that define the parameters of resilience. Network form and character is a key factor in decision-making within formal and informal linkages between individuals and groups (Moon 2001).

Social networks are activated and mobilised in a differentiated and selective manner depending on:

- the type of social capital available;
- the currency/ resources available;
- the relationships between the network members;
- the norms and culture of groups;
- and, the identities of the individuals concerned (Field 2003).

Networks are dense or sparse depending on how individuals are linked to one another. This decides the level of social support, access to information and range of opportunities available to network members (Productivity Commission 2003). Network characteristics may be differentiated by size and extensiveness depending on the number of informal ties; the density of links between members in a network and the cultural and educational diversity of network members (Stone and Hughes 2002).

While most elements of social capital are intangible, overlapping and cross-cutting, networks that provide social infrastructure in human relationships are concrete and observable (Rice 2001). Social networks are systems of personal relationships that evolve into associations of people that expose patterns of communication in society. Social cohesion results from relational ties formed through the activation and mobilisation of horizontal and vertical links. These social networks are constrained by the norms of reciprocity in social relationships of either coalition or conflict operating within formal and informal

[28] Agency: when an individual acts or exerts power which produces effects (Macquarie, L.P.L. (1981). *The Macquarie Dictionary*, Sydney: Macquarie University).

institutions at micro, meso and macro scales. The connectedness of networks depends on relations of trust for explanation.

Norms of reciprocity and practices of exchange

Notions of reciprocity and practices of exchange comprise the norms that are considered important in social capital. Related concepts include role, social order, value and institutions.

Norms are identified as conventions in behaviour and standards of value that are expected and established as forms of social behaviour comprised of sets of implicit social rules (Bullock and Trombley 2000). These social rules exist independently of individuals and emerge through either general consensus or through the coercive influence of sanctions. Though not necessarily actual behaviour, these common guidelines for social behaviour are prescriptions for social action that are rule-governed and reflect the presence of legitimacy and consent. People acquire norms through the internalisation[29] and socialisation[30] of certain values that set the expectations for mutual obligation between group members (Abercrombie *et al.* 1994, Productivity Commission 2003).

Norms are valuable for coordinating the processes of exchange and they reduce the transaction costs normally incurred in formal procedures. Norms can provide an informal complement to laws, legal process and enforcement and may facilitate more predictable and beneficial behaviour patterns. Norms are the cultural parameters and normative standards formed through patterns of procedure. These procedural patterns are prescribed through actions and relationships with other group members to ensure individual action is within general behavioural boundaries (Moon 2001, Field 2003). These relationships are based on the notions of reciprocity which form the social interaction

[29] Internalisation: ”the process whereby an individual learns and comes to regard as binding the values and norms of his *social* group, or of the wider society as a whole” (Bullock, A., and Trombley, S. (2000). The New Fontana Dictionary of Modern Thought, London: Harper Collins Publishers p. 439).

[30] Socialisation: the process by which social rules are self-imposed through the need to conform and through adopting certain norms to gain acceptance and status in the eyes of others (Abercrombie, N., Hill, S., and Turner, B.S. (1994). *Dictionary of Sociology*, London: Penguin p. 394).

between individuals that are enacted through practices of exchange (Abercrombie *et al.* 1994).

Exchange forms the binding nature of the principle of reciprocity and establishes the social relationships between people. Exchange forms the basis for social solidarity in which both goods and services are currency (Bullock and Trombley 2000). Norms of reciprocity are formed through exchanges that are either specific (or particular) in relationship and expectation, or generalised in anticipation of expected behaviour (Productivity Commission 2003). Exchange theory has evolved out of the intellectual influences of behaviouralism and rational choice theory. Two approaches differentiate between an individual behavioural emphasis and the interdependent interests generated in the socialisation process. The first approach is atomistic with application primarily in micro scales and is applied generally at the individual level using a behavioural emphasis. This assumes that people evaluate potential actions independently and without reference to others. The second approach is normative and applies generally to macro scales with a systemic emphasis. This approach assumes that actors have interdependent interests and that social norms are generated in the act of interactive socialisation (Burt 1992, Ritzer 1996).

An integrated form of theories of exchange extends the atomistic approach and restricts the normative aspects of the systemic approach. Actors evaluate alternative actions in relation to the conditions others set as well as the personal conditions in which they act. Theories of exchange are generated within and across the three scales in which social capital operates (micro, meso and macro) and overlaps with network theory (Ritzer 1996).

In practice, norms of reciprocity and practices of exchange operate as a function of a network with both coercion and cooperation contributing (Siisiäinen 2003). Coercion has two main forms. The first, active coercion subjugates individuals through physical force. The power and force of the state or appropriate office bearers are accorded legitimacy. The second, situational coercion depends on individual acceptance of situational circumstances and the structure of society, or social norms (Abercrombie *et al.* 1994). Cooperation

reflects the dynamic characteristics of collaborative interaction and complexity in the non-linear relationships derived through networks (Schuller *et al.* 2000).

Compliance within these relationships of reciprocity is achieved through internal psychological sanctions such as guilt, external sanctions that include shaming and ostracism, and physical sanctions or threats (Productivity Commission 2003). These forms of compliance correlate with distinct approaches used to explain order and cohesion in society. The utilitarian approach is influential in exchange theory and is explained through interdependence in which the self-interest is the imperative of all individuals to maintain social order. The cultural approach places an emphasis on the role of shared norms and values. The third approach emphasises the role of power and domination in the enforcement of order through military, judicial, spiritual and economic means (Abercrombie *et al.* 1994).

Norms of reciprocity are based on social rules and expectations derived through practices of exchange. These social relationships evolve through interaction of atomistic and normative conditions with both coercion and co-operation functioning in a power dynamic. Norms of reciprocity and practices of exchange represent social relationships that overlap with the connectedness of social networks and depend for their explanation on relations of trust.

Relations of trust

The notion of trust reflects multi-scale interactions between individuals and institutions (Schuller *et al.* 2000). Trust is often considered either a pre-requisite for the development of social capital or an outcome of social capital (Fukuyama 1995, Woolcock 1998, Field 2003). In either perspective, trust is an integral element of any consideration of the process, ideas and practices of social capital.

Trusting relationships are multi-dimensional, resting on mutual affection as well as instrumental[31] reciprocity. Gaining access to certain social networks is dependent on trust and is not necessarily a consequence of shared norms and strong networks. Trust is increased with repetition and the density of acquaintanceship (Portes 1998, Field 2003). Trust is dynamic with re-enforcing characteristics so that trust evokes increased trust, and distrust may evoke more distrust thus becoming a defining characteristic of a system (Schuller *et al.* 2000).

Two differing forms of trust lead to differing concepts of 'the other'[32]. The first form, moral trust, operates beyond the rational calculation of interest with security as the intent. This form of trust reinforces institutions of mutual exchange. This is based on and results in exchange trust norms that compete in situations of perceived scarcity. The second form, organic trust, is based on notions of tolerance and humanism with harmony as an intention. This form of trust reinforces institutions of social cohesion. The integration of group and social identity is an outcome (Entrikin 2003). These two forms of trust (moral and organic trust) loosely correlate with notions of specific and generalised norms of reciprocity.

Trust relates to the perception of trustworthiness of and between individuals, groups and institutions. It is the intrinsic element of most personal relationships and facilitates interactions on a day-to-day basis as well as playing an important role in the activities of related capitals (Productivity Commission 2003). In order to trust, people need to have some previous knowledge and trust of one another, either directly or indirectly and expect that if they co-operate then they will not be exploited or defrauded. To achieve trust as an outcome there is a requirement for communication of information, influence and confirmation

[31] Instrumental: indicates the explicit and rational intent of individual agency in a functional sense.

[32] 'The Other' is "the perceiving, conscious, meaning-conferring other person who helps, or forces, the conscious subject to define his own world-picture and view of his place in it" (Bullock, A., and Trombley, S. (2000). The New Fontana Dictionary of Modern Thought, London: Harper Collins Publishers p. 620).

regarding reputation for trustworthiness which is followed up with the reinforcement and repetition of reciprocal actions (Field 2003).

The increase in the 'radius of trust' correlates with an increase in positive externalities and benign characteristics (Fukuyama 1995). Trust can be differentiated as either particularised or generalised trust. Particularised trust is evident in personal relations formed over a period of interaction and shows robust and resilient characteristics in the face of perturbation. Generalised trust arises with confidence in a known social structure in which it becomes possible to rely on strangers and previously unencountered institutions or organisations. This becomes the basis for reciprocity that reaches beyond the short-term interests of reciprocation between individuals or specific groups (Pretty and Ward 2001, Field 2003, Productivity Commission 2003).

Trust is often in expectation that action will be rewarded in positive and reciprocal reaction at some time in the future. The development of trust is necessary when people are not able to anticipate the reactions of individuals they do not know so choices made at the micro level produce norms and expectations of reciprocity and trust at other scales. So, trust as an action at the micro scale becomes a non-intended consequence for social capital at meso and macro scales. This integrates values developed at the micro scale with more generalised values in other scales. This forms the basis for social consensus and the legitimation of modern societies that are founded on trust of authority and government at a generalised level (Siisiäinen 2003).

The utility of trust is important for civil society and is effective in the maintenance of democracy if enculturated[33] within a society. A necessary additional association is institutionalised[34] distrust which provides the checks

[33] Enculturation is the process by which individuals are educated in the broadest sense to have the culture appropriate to their society's culture (Bullock, A., and Trombley, S. (2000). The New Fontana Dictionary of Modern Thought, London: Harper Collins Publishers).

[34] Institutionalisation results when social practices are practiced on a sufficiently regular and continuous basis to be described as institutions (eg. spiritual practice forms religious institution/ practices in teaching children form educational institution). Institutions can be evident in both practices and physical entities (Abercrombie, N., Hill, S., and Turner, B.S. (1994). *Dictionary of Sociology*, London: Penguin).

and balances that maintain trust in institutions (Entrikin 2003). This dynamic of trust and distrust at different scales maintains system resilience and facilitates re-organisation and re-configuration to minimise the negative or phase[35] changing impacts of perturbation in democratic social systems. The tensions between particular and generalised trust exemplify the tensions between concrete and abstract in sense of place.

The dynamic in relationships between individuals, community and society is a key to an awareness and understanding of the interactions of power in shaping relations of trust. Trust is enacted in vertical and horizontal relations in a tension between solidarity and self-interested individualism (normative and atomistic conditions). Relations may be based on interdependence, communication, supervision or authority (Schuller *et al.* 2000). Trust is a key to understanding which of these take primacy and in specific expectations of a relationship in the development, maintenance or re-configuration of social capital.

The relationships between these three elements of social capital (social networks, norms of reciprocity and practices of exchange, and relations of trust) are dynamic and are re-configured regularly within a set of structuring and patterned characteristics that maintain the resilience in these non-linear adaptive social systems.

Bonding and bridging social capital

Social networks, norms of reciprocity, practices of exchange, and relations of trust combine and integrate to facilitate two distinctive forms of social capital depending on social scale, density of relationships and diversity of membership. The first, bonding social capital is formed in relatively homogenous groups. Bonding social capital is more particularist in interest and not always of voluntary association but sometimes due to association through coercion, expectation or obligation. This form of social capital draws on and sometimes relies on vertical links associated with authoritative relationships to solve issues.

[35] Phase space describes "the fluctuation of a system whose concentration of constituent variables is not altered by outside forces" (Marion, R. (1999). *The Edge of Organization. Chaos and Complexity Theories of Formal Social Systems.* London: Sage p. 18).

While bonding capital reinforces identity through the mobilisation of solidarity, the prescriptive norms can limit social linkages beyond the network (Schuller *et al.* 2000, Heffron 2001). This form of social capital is useful in the consolidative phases of the social capital cycle, but in the face of perturbation does not provide adequate access to creative insights and innovation necessary in adaptive response.

The second, bridging social capital tends to operate with weak links and depends on individual ability to cooperate with diverse people and groups with less of an emphasis on shared norms and values. These links draw on horizontal relationships to gain broad and somewhat egalitarian solutions to issues. Bridging social capital allows for a greater leverage of resources through the more expansive norms (Woolcock 1998, Schuller *et al.* 2000, Heffron 2001), but it can be temporary and contingent if not followed up with or complemented by bonding capital. Bridging social capital is useful when issues need creative solutions in communities. It provides creative and innovative options in dealing with perturbation in social systems.

Both bridging and bonding social capital are necessary to maintain resilience in social systems. Weak links in networks allow sufficient experimentation with new ideas to allow adaptive responses to perturbation and thus maintain and re-configure social systems, but without impacting too quickly across the whole system if experimentation fails. Strong links provide sustained resources and stability often through macro scale institutions that maintain system functioning with enough internal diversity to allow bridging social capital to develop new ideas that can be integrated in order to maintain system resilience. A fit system has tightly coupled networks that are contained and constrained by more stable loosely coupled systems (Marion 1999).

A further consideration in the process of social capital is temporal scale. Bonding social capital consists of processes that are evident at macro, or formal institutional scales, as well as informal institutions that operate to maintain social functioning at micro scales. At both scales, bonding capital serves to slow the impact of change and thus provide stability through the slowly changing

variables in a system. The institutions of family relationships such as gendered roles at the micro scale, and political institutions that govern processes of social inclusion in macro scale decision-making are examples of slow variables that are often based on bonding social capital. Bridging social capital may generally be found in systems variables that are able to react more flexibly as fast variables. Fast variables may be found in meso scale social capital structures such as interest groups (sporting associations, research networks and social groups) that have a formal structure with high degrees of informal interaction. Generally, fast variables are innovative and experimental but are constrained by the slow variables that maintain phase state parameters and resilience. Thus, the dynamic between bonding and bridging capital ensures sufficient change within a system to allow adaptive response to perturbation, but not so much as to either shift the phase state, or force collapse through the impact of failure or stagnation.

Social capital represents dynamic social relationships in a linked socio-ecological system. These social relationships form the important but contested basis for empirical assessments of social capital. Though relatively recent, the body of empirical work that provides insight into the outcomes and implications of the interactive and adaptive process that generates social capital draws on the direction provided by three key researchers in this field.

How is social capital used? Three contemporary theorists

Three contemporary theorists are recognised as informing current definition and use of social capital. Bourdieu (1985) places an emphasis on strategies for maintaining or changing positions in social hierarchies while Coleman (1988) links economic rationality with human capital. Putnam *et al.* (1993) investigate a broader scale through research in Italy to make connections between social capital and civic responsibility. These theorists have conducted empirical research into social capital and have tested a range of constructs that require accommodation in a conceptual model for social capital.

Bourdieu

Bourdieu (1985), through an emphasis on the individual and familial scales, portrays social capital as part of a general science of the economy of practices comprised of social, economic and cultural capital. This approach to social capital shows a concern with questions of inequality in access to resources and explicitly positions power and conflict as significant in the process and outcomes (Field 2003).

Bourdieu's portrayal is argued to be the most theoretically refined within contemporary sociological discourse (Portes 1998). Bourdieu's position argues that social capital entails the creation of group boundaries through the exchange of things and symbols within a discrete membership (Wall, Ferrazzi and Schryer 1998, Bourdieu 1986). Material structure and cognitive form mediates through symbolic templates of practice ('habitus') within social space (Lechte 1994, Flora 1998). This instrumental agency focuses on the benefits that accrue to individuals through the participation in groups and deliberate creation of the resource of social capital through sociability (Portes 1998). This can generate both cohesion and conflict within social groups (Flora 1998).

Bourdieu uses Weber's (1947) common traits of class and status attained through lifestyle, taste and attitude as the means by which a sense of belonging is forged. Though Marx's depiction of social life as competition between economic classes correlates, Bourdieu focuses on the relations of power and conflict within each class (Wall *et al.* 1998). This loosely correlates with the development and practice of discourses through institutionalised activities that bind groups and define the locus of competition or cooperation. Within each of these frameworks of practice, relationships and social networks form to constitute the tangible forms of social capital. Bourdieu's social capital has a focus on individuals and families explored through close relationships and repetitive interactions (Bourdieu 1986). The research insight is acquired through historically located comparative context, which defines the emergence, constitution, reproduction and transformation of social reality (Wall *et al*. 1998).

Coleman

By exploring a scale broader than Bourdieu, Coleman integrates the familial relationships within community and social organisation (Wall, Ferrazzi and Schryer 1998, Coleman 1988, Coleman 1990). This integration encompasses a variety of meso-scale entities all revolving around social agency and the constraint provided to social agents through social structures. Coleman explores the construction of social capital through the possessors of social capital, the sources of social capital and the resources in question (Coleman 1990, Portes 1998). This broadly functionalist perspective assumes that the interests inherent in the structure of relations between and among the actors can be harmonised based on rational self-interest (Flora 1998). The mechanisms that generate social capital revolve around reciprocity expectations and the enforcement of norms within groups.

Though social capital has the character of a gift, it is the motivations in giving and receiving (norms of reciprocity and practices of exchange) that provide insight into the consequences of its possession. The existence of sufficient ties within a group engaged in multiple roles over time, ensures the observance of norms that facilitate transactions without recourse to conventional legal contracts (Portes 1998, Flora 1998). Coleman's position holds that social capital is created and destroyed primarily as a result of other activities, but it is nonetheless embedded within rational choice placing an emphasis on instrumentality that favours the receivers (Flora 1998).

Putnam

Putnam's (1993) political emphasis equates social capital with "civicness" on a scale that encompasses participation and associational involvement in broader political frameworks (Portes 1998). This institutional attention allies with the ideals of participatory democracy and successful economic performance. Resilient and responsive representative institutions are traced through Putnam's inquiry into social capital and are associated with stable and predictable engagement that provides models and a means for future cooperation (Wall, Ferrazzi and Schryer 1998). The cycles of social capital outlined by Putnam

(1993) may be either virtuous or vicious in a spiral of success or failure based on initial altruistic behaviour prevalent within a society (Wall *et al.* 1998).

The portrayal of social capital as a resource that governance can manipulate to produce social change has been challenged as a reductionist interpretation. Portes (1998) claims this portrayal neglects to acknowledge domination and control as negative elements of social capital.

Using social capital

As social capital is an intangible resource that cannot be assessed directly, operationalisation within context is required. The shared values and relationships that are evident in social capital are embedded in local context (Field 2003). In general, research into social capital uses quantitative methodologies that interpret social networks, norms of reciprocity and practices of exchange, and relations of trust and their outcomes within existing social structures (Wall *et al.* 1998).

Proxies are inevitably used as indicators for elements of social capital and the three interacting social scales are not always considered together (Field 2003). Research into social norms and social engagement expose only one part of the process of social capital. The quality and connectedness of networks provides further insight but cannot stand alone. The concept of trust is considered acceptable as a proxy but again is dependent on the norms of reciprocity to allow clear interpretation and understanding. Social capital is a dynamic process of interaction between social networks, norms of reciprocity and practices of exchange, and relations of trust. This process operates across three social scales to link individuals to society in the interaction of coalition and conflict that prescribes options and in turn re-configures those options. Social catchments comprise people who live and act within a local context, but are linked to and act on information drawn from other social scales. These social scales reflect the three scales that structure agency and constraint in social capital: micro, meso and macro.

Social capital and scale

Social capital reflects an interaction between sectors of community in social catchments. Social scale within a social catchment context shows an interaction between individuals, community or collective social groups and formal and informal institutions operating as society scales. These scales are differentiated as micro for individual family and friend relationships, meso for informal and formal social groups operating largely within the context of place, and macro scale to capture the interactions and impacts of broader society within a social catchment.

The micro scale of social capital

Family and close friends communicate in individual contexts operating at micro social scales. In an assessment of social capital in rural and urban communities that focussed on the family level, Hofferth and Iceland (1998) contend that although rural families benefit from the strong ties of kinship, they may suffer from a lack of weak ties that create social capital and permit upward mobility. They advocate considerations of age, normative based participation in social exchanges and relationships between urban and rural based family members in measuring and assessing social capital. Introducing and maintaining sustainable land management practices may well correlate with these findings, particularly in rural communities where ageing is known to be a factor (Barr 2000).

The meso scale of social capital

Meso scale social capital reflects the nexus and potential coalition of individuals and family (micro) within a local context. This scale of social capital includes the constraining influences and links from macro scales of social organisation such as formal religious and political processes. Empirical inquiries by Flora (1998) and Kilpatrick and Falk (2003) found that the level of integration, kinds of networks (horizontal or vertical) that are inclusive and broad in representation are most likely to produce sustainable communities that are resilient in the face of change. Communities that seek improvement and change are more successful if they embrace community-wide outcomes and broad involvement.

Communities that intend to develop locally-initiated economic development projects need to develop and maintain high levels of social infrastructure.

By measuring social capital according to values, networks and outputs, Rice (2001) notes that communities characterised as having high social capital tend to be those that perceive their local government to be responsive and effective and consistent with better government performance. This outcome correlated with those urban areas that had well kept streets and parks that may indicate a link with a strong sense of place.

The macro scale of social capital

In a much broader approach that measures social capital and compares the usefulness of measures of social capital, Inkeles (2001) claims the distribution of attitude and value orientations such as trust, individualism and materialism are linked to durability of democratic government and the rate of economic growth.

Stone and Hughes (2002) found that the range of measures they used to assess norms, networks and network characteristics ”do not cohere readily to form an overall measure of social capital, but rather that differences exist between these core elements” (p. 40). The contested definition of social capital and the range of elements that have been explored would seem to indicate that social capital is an explicit system that results from the interactions of three core elements in three interdependent scales. Each of these elements and scales require operationalisation though the results will not necessarily capture the inherent form from the sum of the parts. A methodology that allows the simultaneous evaluation of the interdependent elements and scales is necessary to reduce linear and *a priori* based reductionism.

Critical approaches that reveal both obvious and obscured intentions (subjugating and subjugated values and communities) explicitly acknowledge all facets of the relationships between social structures and social actors in the development and maintenance of social capital. A dispassionate assessment of the role social capital plays within society helps to avoid any blanket

applications in anticipation of remedial social engineering (Portes 1998, Flora 1998). Civic engagement, and thus the implementation of environmental solutions, is historically contingent and develops over long periods of time. The participation in the affairs of society is embedded in social and institutional contexts and is not reducible to individual positions but forms complex relationships (Duane 1997).

A conceptual model for social capital

This conceptual model attempts to implement Woolcock's (1998) recommendation to attend to ontological status, conceptual and intellectual history of social capital in order to minimise weak theoretical and empirical claims common to research practice in this field. The theoretical and empirical literature revealed three social scales (micro, meso and macro) to include in the conceptual model. This model focussing on trust for assessing social capital provided an empirical research basis to engage a range of political and social scales in the sampling strategy and survey operationalisation.

This range of social scales, coupled with the quantitative and qualitative analyses of the three interacting elements (social networks, norms of reciprocity and practices of exchange, and relations of trust) of social capital provided a validity check for the theoretical assumptions that underpin the theoretical branches (Bourdieu, Coleman and Putnam) of social capital. Interactions that capture both formal and informal institutions developed either through generalised bridging or particularised bonding links provided the context for exploring interactions within and across social scales.

Figure 4.1 Conceptual model for social capital

The interacting elements that form social capital, the means of developing links and networks of social capital and the interacting formal and informal social scales are synthesised in the conceptual model (Figure 4.1) to act as a means of operationalising the survey and focusing qualitative inquiry into social capital.

Section two: The quantitative exploration

The survey questions (Appendix 2) were designed to capture three social scales of social capital, micro, meso and macro in formal and informal institutions. In addition, three core elements of social capital, social networks, norms of reciprocity and practices of exchange, and relations of trust were identified through the conceptualisation drawn from the literature. This conceptualisation (Figure 4.1) served as operationalisation for measures of assessment and evidence of social capital. Research questions gathered information on potential levels of social capital available at each social scale.

Questions asked through the analysis of the survey data assessed the relationships of forms of social capital with community sectors.

Micro scale social capital

To address Bourdieu's position that family help is critical in the development and maintenance of social capital, survey questions gathered information on micro scale forms of social capital through questions about:

- the numbers of extended family living within the same catchment of each participant;
- the extent of help provided by both family, and family-in-law in the catchment;
- the extent of help provided by both family, and family-in-law living outside the catchment.

Help provided within and outside the hydrological catchment through extended family provided a proxy for micro scale social capital. The relationships that were evaluated (Appendix 2) included categories of extended family living in the hydrological catchment and extended family living outside the hydrological catchment:

- Parents and parents-in-law;
- Brothers and sisters, and brothers and sisters in-law;
- Grandparents and grandparents in-law
- Cousins and cousins in-law
- Aunts and Uncles and Aunts and Uncles in-law
- Other family members (which were specified by participants to include sons, daughters, nieces and nephews).

The scale applied to these questions was:

- 1 = never
- 2 = once a year
- 3 = sometimes (from twice a year)
- 4 = once a month
- 5 = often (at least weekly).

These responses were summed to show the percentage of the possible maximum score out of the possible twelve categories of extended family (within and outside the catchment) and were reflected in the variables:

- C-FAMCAP = help provided by extended family from within the catchment;
- FAMCAP = help provided by extended family from outside the catchment;
- fam-no-{0 to 5}: numbers of extended family living in the catchment provided a proxy for potential micro scale social capital available:
  - 0 = none
    1 = 1 to 4
    2 = 5 to 9
    3 = 10 to 15
    4 = 16 to 20
    5 = more than 20 members.

Meso and macro scale social capital

Questions that address the local, regional and national scales of social capital that may be generated through relationships with other people were asked in order to represent both particularised and generalised trust and to indicate social networks (see Appendix 2). The sampling methodology sought to include as wide a range of meso forms of social capital possible and a representative range of macro forms (institutional) of social capital in both catchments. These forms of social capital were assessed by asking about membership of local and regional associations and groups for meso scale social capital, and political and professional bodies for macro scale social capital.

Nine different types of associations and groups were identified as survey categories to represent both meso and macro scales of social capital. These forms of social capital (see Table 4.1) were assessed through the following survey questions (Survey Q1; 2; 3):

- How many groups/associations are you a member of? (Participants were asked to nominate up to four groups for each category and level of trust and value was rated for each). Nine categories of groups.
- Rate the value of each group to you: 0 = no value, 5 = high value.
- Rate the level of trust within each group: 0 = none, 5 = high trust.

Table 4.1 Group/ association categories (9) with variable names for survey questions

Type of group/ association:	Social capital Scale	Survey Q1: Variable name	Survey Q2: Variable name	Survey Q3: Variable name
Social/activity	meso	SocialNo	SocialValue	SocialTrust
Service	meso	ServNo	ServValue	ServTrust
Church/Religious	meso & macro	ReligNo	ReligValue	ReligTrust
Environmental service	meso & macro	EnvServNo	EnvServValue	EnvServTrust
Lobbying	meso	LobbyNo	LobbyValue	LobbyTrust
Political	macro	PolitNo	PolitValue	PolitTrust
Professional	macro	ProfNo	ProfValue	ProfTrust
Community	meso	CommNo	CommValue	CommTrust
Other groups/ associations.	mostly meso	OGrpNo	OGrpValue	OGrpTrust

In addition, variables that measured the strength of the social capital generated through the membership of groups were assessed. These questions pertained to the length of membership in a group, the approximate number of members in each group, the number of meetings held in a year and the approximate number of members attending meetings. Though the responses to these questions were useful in the participant's evaluation of the importance of each group/ association mentioned, the responses depended on memory and were thus insufficiently reliable to be included in this analysis.

Summary statistics for social capital in the Katanning Zone

The extent of different scales of social capital across the catchment is evaluated through percentage accumulations and formed preliminary insight into understanding the extent of and difference in social capital between the two hydrological catchments. This provided an insight into differences in social capital between the two social catchments before multi-dimensional scaling was used to differentiate between community sectors and social scales in the sampled population.

The sum of extended family living in the Katanning Zone hydrological catchment is shown in Figure 4.2. More than 30% of respondents did not have extended family living in the catchment, and about 8% of respondents each had more

than 20 members of their extended family living in the catchment. Roughly one in five participants had more than ten members of their extended family living in the hydrological catchment.

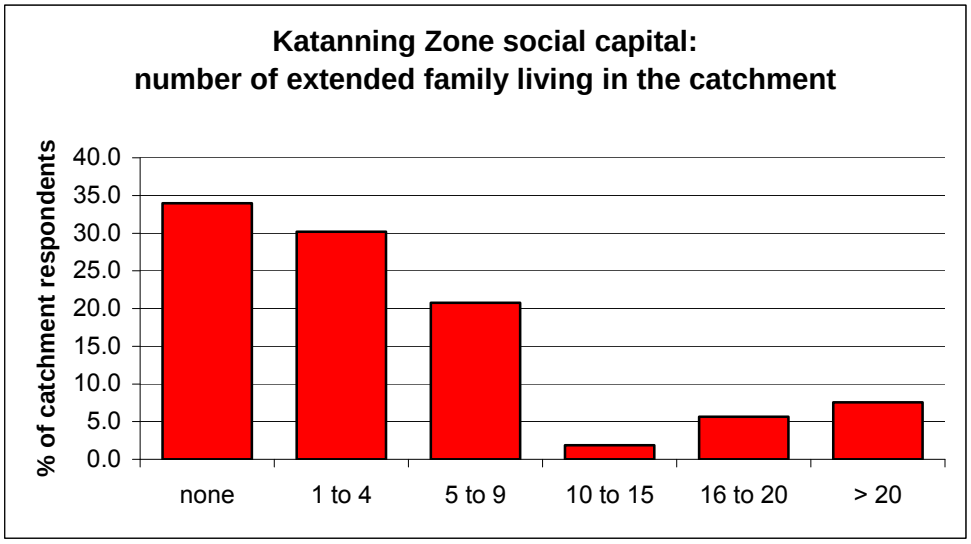

Figure 4.2 Figure showing the extent of family members living in the catchment

Family support to respondents across the catchment was gauged on a scale of 1 – 5 (1= never and 5 = at least weekly) for nine categories of extended family. This was consolidated in Figure 4.3 for both extended family support from within the catchment, and from outside the catchment. The percentage comparison was based on the total potential help available from extended family. More help was forthcoming from extended family within the catchment than from family living outside the catchment.

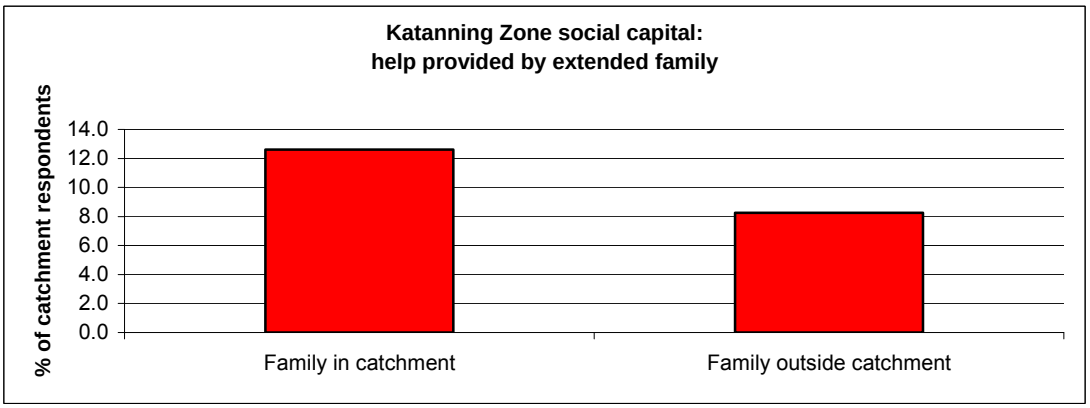

Figure 4.3 Frequency of help from family members

Figure 4.4 shows the percentage membership of the sampled population of nine categories of groups/associations in the catchment. Social groups had the highest rate of membership, followed by environmental service groups. Political groups held the lowest rate of membership in the sampled population.

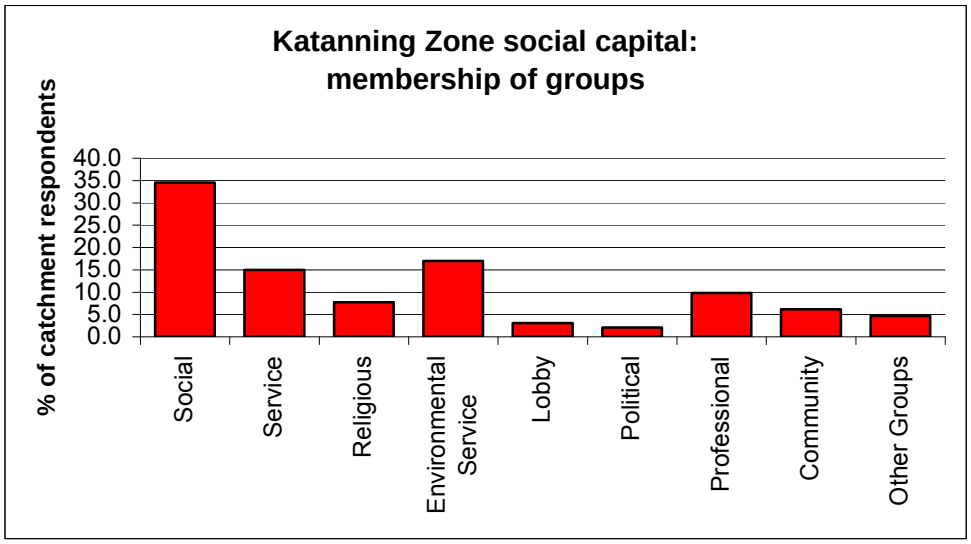

Figure 4.4 Figure showing participant's membership of groups

The value of these groups to the respondents in the Katanning Zone was rated from 0=none to 5=high value. Social groups scored the highest value, followed by environmental service groups. Membership levels correlated closely with ratings of trust and value allocation (Figure 4.5) with the exception of the category of other group, which showed a minor difference.

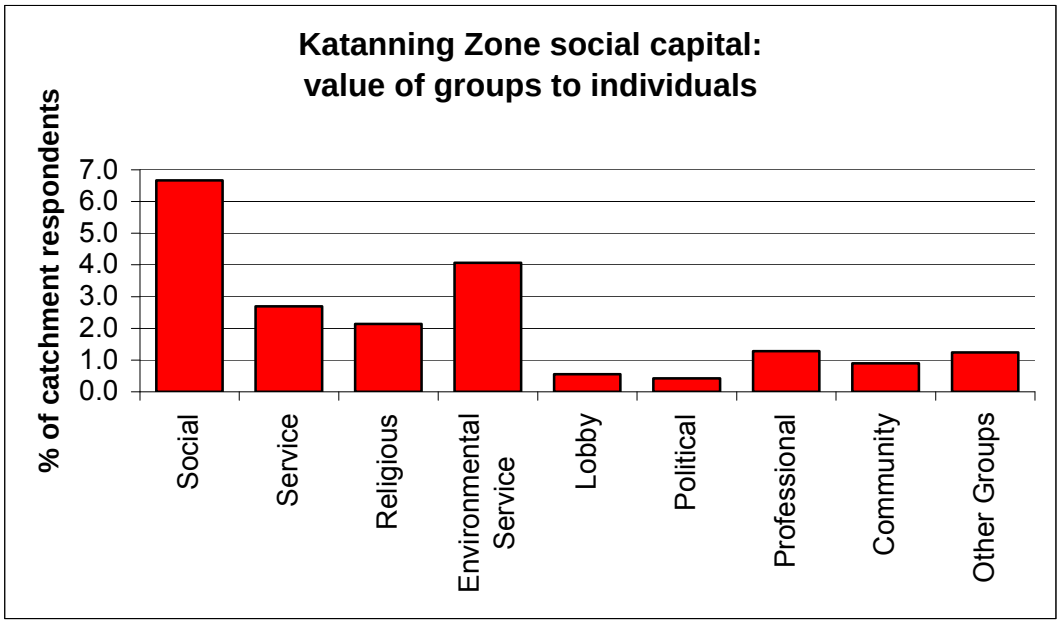

Figure 4.5 Figure showing the rating of value of groups to participants

Rating the level of trust within membership of groups is considered to be the best way of scoring the level of social capital in communities (Inkeles 2000). Table 4.6 shows the level of trust rated by respondents in the catchment. Scores correlated reasonably closely with membership and with value ratings, with the exception of environmental service groups that showed higher membership and value ratings than trust ratings.

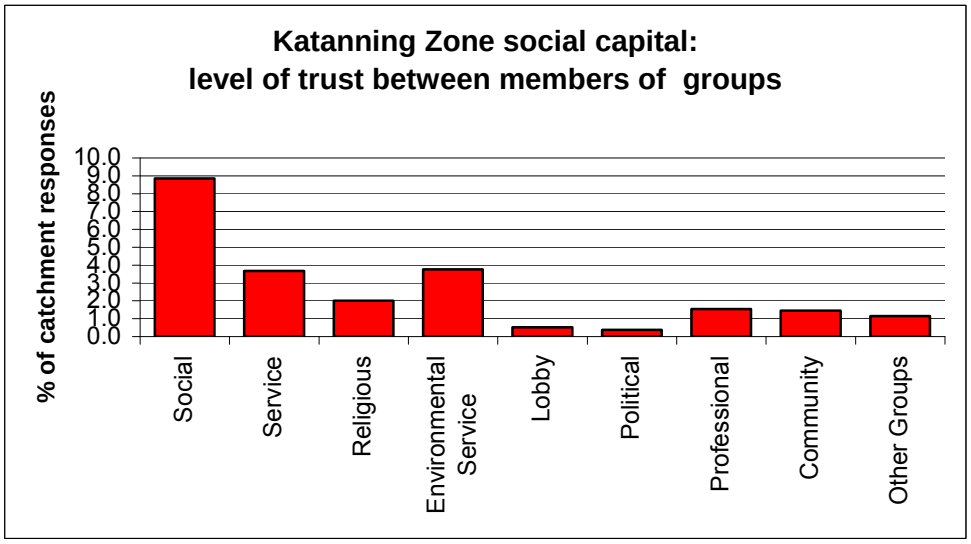

Figure 4.6 Scores for trust between members of groups

Most participants in the Katanning Zone study did not have high numbers of extended family living in the catchment but some had high numbers of extended

family from which their micro scale social capital could be drawn. Participants could expect more help from extended family living in the catchment that from extended family living outside the catchment.

Social groups (such as Crafts and Arts, interest groups etc) had the highest levels of membership as well as the highest ratings of both value and trust. These meso scale associations between membership, value and trust were similarly reflected in service groups (eg. Lions, Apex, Rotary etc) and environmental service groups (Landcare and Catchment Groups).

At the macro scale, professional groups represented about ten percent of the total of group membership. The presence of this form of social capital indicates that all three scales of social capital were part of the active process of social capital in the local catchment context. This represented a potentially high level of generalised trust and bridging capital in local communities. These summary scores give an indication of the total and diversity of social capital present in the Katanning Zone.

Summary statistics for social capital in the Condamine Headwaters

More people in the Condamine Headwaters had some extended family living in the catchment than did not (Figure 4.7). Compared to the Katanning Zone figures, the category of 1 to 4 members of extended family was about half, with the category of more than 20 just less than the Katanning Zone. More people in the Katanning Zone had more than 20 members of their extended family living in the catchment.

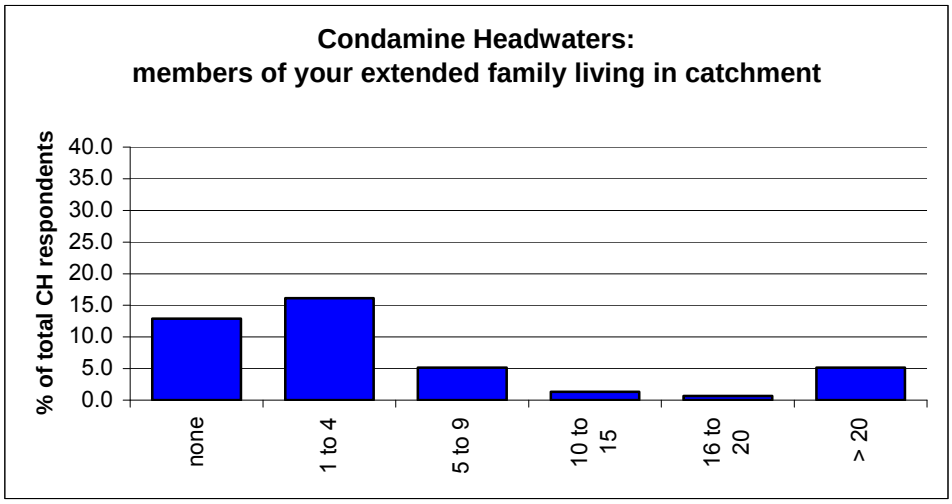

Figure 4.7 Figure showing extend of participant's extended family living in the catchment

When asked how often members of family help out, Condamine Headwaters respondents indicated that they could rely equally on family living in the catchment and those living outside the catchment (Figure 4.8). The percentage comparison in Figure 4.8 is based on the total potential help available from extended family. The Katanning Zone respondents indicated that they could rely on family members living in the catchment to help out at about 3% more than those living in the Condamine Headwaters.

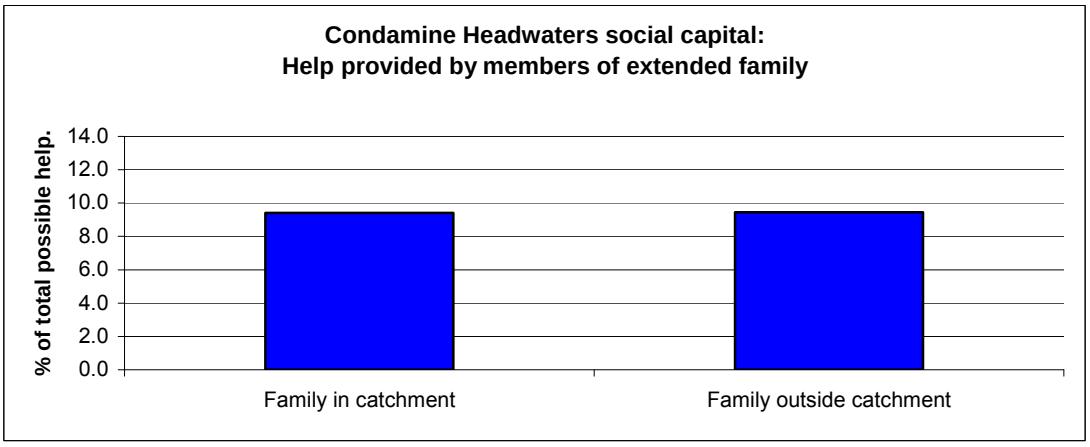

Figure 4.8 Figure showing extent of extended family for participants

Meso and macro scales of social capital were identified through membership of nine categories of groups and associations (Figure 4.9). Results indicated that social groups are the most popular form of membership, as was the case in the

Katanning Zone, but the rate of membership of these groups was more than 10% less in the Condamine Headwaters. Membership of environmental services groups (approx 12%) was only slightly less in the Condamine Headwaters than in the Katanning Zone (approx 15%). Political groups were the least popular in both catchments. There were higher levels of membership of religious groups in the Condamine Headwaters than in Katanning Zone.

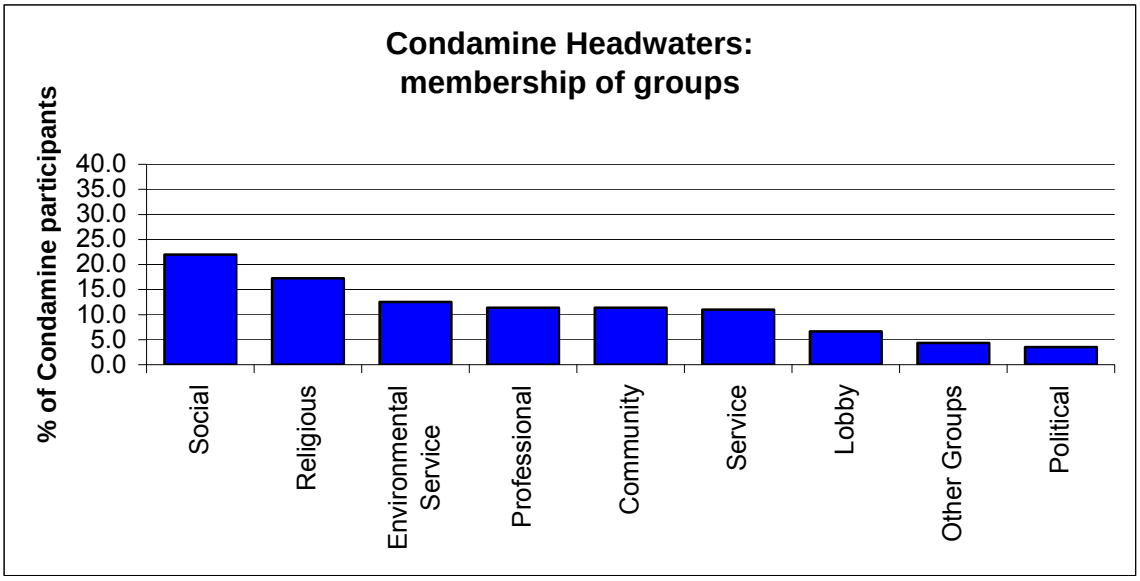

Figure 4.9 Figure showing participants' membership of different kinds of groups

The value of these groups to people in the Condamine Headwaters indicated that social groups were considered most valuable, followed by professional groups. Respondents in the Condamine Headwaters rated the value of the social groups and environmental service groups they are members of at about half the value of the Katanning Zone participants.

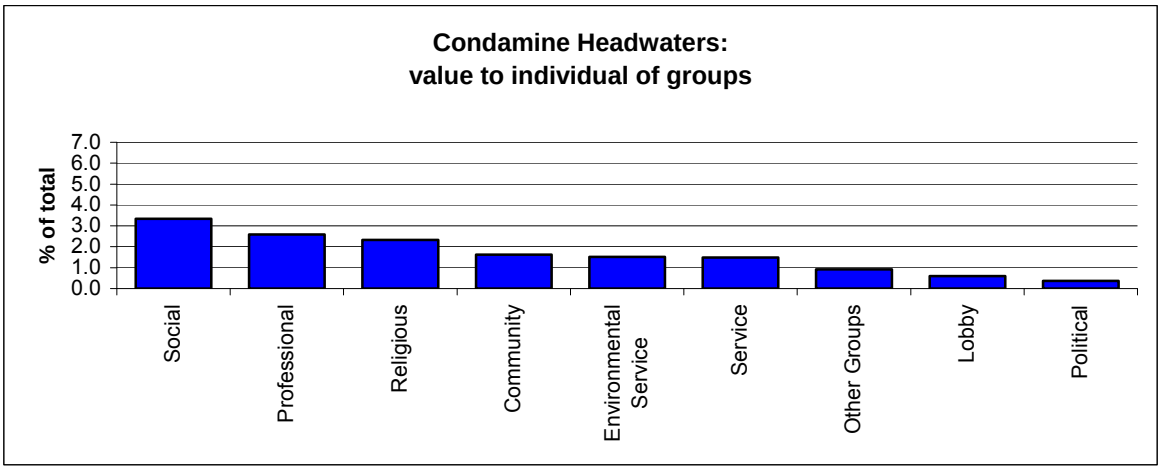

Figure 4.10 figure showing rate of value of groups to participants in Condamine catchment

The rating of trust between members of groups providing a good indication of the strength of social capital in the Condamine Headwaters indicated a lower level of trust than was evident in the Katanning Zone respondents (Figure 4.11). Trust ratings corresponded with those scores for each category of group or association in the Condamine for value and membership overall.

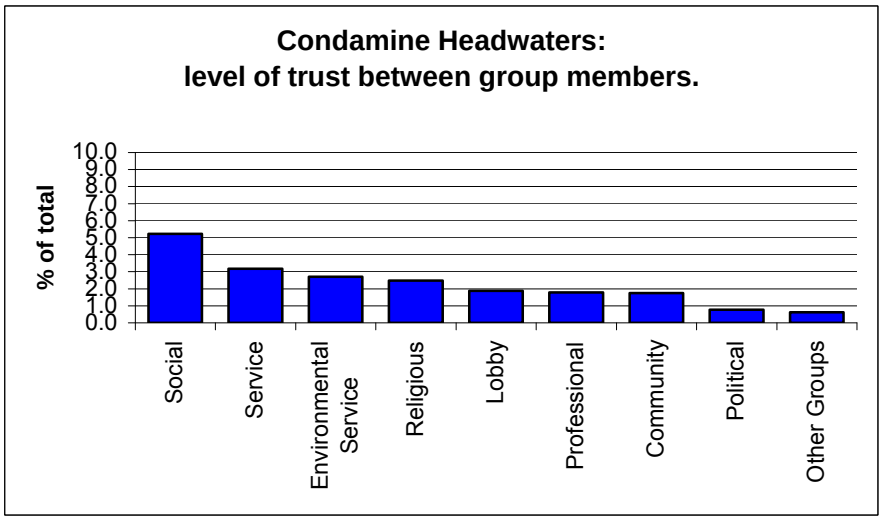

Figure 4.11 Figure showing participant rating of trust between members of groups in Condamine Headwaters

Social groups in the Condamine Headwaters sample population have half the membership and value ratings of the Katanning Zone participants. In contrast, service groups and community groups are more important to the Condamine

population than in the Katanning Zone, while environmental service groups score higher in Katanning than in the Condamine.

Indications were that two forms of interaction differentiated meso and macro group functions. Institutional groups function by association rather than face-to-face contact. Local and regional groups that were activity based, such as local catchment groups, sporting groups, the Country Women's Association functioned by face-to-face contact establishing particularised trust. This differentiation provided some insight into the scale of operation as well as the strength of direct social capital of groups within each catchment. Though Katanning Zone had a greater diversity of religious institutions than the Condamine Headwaters, they had lower levels of membership of religious groups. These questions on membership served to prime each participant's consideration of the rating of trust and value within the groups.

The numerical classification identified social assemblages in each of these catchments to provide some insight into the distribution of social capital between different sectors and the value of available social capital to participants in each catchment.

The synthesis through numerical taxonomy

The data from both catchments was combined (but each catchment was kept identifiable through coding) to meet continuum and replication requirements in the sampling strategy. A numerical taxonomy was conducted on the data using data derived from social capital questions as the intrinsic variables and socio-demographic data as the extrinsic variables. Both the intrinsic and extrinsic variables contributed to the resulting ordinations, but the intrinsic variables provided information on the structure of social capital data and formed the basis of the analysis results. The extrinsic variables contributed descriptive characteristics. This data was evaluated simultaneously for statistical contribution to the formation of clustering in the social assemblages at the individual participant level and the group level (social assemblages).

The numerical taxonomy was conducted in two stages. The results from the first numerical taxonomy identified a proportion of participants from both catchments with very individual responses to the questions on social capital (Figure 4.13). Almost 10 percent of the total participants (total analysis cases of 117) did not cluster so a second analysis was conducted to separate these non-clustering participants to form extrinsic cases in the second analysis. This was done in order to improve the insight provided by the ordination of social capital variables for the majority of the population. This extrinsic group of participants was not excluded from the analysis but treated separately in the interpretation, and is identified as Social Assemblage Six (aqua) in the descriptions in the secondary analysis. A total of 84 variables were used in the analysis with 30 (34.5%) comprising the intrinsic social capital variables that formed the clustering.

The multi-dimensional scaling ordination (SSH MDS, Gower Metric, Stress = 0.18 in 3 dimensions) of social capital shows trends in assemblages of participants and indicated there were different sectors in each of the catchment communities. The overlaid vectors of social capital (statistically significant intrinsic variables) and socio-demographic descriptors (statistically significant extrinsic variables) indicated the values and descriptors that contributed to the differences between the social assemblages and variable clusters defined through cluster analysis (UPGMA, Gower metric, B= -0.05). The significant variables in the ordination (PCC, MCAO, Kruskal Wallis) indicated the variables that needed to be considered in identifying differences between the sectors (social assemblages) in each of these communities.

The evaluation of the ordination using ANOSIM (Table 4.2) showed that the five social assemblages (assemblage six is referred to separately) are all significantly different to one another.

Table 4.2 ANOSIM table showing significantly different statistical relationships between social assemblages where cut-off for significance is 0.05 (SSH MDS, Gower Metric, Stress = 0.18 in 3 dimensions)

Row ANOSIM with Group Pairs (Stat)				
	SA 1	SA 2	SA 3	SA 4
SA 2	0.0000			
SA 3	0.0000	0.0303		
SA 4	0.0000	0.0000	0.0101	
SA 5	0.0000	0.0303	0.0505	0.0000

The column dendrogram (Figure 4.12) shows the clustering of variables that comprise the attribute clusters that characterise and make each social assemblage (the clustered participants) distinctive. The participants clustered responses to social capital questions formed 4 distinct associations of social capital. The first attribute cluster included variables relating to quantity (all variables ending with no) clustered together in a broad group with the exception of the variable relating to lobby groups. These variables related to number of extended family living in the catchment group and number of groups or associations participants hold membership with variable names: famno; ReligNo; ProfNo; SocialNo; ServNo; EnvServNo; CommNo; OtherGrpNo; PoliticNo. This identified a separation between quantity and value in the social capital variables. The number of groups a participant was involved with did not cluster with the associated values in social capital.

The second attribute cluster identified on the column dendrogram (Figure 4.12) reflected the local and regional scale (micro and meso scale) of social capital and informal institutions. Groups represented in this cluster of social capital represented social, community and service groups, along with the family capital variables of help from extended family (variable names: SocialTrust; SocialValue; C-FAMCAP; FAMCAP; ServTrust; ServValue; EnvServTrust; EnvServValue; ReligTrust; ReligValue; CommTrust; CommValue; OgrpTrust; OgrpValue). Within this larger attribute cluster of micro and meso scale social capital, four separate clusters were identified. Social capital was separated into social groups and family capital, service and environmental service groups, religious and community groups and the fourth part in this social capital attribute cluster represented the group category, other group, which included a

combination of self-help and interest groups. The red boxes on the dendrogram indicate attribute clusters, the blue boxes show the sub-clustering within each attribute cluster.

The third clustering of attribute variables were those that reflected regional and national scales of social capital (institutionalised meso and macro social capital) and related to political, professional and lobby groups/ associations. There was clear evidence that lobby groups formed a distinct purpose that was differentiated from political and professional groups. This column dendrogram (Figure 4.12) confirmed the differentiation of micro, meso and macro scales of social capital in local contexts. The three elements of social capital (social networks, norms of reciprocity and practices of exchange, and relations of trust) interact to form three scales (micro, meso and macro) that structure the process of social capital.

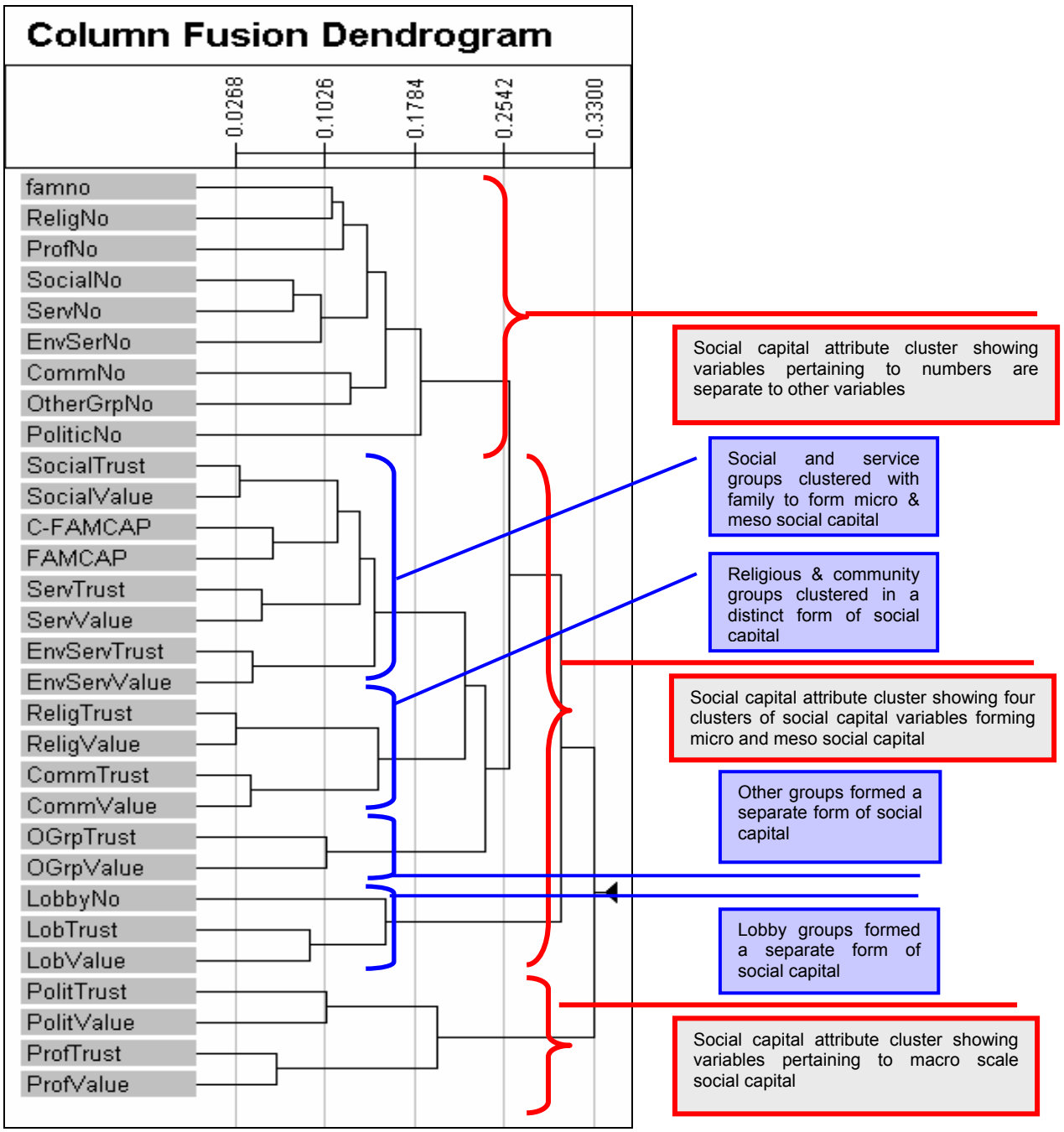

Figure 4.12 Column dendrogram showing clustering of social capital variables (SSH MDS, Gower Metric, B=0.05, UPGMA, Stress = 0.18 in 3 dimensions)

The row fusion dendrogram (Figure 4.13) showing the clustering and ordination results of participants showed that within the 5 social assemblages identified in this analysis (red cut-off line and red circled numbers), there were considerable numbers of people who formed very independent and individual representations of social capital (red bracket with black number 6 in Figure 4.13). Within the major cluster (red brackets with black numbers from 1 – 5), there were clearly identifiable smaller clusters of people with commonality that indicated a distinct

but broad range of social capital in both catchments. The red bracketing shows the diverse clusters of people within the broader ordination with a more distinctly different social assemblage already nominated as extrinsic cases (Social Assemblage 6) that is not shown in this dendrogram.

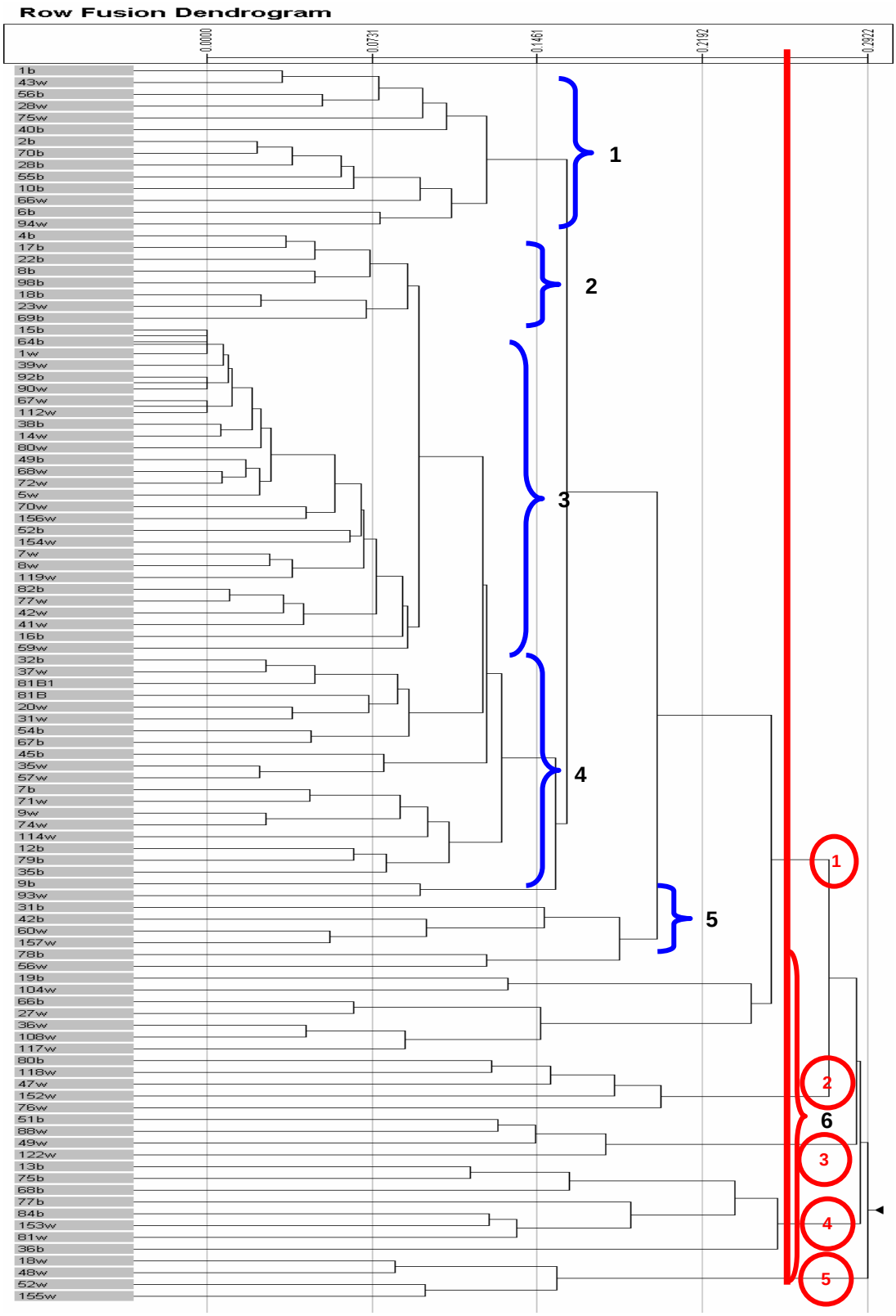

Figure 4.13 Row dendrogram showing clustering of participants into social assemblages according to social capital variables (SSH MDS, Gower Metric, B=0.05, UPGMA, Stress = 0.18 in 3 dimensions)

The ordination of the participants (Figure 4.14) that formed 5 social assemblages showed one large cluster (Social Assemblage 1) representing about 75% (n = 84) of the participants in this analysis and a further 4 small assemblages that did not always form cohesive assemblages, despite the statistically significant results of group comparison in the outcome of the ANOSIM evaluation (Table 4.2).

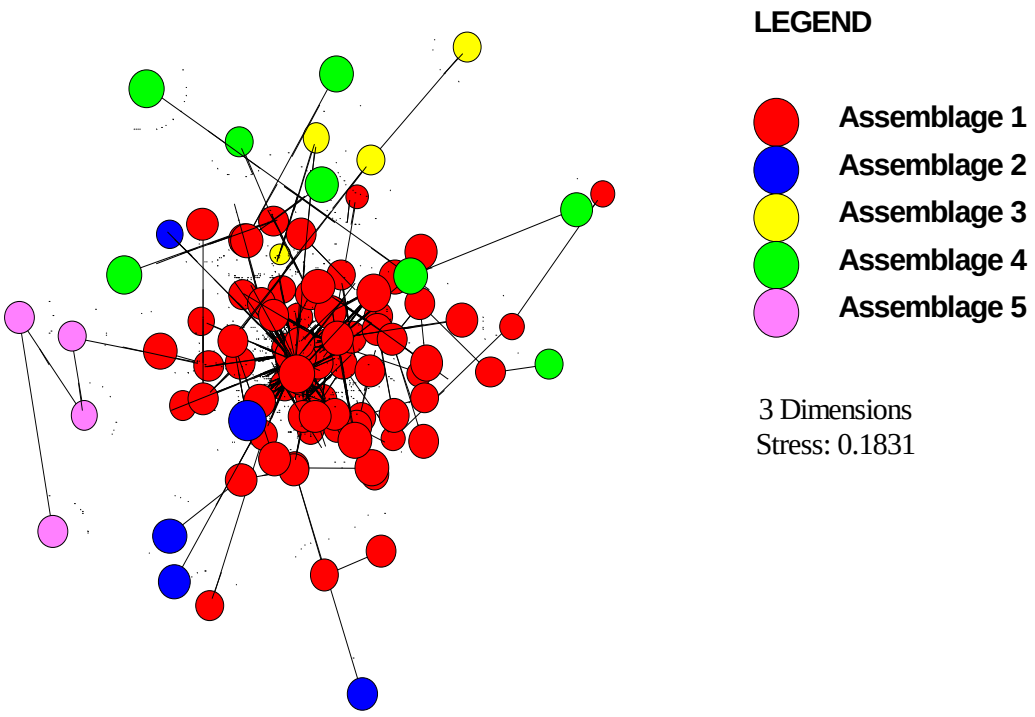

Figure 4.14 Ordination showing social assemblages and relationships between participants in minimum spanning tree (SSH MDS, Gower Metric, B=0.05, UPGMA, Stress = 0.18 in 3 dimensions)

Appendix 9 shows detailed histograms giving the percentage breakdown of all variables for each catchment in each social assemblage. This result is a useful means of portraying details of socio-demographic descriptors. These percentages made it possible to describe the attributes of each social assemblage through a separate analysis of both catchment communities. The results of this ordination were used as a means of identifying the different sectors within the social catchment and to assess possible differences in social

capital between catchments. Table 4.3 shows social assemblages described using Kruskal Wallis scores for statistically significant variables that portrayed differences in social capital between social assemblages in each social catchment: 3 = association; 2 = some association; 1 = little association; 0 = no association. This characterisation of cases through the social capital variables provides insights into the different forms of social capital within social catchments. In Figure 4.3 statistically significant results from the numerical taxonomy are used to portray each of the social assemblages. Each colour represents a social assemblage, while the darker shading for each colour indicates stronger correlation between attribute variable and social assemblage. Social catchments are differentiated in the table through K (Katanning Zone) and C to represent participants from the Condamine Headwaters.

Table 4.3 Defining characteristics of social assemblages shown through statistically significant variables derived from Kruskal Wallis scores

Social Assemblage	%	Catchment	Other Grp Value	*Other Grp* Trust	Community Grp No	Community Grp Value	Community Grp Trust	Religious Grp No	Religious Grp Trust	Religious Grp Value	Social Grp No	Social group Trust	Social Grp Value	Service Grp Value	Services Group Trust	Environmental service Grp No	Environmental service Grp Value	Environmental service Grp Trust	Political Grp No	Political Grp Value	Political Grp trust	Professional Grp Value	Professional Grp Trust	Catchment Family No 16 to 20	Catchment Family No > 20	Place and Identity	Place, Identity & Interest	Dairy Farmer
1	71	K	0	0	2	1	1	2	1	1	3	3	3	1	2	2	2	2	1	0	0	1	1	2	1	3	2	0
		C	0	0	1	1	0	1	1	1	2	2	2	1	1	1	1	1	1	0	0	1	1	0	2	3	2	1
2	4.3	K	0	0	0	0	0	3	2	2	0	0	0	0	0	3	2	2	3	0	0	2	2	0	0	0	3	0
		C	0	0	1	0	0	1	1	1	1	2	2	0	0	1	1	2	1	2	2	2	1	0	3	2	3	0
3	3.4	K	3	2	0	0	0	0	0	0	3	3	3	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0
		C	2	2	1	1	1	1	0	1	1	3	3	0	1	0	0	0	0	0	0	1	0	0	0	0	3	0
4	6.8	K	1	0	1	1	1	2	1	1	3	3	3	2	2	3	3	3	0	0	0	1	0	3	3	3	0	0
		C	0	0	1	2	2	1	3	3	1	3	3	3	3	1	1	1	0	0	0	0	0	0	3	3	0	0
5	3.4	K	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		C	0	0	1	2	3	1	3	3	0	0	0	0	0	1	1	1	0	0	0	1	1	3	3	3	0	3
6	10.4	K	3	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	2	2	2	1	1	0	0	3	3	0
		C	0	2	1	2	3	1	2	1	1	2	1	1	1	1	2	2	1	1	2	3	3	0	0	3	0	0

Social Assemblage 1: RED

This assemblage (Red)(see Appendix 9 for histograms) was characterised by a wide distribution of occupations and industries. There were more men than women, and most of the respondents were between the ages of 40 and 64. In the Katanning Zone, they had lived in the catchment for between 20 and 40 years and comprise communities of place, identity and interest. They had a high membership of, trust and value in social groups. In the Condamine Headwaters, the respondents in this assemblage had lived in the catchment for between 10 and 20 years with few members of their extended family living in the catchment and overall lower value and trust scores in the groups they were members of. There were indications of active engagement in social life but without high levels of bonding capital at the meso-scale (indicated through the trust ratings).

Social Assemblage 2: BLUE

This social assemblage (blue) (Appendix 9) was characterised by select membership of groups predominantly represented in social, religious, environmental services, political and professional groups. In the Condamine Headwaters, most of the participants had lived in the catchment for between 20 and 40 years and were mostly male aged between 40 and 64. They comprised the community of identity with some community of place. This group of people were members of religious, environmental services, political and professional groups and were General Managers and professionals working in environmental services, services to agriculture, government administration and education. There were no farmers in this social assemblage in the Condamine.

This was in contrast with the respondents within this social assemblage (2 - blue) representing the Katanning Zone. All representatives were farmers aged between 65 and 79 who had lived in the catchment for more than 40 years. They were all male with limited family support both from within and outside of the catchment. They were members of religious, environmental services and professional groups and all represented communities of place, identity and interest. So, though this assemblage was characterised by different socio-demographic descriptors between the two catchments, in general they were all members of and have similar values pertaining to the same kinds of groups,

their meso and macro social capital was the same. Low numbers of extended family and low scores for family-based help indicated that they had limited access to micro scale social capital.

Social Assemblage 3: YELLOW

This assemblage (yellow) was made up entirely of the age-group of 40 to 64 year old people. Contrasts in this assemblage between the Condamine people and the Katanning Zone people in the assemblage showed that the participants in the Katanning Zone had lived in the catchment for more than 40 years while the Condamine respondents had lived in the catchment up to 40 years. Communities of place and interest comprised the Katanning Zone respondents, while communities of place, identity and interest comprised the Condamine respondents.

All the Katanning Zone respondents were women with a high number of extended family in the catchment and high scores in family help from within the catchment. They were members of social, religious and community groups and were all traders. In the Condamine, there were more women than men in the assemblage but with low extended family numbers and limited help from extended family. They were members of social and community groups, representing farming and the professionals working in services to agriculture and human services. This social assemblage engaged in community via social activities.

Social Assemblage 4: GREEN

Assemblage four (green) comprised people aged between 40 and 64 representing a range of group membership but excluding macro scale membership. In the Katanning Zone most had lived in the catchment for up to 40 years and represented communities of place, identity and interest. Half were men and half women with a range of numbers of extended family and reasonable scores in help from catchment based extended family members. They were members of many social and environmental services groups, and reported high scores in trust and value in those groups. The assemblage was a mix of farmers, professionals and traders.

In the Condamine Headwaters equal numbers of members of this social assemblage had lived in the catchment for up to twenty years as had lived in the catchment for over forty years. They comprised communities of place and interest, as well as place and identity.

Half were men and half women with big extended families but without correlatory high scores of help from their extended families living in the catchment. They belonged to social, religious and services groups (including environmental services) and included those working as professionals and traders in government administration and manufacturing. No farmers were represented in the Condamine component of this social assemblage. These people were active in micro and meso scale process of social capital but not in macro scale social capital despite macro scale networks forged through professional occupations.

Social Assemblage 5: PINK

This social assemblage (3.4%) was only found in the Condamine Headwaters. No respondents from the Katanning Zone were represented. The descriptive elements of this assemblage indicated a broad range of ages spanning from 25 and 64, and all were communities of place and identity who had lived in the catchment for up to 20 years. They were mostly male and were members of religious and community groups with a range of totals in extended family living in the catchment. They were all farmers with reasonable levels of help from their extended family living in the catchment. There were indications of strong bonding social capital but little bridging social capital that linked through meso and macro scales vertically or horizontally outside the micro social scale.

Social Assemblage 6: AQUA

People in this assemblage (aqua) represented those individuals who had a diverse range of characteristics that could not easily be clustered into groups in the ordination process (these cases were made extrinsic in the second taxonomic analysis). This group was aged between 40 and 64 with strong membership of all types of groups and associations, and accompanying high

levels of value and trust. In the Condamine these people had lived in the catchment for up to 20 years and for more than 40 years, while in the Katanning Zone they had lived in the catchment for up to 40 years. They comprised a range of communities in the Katanning Zone but only represented that of place, identity and interest in the Condamine Headwaters.

In Katanning they were mostly female with low numbers of extended family living in the catchment, and worked as managers and professionals in trade, grain, sheep and beef farming, service industries and government administration. In the Condamine component, they were mostly male with some extended family but low levels of help from family in the catchment. They were all managers and professionals working in stock farming and human services. As individuals, these participants represented a high number of community leaders in each of these communities and were actively engaged in meso and macro scales of social capital processes.

The tensions: critical vectors in social capital

The critical vectors are derived from three different evaluations of the ordination (Monte Carlo's Permutations and Principal Axis Correlation). Table 4.4 shows all the variables that have a statistically significant bearing on characteristics of the social assemblages. These vectors provide an insight into the way each of the social assemblages is characterised through both intrinsic social capital variables and extrinsic socio-demographic descriptors. The statistical association of critical vectors with social assemblages gives an insight into the value tensions between sectors of these social catchments and provides direction for the qualitative inquiry and complex systems analysis.

Table 4.4 Scores for most significant variables in ordination

Variable	Variable Short Name	p derived from Monte Carlo's permutations (MCAO)	r^2 values derives from Principal Axis Correlation (Pcc)	Kruskal Wallis value between groups
Trust in social groups	SocialTrust	p < 0.001	0.461	14.63
Value of social groups	SocialValue	p < 0.001	0.321	21.48
Trust in service groups	ServTrust	p < 0.001	0.339	11.59
Value of service groups	ServValue	p < 0.001	0.339	20.68
Trust in religious groups	ReligTrust	p < 0.001	0.196	30.29
Value of religious groups	ReligValue	p < 0.001	0.146	26.60
Trust in environmental services groups	EnvServTrust	p < 0.001	0.142	23.86
Value of environmental services groups	EnvServValue	p < 0.001	0.155	25.23
Trust in lobbying groups	LobTrust	p < 0.001	0.310	1.29
Value in lobbying groups	LobValue	p < 0.001	0.225	2.02
Trust in political groups	PolitTrust	p < 0.001	0.098	82.35
Value in political groups	PolitValue	p < 0.001	0.144	40.38
Trust in professional groups	ProfTrust	p < 0.001	0.314	14.04
Value of professional groups	ProfValue	p < 0.001	0.314	20.16
Trust in community groups	CommTrust	p < 0.001	0.327	42.37
Value of community groups	CommValue	p < 0.001	0.301	51.87
Trust in other groups	OGrpTrust	p < 0.001	0.183	77.22
Value of other groups	OGrpValue	p < 0.001	0.228	85.57
Family capital (total score derived from 0 – 5 for each category (9) of the extended family for frequency of help given)	FAMCAP	p < 0.001	0.131	9.43
Family members living in catchment: 5 - 9	fam-no-2	p = 0.01	0.108	2.07
Family members living in the catchment: 0	fam-no-0	p = 0.04	0.078	1.10

Interpreting the critical vectors

A selection of the statistically significant variables are shown in Figure 4.15 indicating positive association at the end of the vector line where the variable name is found, and negative association at the linear opposite on the ordination figure. These dichotomies emerge from the numerical taxonomy to indicate statistically defined tensions within ordination space that indicate both association with certain values or variables, but also the negative association with cases/ participants and other variables. Interesting dichotomous associations were evident between environmental services and services groups (meso scale social capital) both with family capital, of extended family help from

outside the catchment (micro scale social capital) and with political and professional groups (macro). This indicates that different forms of social capital are important to these different participants. Similar dichotomies are evident between Lobby groups and religious and community groups and between social groups and community groups in the ordination.

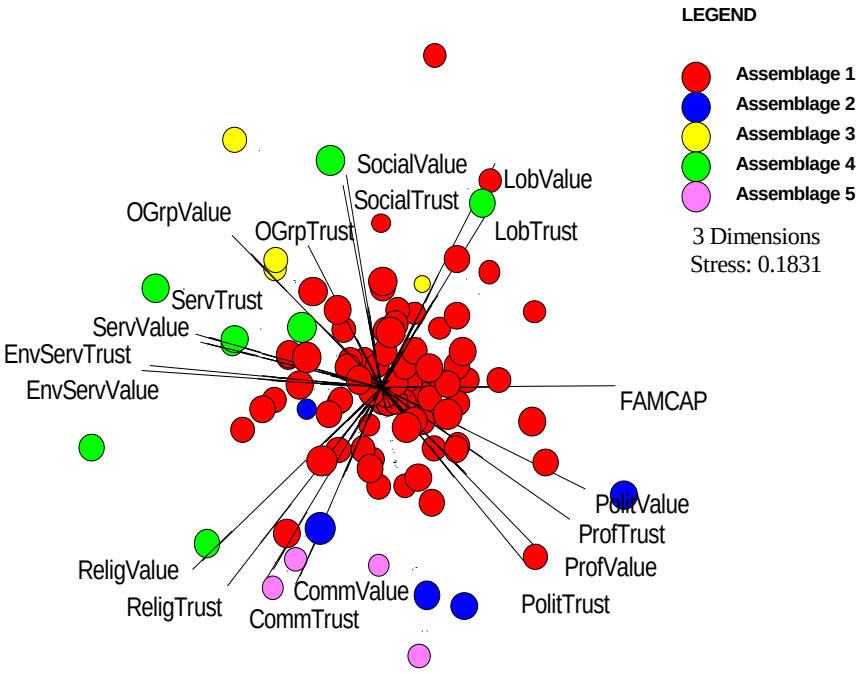

Figure 4.15 Ordination with overlaid statistically critical variables showing dichotomies in social capital (SSH MDS, Gower Metric, B=0.05, UPGMA, Stress = 0.18 in 3 dimensions)

Discussion

Social capital supports, maintains and configures the values that direct, facilitate and constrain individual and collective decisions in landscape management. The outcomes of social capital give tangible form to the process and potential application of social capital (Field 2003, Portes 1998). Understanding the form and location of social capital in relation to social scale provides an insight into interaction across social and geographic scales. This analysis used the multi-scale interactions that characterise organic and moral trust as a part of social cohesion and indicator of social capital at meso and macro scales (Schuller *et al.* 2000, Entrikin 2003). The notion of help from family as an indicator of micro scale social capital confirms results from research conducted by Hofferth and

Iceland (1998) that kinship ties in communities of place and identity (rural farming families) are a defining characteristic of micro scale social capital. Though recommended by Hofferth and Iceland (1998) as a consideration in measuring and assessing social capital, age did not emerge as a statistically significant variable in the numerical taxonomy. Their recommendations that consideration be given to the relationships between urban and rural based family members in measuring and assessing social capital were partly born out in the statistically critical vectors that indicated differences in the distribution of social capital variables within ordination space. These results confirm that social capital is available and used in different forms between different community sectors within a social catchment.

Social capital was assessed at three social scales to provide evidence of interaction within local place-based contexts. The dendrogram (Figure 4.12) indicated that there were different forms of social capital within these catchments that reflect distinct scales of social capital associated with different sectors of the community (shown through association to social assemblages in Table 4.3). Social capital is a process that is developed and maintained through bridging and bonding links in social networks, norms of reciprocity and practices of exchange, and relations of trust. This methodological approach extends results from intra-scale studies (Putnam *et al*. 1993, Coleman 1990, Bourdieu 1995 and others) to show the potential for interaction across the three social scales within a place-based context. This shows that different forms of social capital can contribute to social networks, norms of reciprocity and relations of trust at each scale.

Social capital: from content to process.

The content of these complex adaptive rural social systems was explored through numerical taxonomy and the results portrayed social relationships within social catchments and the form of social capital available at each social scale. To understand the processes that define the social interactions relating to landscape management in these social catchments, the critical vectors differentiating form and social location of social capital were problematised. This

provided the focus for qualitative exploration of the processes that form the social relationships within social catchments.

Three scales of social capital were evident in the dendrogram (Figure 4.12) that confirmed the conceptual framework that was developed to test for evidence and form of social capital. The survey questionnaire provided a full range of organisations in an undifferentiated representation of meso and macro scale social capital. The dendrogram showed distinct differentiation between the three scales indicating that meso and macro are different to micro scale social capital, and that more importantly, all three scales exist within the social catchment scale representing local context (Dendrogram, Figure 4.12). The most noteworthy elements differentiating assemblages in the numerical taxonomy and quantitative analysis revealed scale of social capital and community sector (community of place, identity or interest) to be critical differences in the process and practices of social capital. Membership of groups did vary between assemblages, and did characterise the form of social capital in certain assemblages (Table 4.3).

The ordination showing the statistically significant vectors (Figure 4.15) confirmed that social capital was used by different sectors of the community indicating different family or organisational relationships. Each form of social capital draws on a different knowledge source and confirms a specific set of norms. Loosely expressed, it is likely that micro scale social capital (family and close friends) draws on local knowledge (as was evident in the results from the inquiry into sense of place), while meso scales (community organisations that integrate institutionalised processes with informal relationships) integrate knowledge from local sources with scientific and Indigenous sources, depending on the constitution of the social processes and settings. It is likely that macro scales reflecting links to professional and formal institutions primarily draw on formal and scientific sources of knowledge. This assumption provided a focus for qualitative ground-proofing to expose complex systems interactions through a different lens.

All three scales (micro, meso and macro) were found in both these locally contexted social catchments. In general, social capital appeared to be sufficiently diverse and oblique (showing non-linear interactions) to challenge easy and explicit categorisation according to socio-demographic descriptors. This confirms results from research on measurements for social capital by Stone and Hughes 2002, Productivity Commission 2003, and the cautions from Field 2003, Siisiäinen 2003 and Woolcock 1998.

Section three: qualitative inquiry into social capital

The results from the numerical taxonomy were used to develop interview questions that were explored with a selection of representatives from each social assemblage in each catchment. The dichotomies in the ordination revealed that social assemblages had access to different forms of social capital as a potential resource in decision-making. This raised further questions about the importance of families and friends for communities of place and identity (primarily farmers) in landscape management in comparison to government agency staff or business consultants. In addition, this raised the question of the role micro scale social capital plays in forming a sense of place for agency staff and the private sector in local landscapes. It was thus important to identify the explicit processes of group membership in relation to the generation and maintenance of social capital as a pattern of use in different sectors of the social catchment. Was social capital likely to form implicit and repeated processes that require macro scale intervention (through governance) to facilitate adaptive capacity in relation to landscape decision-making at the micro and meso scale? These research questions were framed through explicit interview questions that were asked of all participants along with probing questions to confirm an understanding of responses and to provide more detail. This section of this chapter describes and discusses the process of social capital by using direct quotes from interviews with participants.

The research and interview questions

Critical results that emerged from the numerical taxonomy were developed into interview questions that used the conceptualisation of social capital in the local context of social catchments in both of the hydrological catchments. The

interview questions are presented in Table 4.5 to show their connection with the research questions.

Table 4.5 Table showing how interview questions answer research questions

Research question	Interview question
• Has the participant developed particular norms of reciprocity and practices of exchange from the local micro-scale context? • Is there evidence of the presence of micro/ meso scale social capital? • Which occupation does the participant have and how does this reflect community sector (place, identity or interest)? (scale & networks) • Which industry sector does this participant relate to or work in? (networks)	• Did you grow up in this catchment/area?
• Has the participant developed particular norms of reciprocity and practices of exchange from the local context? • Has the participant acquired networks and micro scale social capital?	• Do you have members of your extended family living here?
• What forms of meso and macro scale social capital and networks has the participant acquired?	• What sorts of groups are you involved with?
• What forms of micro and meso scale social capital and norms of reciprocity have been acquired? • How important is the maintenance of the norms of those groups to the participant? • Is there a difference in which groups or forms of meso scale social capital are important in different sectors of the social catchment? • Which groups (meso scale social capital) facilitate the most diverse and inclusive forms of interaction across a community? • Which groups facilitate the most effective exchange of information, both formal and informal? (networks)	• Which of these are most important to you and why?
• Is there an association between occupation and industry and form of social capital used in decision-making? (norms & networks) • Do different sectors of the community consult across sectors in decision-making? (networks) • What role does social capital play in the process of decision-making?	• What sources of learning do you use in making decisions? (most often followed up with: who do you go to if you need a second opinion on a new idea or approach?)
• Which forms and scales of social capital are used in decision-making? (norms & networks) • How are different scales of social capital used in decision-making? • Is the most important and most used source of knowledge also the scale or form of social capital most valued? (norms)	• What do you think is the relationship between the three kinds of knowledges: local, Indigenous and scientific?
• Which forms of social capital (meso and macro scale) are supportive to which sectors in landscape decision-making and management? • Are both horizontal and vertical links used? • Is bonding favoured over bridging social capital in certain sectors?	• What role does group membership provide in your commitment to looking after this landscape?
• What role does social capital play in maintaining norms? • How does form of social capital support innovation? (norms)	• Do you think trust between people in this community influences the way in which they think about and solve environmental problems?

Qualitative results provided insight into and illumination of the research questions that arose from the numerical taxonomy and other quantitative results. The results from the interviews are reported in five sections that explore the three scales of social interaction, social capital through social networks, social capital through norms of reciprocity and practices of exchange, relations of trust, and finally, the emergent processes that maintain resilience in these complex systems. Each section uses the conceptual model for social capital to define categories and interview questions to explore the processes. The insights offered by the participant's quotes are briefly discussed within each section.

Three scales of social capital

The social capital process develops from the relationship between three elements and is reflected through three scales of social interaction. Micro level social capital is found in the relationships between family members, close friends and neighbours. It is often informal and flexible in interaction, but bounded by slow social and cultural variables that constrain through norms. Micro scale social capital based on bonding links was often the first point of call in the decision-making process for communities of place and identity. In contrast communities of interest and identity usually called on other resources in their decision-making. This contrast demonstrated in Table 4.6 shows explicit differences in the way social capital was used and drawn upon in micro, meso and macro scales with implications for the development of a sense of place.

The first column in Table 4.6 shows that at the micro scale for communities of place and identity, family and friends were the first point of call. At the meso scale of interaction (second column) between communities of place and identity, and communities of place and interest, social networks facilitated business interaction and business advice. At the macro scale (third column in Table 4.6), formal institutions were generally identified (or differentiated) as offering bridging links that used formal and institutionalised processes to generate personal contacts that provided information or knowledge that may be drawn on to enhance adaptive capacity and processes of self-organisation. These links

were particularly important for people with low levels of local knowledge who may work in rural Australia but did not have strong bonding social capital in local communities. In general, communities of place and identity used micro and meso scales of social capital while communities of identity and interest use macro scales of social capital. Trust formed the basis of who or what is used as a sounding board:

Table 4.6 Quotes showing different forms of social capital used by social scales

MICRO: communities of place and identity.	**MESO: communities of place, identity and interest.**	**MACRO: communities of identity and interest.**
"I'd use family and friends"	"we use all the local blokes as well" {private sector agronomists}	"academic references, experiences in my own work life, talking to peers and related people"
"sometimes just talking to the neighbour informally, in town or sporting occasions"	"and of course {the son} finds out a lot at footy"	"the school really was a pathway…into the local community. That was the commonality, those sort of schoolie things."
"we work together, and its not as if everybody knows what everybody is doing but there are a lot of young fellows here and they get chatting to one another"	"A group of growers got together and set up a growers organisation and its just gone from there really…I will ring one of the more proactive growers."	"the literature, journals etc, and then personal contact with other researchers, both nationally and to other people from all over the world."
"we've been to see each others farms, discuss the problems, discuss the solutions, do some of those things on our own farms. Finding out from first hand experience from the guys. By yourself, you can't really do much, but if you band together with other people you find things become more easier"	"if I've got a question for the Ag Dept or the Shire, I would hop on the phone and I would go further with their advice {consultation}."	"If it's about a process thing that's going on, I ring either the Council or the Department of Natural Resources to find out, and I guess I've got pretty good connections locally and regionally if I want information."
"other old farmers, friends around about. I get the Warwick paper every day and I get the Courier Mail twice a week."	"The local Co-op because they have got a lot of information on weeds and seed and projects that people have done."	"there is the political information, talking to some people in the political sphere. It is a bit more than gossip, informal and formal as well."
"probably your local knowledge and you go back to your agents and then they put you onto your representatives in whatever you're dealing with"	"I've got a farm advisor and a couple of agronomists and an accountant, and the wife and the son"…"mostly our accountant. See, I've done farm management courses and none of the others can advise me better than what I know myself, so the accountant gives us a lot of advice."	"I rely on the network of landcare professionals, prefer to get that information from their website or publication or their support person."
"…{neighbours} out on the road, at the cattle sale, at the local functions. That kind of social thing."	"Our local member for political information, regulation and things like that."	"Meetings, being a councillor, that brings you in contact with other people"

Social catchments include a range of social sectors that reflect three social scales in a local place-based context. The interaction between structure and agency links individuals to society to configure and maintain the social components of these landscape systems. The proxies used to assess social

capital in the quantitative analysis are complemented and given form in these quotes. Interacting social scales are not always considered together but this evidence confirms Field's (2003) view that social capital is embedded in local context. While Hofferth and Iceland's (1998) study showed that rural families benefit from strong ties of kinship, the results of this study show that if links between the three scales of social capital are contexted, the knowledge each scale brings may allow the development of bonding capital between scales. This has the potential to develop into iterative interaction between communities of place and communities of identity and interest to maximise opportunities for innovation in the face of perturbation.

Social networks

Social networks provide the tangible evidence of communication in society, exposing the structure of social reality that links individuals, groups and institutions (Ritzer 1996). These networks constrain and facilitate through horizontal links based on reciprocity and cooperation and vertical links characterised by authoritive relationships (Rice 2001). Moon (2001) found that network form and character is a key factor in decision-making within formal and informal links between individuals and groups.

Informal networks

Informal networks link micro scale social capital with a range of other scales. These links are generally quite personal and when trust is generated it is on a particularised basis. Informal networks comprise the bonding social capital within and between networks and are often the basis for the development of generalised trust in horizontal and vertical relationships.

Informal institutions such as the local pub were critical to generating and maintaining personal links that develop outside family relationships. People arranged to meet others that they would not necessarily invite to their home at the local pub. Informal meetings that happened along the roads, in local pubs and sporting clubs were also important to formal relationships and decision-making. These types of informal institutions provided the context for norms of

reciprocity to develop and be reproduced, and particularised trust was generated through exchanges at the personal level:

> one of my friends from the pub, known him for years {response when asked if anyone provides a second opinion before new ideas are tried}

> The bush telegraph system is incredibly efficient, the things you learn in having a yack in a ute parked in the road is more relevant to anything than what you hear from standard government channels

> It is probably worse for me here, because I don't have that many neighbours in regards to potential networking

> It is a kind of continual thing. As long as you have the same people here you are going to {have trust}…They don't just know their neighbours but they know everybody at the co-op, at the shopping centre, everybody says hello…They usually do. They haven't got much choice {in adopting these values} if they want to be part of the community

Informal social opportunities mediated through resources in local contexts are the first point of network development. These informal networks also provide a contexted validation of information and knowledge received from other social scales and knowledge frameworks.

Meso-scale networks

Social activities and clubs played a range of roles in developing, maintaining and re-configuring social capital. Field (2003) noted that the development of this form of meso-scale social capital is dependent on the type of currency, resources and social capital available. In addition, existing identities of individuals, relationships between network members and the norms and culture of the groups are important. Social capital formed through these voluntary associations might on the whole provide resources for micro scale and communities of place but can also provide an opportunity for linking with of communities of identity and interest who might only be contracted to work in a rural region for a few years. These social networks operate through a combination of coalition and conflict and are constrained through social norms.

Table 4.7 Meso scale facilitation of bridging and bonding social capital

POSITIVE DEVELOPMENT OF SOCIAL CAPITAL
"The young fellows get together and talk, they have their fire meetings {Rural Bush Fire Brigade} and they chat when they see each other down the road." (KZ)
"The Bush Fires group is probably a better example than most others...it is where people get a chance to interact, …dangers are real dangers. The training is quite amazing. In terms of working with other people, the training needs to be through quite a number of people in order for the trust to be there. You have to develop direct relationships in order to work with people and in order to build trust. You can't come to it in any other way." (CH)
"Socially see, you've got your basketball, squash, football and tennis and these young fellows get together, and of course, the pub." (KZ)
"I think an important thing to me is {my son} plays football in Nyabing. That's where a lot of people talk." (KZ)
"I think the ordinary government workers fit in very very well in the local community. A lot of them are sporting types and I think they've got real positive input to local communities." (KZ)
{new people in the catchment are welcomed} "just BBQs and that, and a Christmas Party".
FAILURES IN THE POTENTIAL DEVELOPMENT OF SOCIAL CAPITAL
"Most sporting groups, their interests are probably going to be a bit too far away from landscape issues. Something like a Lions Club, they tend to be fairly supportive, and Apex, so any of those Service Clubs are reasonably supportive." (CH)
"they don't intermingle….well the religious people come to the sporting events, but don't seem to intermingle. They sort of have it separated, …if they're involved in the landcare, they do the landcare and they don't discuss their religion."(KZ)
"I don't know what amount of young ones there are…come Friday night they're off and gone to Perth or Albany. You get that with the school teachers and the nurses, its always been a thing, come Friday, 3 or 4 o'clock and they're off and they're gone….its not as if there's nothing to do here." (KZ)

Social capital in the micro and meso scale serves to use local knowledge to assess and evaluate the usefulness, applicability and implementation of other forms of knowledge. At this scale symbolic values appear to be less subjugated and more likely to achieve status of consideration than at the formal meso and macro scales. Experimentation and exploration of innovative approaches can take place within these flexible relationships. Government agency staff members {such as, teachers and hospital staff} gain entry into local communities and are able to build bonding social capital through the social networks in these meso scale voluntary associations.

Institutionalised groups in rural Australia, beyond landcare, serve as on-going resources for the development and maintenance of social capital. They include bridging and bonding social capital, are forged through necessity and comprise diverse membership. Some of these groups such as the Bush Fire Brigades provided regular contact and training with clear objectives and codes of practice and facilitated the development of innovation within a stable institutionalised local system. Primarily these sorts of meso scale voluntary associations acted

as symbolic places to meet, develop relationships and exchange information informally. While these meso scale networks could facilitate exchange of information that is useful in adaptive and innovative decision-making they were not failsafe (Table 4.7) confirming Putnam *et al's* (1993) and Field's (2003) points on the sensitivity-dependent nature of social capital.

As farm incomes are on the down-turn, and changes to the community structure come about as non-farming people move in (Cocklin and Dibden 2005, Gray and Lawrence 2001), traditional social events that provided an informal forum for discussion about farming are used for social discussion. This appears to be the current situation in the Condamine Headwaters:

> All of us ring-ins have trouble coopting and getting involved. There are some very active groups here, mostly based around sport. They work really well, but if you have to coopt help for landcare or something, they don't understand it. So, there is plenty of trust and spirit for football and rodeo….You could name five people who live off the land. They talk about the weather, and how tough it is and how dry it is, but as far as new farming practices, they are more likely to be talking about their other job

This provides a double bind in regional and national scale policy attempts to change landscape practices. Changes in social capital form at micro and meso scales and formal networks based on bridging capital in communities of place and identity has implications for the capacity of informal networks to facilitate information exchange particularly about land management practice.

Social activities and clubs also helped alleviate the monotony and isolation of farming. These meso-scale social institutions were closely linked with agricultural/landscape viability. Not only did they provide a crucial informal forum for discussion but they limited the potential for dependence on drugs and other forms of escapism. These forms of escapism had the potential to lead to social isolation particularly of younger members in farming communities. There was some concern expressed by various participants that when individuals are not integrated into the community they are more likely to develop dependence on drugs:

> a lot of the younger ones now days get into the drugs if they're on their own, if they've got no partners

Macro-networks

Local newspapers play a very important role in institutionalising social capital and maintaining communication links for communities in rural Australia. The quote that follows (and the news stories in Appendix 5) shows the general emphasis on good news and information exchange in news stories:

> We have a local newspaper and … if somebody's doing something, information goes in that and if you've got any suggestions or queries. So, there's communication about different issues. The Shire might have a little piece, so there's always an exchange of information in Nyabing

Solutions to issues are possible because social capital mediates options and opportunities but these are not always straightforward because social norms dictate the way meshing between social capital scales happens. A keen social observer commenting on leadership and interaction between communities of place and communities of identity and interest that have the potential to introduce macro forms of social capital noted:

> within the community there is an unbelievable level of expertise that we don't tap into…we lose a great deal because {they} very rarely are seen to work as a group of leaders together. That network is very important

> they tend to sit on the fence, they don't need to get involved {short-term residents that work for government agencies}

Informal networks that bridge the micro, meso and macro divides introduce solutions that link between macro contexts of government policy and local contexts for appropriate implementation of policy and resources:

> We've had the {local state government agriculture agency representative} involved with the potato growers over the past ten years. The fellow we had in there, he was quite concerned that all this conservation stuff was going to come back and fall on our heads so, the potato growers got together and said well: 'we will have some meetings', you know, 'two or three months apart and have him come out to get all the farmers on that so that they are aware of what could happen down the track', so that they could start to prepare for it and that helped a lot. It brought the community together

Norms of reciprocity and practices of exchange: the capacity of social capital

The conventions of behaviour and standards of value that comprise the social norms of reciprocity and dictate the practices of exchange are acquired through internalisation and socialisation within expectations of mutual obligation between groups of people (Productivity Commission 2003, Abercrombie et al. 1994, Bullock and Trombley 2000). The interaction between social scales reflects relationships between communities of place and communities of identity and interest (Duane 1997 and Cheng *et al.* 2003). These interactions are most clearly evident in contemporary policies of landscape management and new forms of governance currently being implemented in Australia (Lane and McDonald 2005).

New approaches to land management policy such as capacity development serve as an example of the interdependence of communication between communities of place, identity and interest in both formal and informal institutions. The norms of reciprocity and practices of exchange that may facilitate knowledge development and changes in resource use are dependent on both bridging and bonding social capital:

> the government just announced that they are going to put in so many million dollars to help salinity in Australia. I bet you not one penny of it comes through this office to us farmers. It will all go on admin and lectures and consultancy and consultants. The salt problem in this country is just getting worse and worse and worse and nobody's doing anything. Its all talk

> my biggest disappointment is we get projects funded, and they do about twelve months work, but there is no follow up. Fantastic at the start, {but} once again that continuity, long term perspective thing is even more inhibited

> I could never afford to buy five thousand trees every year and then its only the availability of the system they have at the moment through the Federal government which I have been able to access….in ten years down the track you will see the results

Changes in technology and increased participation in decision-making has meant that bridging social capital is bringing new ideas and a diversity of

information to the process. Women were singled out as playing a new and important role in the process:

> I think the role of women on farms is increasing now because they just can't afford the extra worker and now its coming down to economics of scale….they are more involved not only physically but also in decision-making

> I think women are far better at networking. They are out listening, involved in sports, schools. They make good use of their time gathering information

> of course, the school has been at various times the prime focus of community life (by a woman about women)

Bridging social capital was being facilitated through interactive technology but was dependent on bonding social capital for implementation. A wider range of available information means farmers were more discerning and selective about how they used information. Bridging social capital was also being formed with individuals in business institutions via the Internet. It was primarily the role of younger farming women to source information from the internet and build interaction and networks with business connections and advisors in this medium. This was encouraged by the business sector and contributed to other inputs into how decisions were made in the micro-scale of social capital and landscape management:

> you can access quite a lot of things {from the internet}. The Grain Pool and Cooperative Bulk Handling are out there trying to encourage people to use their websites. My daughter-in-law went out a few weeks ago and did an evening course which they actually paid her $70 to do and just so that she was better equipped to get in there and download. Now we can get on the net the next day and find out what was delivered and what the proteins are and what the tonnage was, so that has become quite important

> a lot more partners are working off farm which brings in another sphere of information. The guys tend to travel a lot more further a-field to different field days, doing more communication with the various advisors that come along

Bonding social capital within networks or associations does not guarantee successful integration and implementation of new approaches or ideas and is dependent on bridging social capital to be in place before effective capacity development can happen. This is a path dependent process that requires both forms of social capital and interactive vertical links to adjust macro scale solutions to meso and micro scale contexts. Like social capital, capacity must be used on a repeated basis for trust to be generated if it is to be transformed into capital. Capacity development initiatives will be successful if bridging social capital is interactive through vertical links and if bonding social capital provides a receptive set of norms and relations of trust at micro and meso scales to integrate and implement the new ideas and approaches.

Current regionalisation and changes in governance have reduced sources of funding available to meso scale associations that build bonding social capital and thus capacity in local contexts through boundary organisations (Cash and Moser 2000). The impact is a loss of bridging social capital and a reduction in interaction between social scales and knowledge frameworks:

> you've always got to have somebody coordinating it {landcare}. A group of farmers wouldn't have time to organise all the funding and that sort of thing

> Landcare seems to have a bit of a shelf life. Some people can get so feverish and flat out about it. Then they burn out. The Landcare got a little bit political in that. You tended to find that it wasn't so fair and that some people were drawing more money than others in the way the government set it up

> …a lot of distrust. The agency's budgets are being cut all the time and they haven't got a choice. They've got to go after the same funding that the community is going after and that's creating this tension

> I guess the departments, like the old DPI and the old Soil Con had a very important role to play and had the respect of the community, important change agents. But, the way the departments have gone, that is now lost

This is impacting on capacity, the generation and maintenance of trust and the consolidation of innovation in local contexts. Innovative solutions are more likely to be adopted in situations where social networks and meso-scale social capital are present in the process of social capital development. Sobels *et al.* (2001) found that social networks and meso-scale organisations played a strong role in the willingness and ability of communities of place to adopt new land management practices. Social networks facilitated through engagement in meso-scale institutionalised groups were shown by Kington and Pannell (2003) to be a positive indicator of adoption. Pannell *et al*. (2005) reviewed adoption of knowledge and conservation practices by communities of place from communities of identity and interest and this thesis confirms their contention that "communication, education and persuasion activities" may further abstract communities of identity and interest from communities of place if extension activities are not adequately 'adoptable' (p. 18) The consequences are that decision-making processes that are more dependent on micro scale and informal bonding social capital for adaptive capacity at the expense of the integration of scientific knowledge held by communities of identity and interest.

Social capital is generated through a continuous process of interaction. Institutionalised interaction minimises transaction costs and can facilitate broader inclusion. Adaptive capacity and ability to self-organise following perturbation is facilitated through access to resources and solutions outside of the local context and by well-developed forms of social capital. Interaction at the meso scale links micro social capital with macro scales helping with activities beyond the meso scale. Effective facilitation of bridging and bonding social capital through the meso scale is dependent on institutionalisation and particularised trust that allows the development of informal relationships:

> Once people get into something, it might take a little while to get them interested, but once everybody's decided they're going to do something they will do it. It will even help that area with the landcare now because its brought all those people together and I am pretty sure if there was another project going, it wouldn't matter what it was for they would all come together

> There are a lot of people that are interested and I think its important to keep that momentum and general interest going {landcare}

> I probably only see her once in twelve months {the landcare officer}. She rings up and tells us when there is a meeting on but I've never been to a meeting yet. But, they've been very good because it keeps us up to date with anything that is changing

> {groups} stimulate you to do something. I think they can potentially be driven by landholders, but landholders have got other concerns and whatever assistance they can get they appreciate

The meso scale offers a golden opportunity for the introduction of bridging capital through policy implementation: provide the forum and facilitation (institutionalise the organisation), and over time, through the repeated processes of interaction, bonding capital may develop. Bonding capital within meso-scale association provides the forum for creative and free ranging exploration of alternatives to the slow constraining micro scale cultural variables. This link between micro and macro at the meso-scale maintains resilience in systems if the interdependence is maintained between fast and slow variables.

Adoption of innovation that results in adaptive behaviour is more likely when there is an interactive balance between bridging and bonding social capital. A participant from the Katanning Zone catchment who played a bridging role of vertical links (both formally and informally) but had strong bonding social capital through personal networks and meso scale voluntary association in the local community put it like this:

> The regional process has got pretty toey about whether communications are actually getting back on the ground. There is not enough progress and direction at the regional level…I can play a part in bringing information to people that changes the way they behave with their land…to be more aware of looking after the land. Nothing takes the place of one to one

The role of boundary organisations in the translation of macro scale knowledge to micro scale context, and micro scale local experience to macro scale adaptive learning is critical. The meso scale holds the key to iterative and

engaged interaction that integrates communities and facilitates the adoption of innovation within social catchments.

Changes in governance can mean small populations loose both capacity and social capital. Regionalisation is too far removed from the local context in situations for dealing with environmental issues. The ineffective and top-down use of vertical links in bridging social capital (one way macro to meso) has resulted in a mismatch between scales for communication, evaluation and adoption. In this style of governance, the capacity and form of social capital is to some extent dictated by formal macro institutions (politics of interests) and the interaction with other scales is limited to bridging social capital that is largely authoritive in form.

Relations of trust

Gaining access to certain networks is dependent on trust and is not necessarily a consequence of shared norms. Trust, through the dynamic of re-enforcing characteristics can become the defining characteristic of a system (Field 2003, Schuller *et al*. 2000). Moral trust reinforces institutions of mutual exchange while organic trust reinforces institutions of social cohesion (Entrikin 2003). The interaction between these particularised and generalised norms of trust result in robust social systems that are confident in social organisation (Field 2003). This integrates values developed at the micro scale with more generalised values in other scales forming the basis for social consensus and the legitimation of social systems founded on trust of authority and governance at abstract scales (Siisiäinen 2003). This system of trust is effective in the maintenance of democracy through both legitimation and through institutionalised distrust which provides the checks and balances (Entrikin 2003) necessary to maintain and re-configure systems in the face of perturbation

The role of social capital in maintaining trust

Formal institutions were generally identified (or differentiated) as offering bridging links/ ties that use formal and institutionalised processes to generate personal contacts that provide information or knowledge. Failures to maintain the processes of regular interaction have consequences for meso scale social

capital and thus impact on relations of trust and the norms of reciprocity and practices of exchange. Once social networks based on either bridging or bonding social capital are broken, the introduction of creative approaches via bridging capital into a system is hampered, limiting the transfer of information and potentially reducing resilience (Table 4.8).

Table 4.8 Trust and legitimacy: successes and the potential for failure

TRUST AND LEGITIMACY: Successes
"Trust in the group has been built by interaction with each of the members of that group and my growing understanding of how they think, what it is that is making them say certain things. A long process. I know where they're coming from, what I expect from them…it does have a great deal to do with that trust, that interaction."
"well we just got into the trees together through the landcare group." {small scale planting and production enterprise between neighbours}
"…mostly volunteers {from Perth, over 300 kms away}. We ring them up and they come down for the weekend, about half a dozen around for the weekend, and they put in quite a few {trees}. They're quite handy." {tree planting for amelioration in salinised landscapes.}
"I think the LCDCs {Land Conservation District Committees} are fairly strong. They were very much on-ground and each little catchment had its own ownership and I think that's been an important part."
"A lot of the projects that have gone and developed in that area have been as a result of those shed meetings" {organised through the landcare groups and soil conservation officers}.
TRUST AND LEGITIMACY: Failures
"you lose momentum and the awareness. I would think you could go for two or three years {without a landcare coordinator} then you have problems. Getting more support back together in terms of catchment coordinators and the community to trust them again to build up that relationship"
"I had a much more of a leadership role. I can't afford to do that now. The landcare support has been reduced as well, so they are floundering a little bit on their own at the moment. A lot of funding has gone to these groups {regional bodies}".
"he was excellent {agency staff member involved in agricultural activities} and now he's moved….as soon as you get one good one they go."
"there is now a concentration of staff in large urban communities and with those changes you don't have the same relationships with {local community groups}, school, the church, sporting clubs, children. ..{we}.. were an integral part of the community."

While much doubt has been expressed on the potential and ability of policy to develop social capital (Portes 1998, Field 2003) once social capital is conceptualised as a process of interacting elements across scale, then the implications of links between social capital at the macro scale with those at meso and micro scales are obvious. While there is no guarantee that particularised trust will generate bonding capital, resilient systems require the parameters of generalised trust to be maintained in order for the 'radius of trust' (Fukuyama 1995) emanating from process-based institutionalised interaction to perform the wonders of benign impact. There is a tension between particularised trust generating social consensus and institutionalised distrust (Siisiäinen 2003), which provides the guidance from micro and meso scales to

macro scales of governance that provides context for policy development and direction. The political process operating in natural resource management provides opportunities for macro scale hierarchical authority to implement and structure outcomes, but micro and meso scale players still hold sufficient power in the situational context to veto actions (Moon 2001).

This interaction of power operates between coalitions that require agreement horizontally to maintain the relevance and effectiveness of sanctions. Social movements, such as meso scale landcare, operating as coalitions often work as a destabilising factor in the integrative functioning or normative roles of the *status quo* of macro scale institutions through their veto power (Siisiäinen 2003). The management of conflict in democratic political systems such as the new forms of governance in Australia functions through the prioritisation and foregrounding of some issues over others. Thus, subject groups form through reaction to the *status quo* and subjugated groups are formed in the process of silencing.

New forms of governance and increasing requirements for local scale representation on a diverse range of institutional bodies (formal and vertically linked to micro and meso scales) has reduced attention to context and the conservation of bonding social capital that provides legitimacy. Bridging social capital is more effective within contexts of existing relations of trust and social communication built through politics of place through bonding capital. The best governance at one scale is ineffective at another if interactive participation is not in place as the *status quo* norm. Bridging social capital is useful for short term gain such as planting trees quickly, but developing and maintaining other forms of social capital requires a degree of institutionalisation (rather than bonding) to build and consolidate bridging social capital. Commitment to this process is required in both directions of vertical links, from the micro and meso scales to the macro scale and from macro scales to meso and micro scales. If relations of trust tend toward generalised forms in local contexts, then resources provided through bonding social capital are lost to the process. Particularised trust enables the development of bonding social capital:

> Every community member has to participate in the decision-making process…{like} make sure we vote in local elections….about being able to interact within that community

> We have a meeting there every month, so it's a way of coming together and building up….meetings are formal…we always have our councillors at the meetings and we get reports from the council and reports from the P&C, and the Parks and Gardens

Boundary organisations (Cash and Moser 2000) operating at meso scales are a necessary part of the development of trust and links between communities of place and communities of identity and interest but have been dismantled or disempowered and marginalised in the new forms of natural resource governance. Macro scale legitimacy is dependent on meso and micro scale allocation of credibility. In every imposition of power there is a reaction (Foucault 1980). While social structures operating at the macro scale (such as government institutions) claim to be representing a national situation (governance in natural resource management and policy application) this is only effective if bridging links afford cross scale interaction that reflects social consensus. This consensus is dependent on particularised and generalised trust. Ineffective implementation of policy reflects a decline in generalised trust and ineffective cross scale bridging interaction:

> I would like to see a return to our regional advisory bodies. The word is not getting out there. We're only meeting twice a year and we've just lost touch completely

> I think its {the new regional body for the National Action Plan for Salinity Management} probably going to be another level of bureaucracy. If we can actually get good representation on it, it will be good. This new body is totally different to the old body and they are a total different group of people and you just get to have an understanding with them and they get to understand your problems and then the politicians and the bureaucrats in Canberra change the ball game, bring in a whole new set of people. Its been very demoralising for people on the ground

> we used to have LCD {Land Conservation District Committee meetings} every two or three months. We'd go out and have a meeting on a farm somewhere and we used to encourage them to come along. I used to know personally virtually all the staff in there

> {government agency for agriculture} and I go in there now and I know virtually nobody

> I think it's a bit of a retrograde step. What they've done in the past has worked well, hands-on right from the start {local people}….now not a lot, through the local landcare office and only what we read in the paper

The role of sanctions in maintaining trust

Sanctions applied in both prescriptive and proactive terms are used to maintain the norms of reciprocity and relations of trust in the social capital process. At the micro scale of social capital, trust is active in only some parts of the relationships with local friends and neighbours. Farmers are often thought of in one sense as individualistic and independent, but at the same time, part of a close-knit community. Trust performs a distinct role in the generation of a shared set of norms that contribute to integration but doesn't extend to blurring boundaries between individuals. Bonding social capital has distinct boundaries and limits. The notion of competition was still keen and the differences in values were evident:

> whatever they tell you at the bin at harvest time, you cut it in half

> I think its practical stuff. The most difficult way of getting engaged is philosophically, because there is always a point where your own politics and values aren't shared. I find that a lot of the farmers in particular tend to find that more of a reason for distancing than I would, a sort of barrier…but if you are fighting a fire and standing next to someone protecting somebody's property within a fire team, it doesn't matter, those sorts of things are put in perspective

> We've had big trouble with stock theft so we went out of sheep for that reason….someone locally who knows what they are doing. The last four years we've lost over a thousand sheep

> You've got to make up your own mind. Use common sense. You've got to do what works for you

Disasters such as wildfires, offered a reason to help neighbours but the kind of help varied and seemed to be connected to the strength of bonding social capital coupled with economic capacity:

> I can tell you about fire, because my father was pretty badly burnt but he didn't lose any of his place, we saved his place….I believe there would have been some helping out, there is no doubt about that, but at the end of the day, you've got to look after yourself

> There's a point at which all the help in the world is available but if you are not going to help yourself it will stop. There is a point there that is everything's fine, but I think you go it alone. I wouldn't expect that if our farm was going under that our neighbours will come and help us out. If a tragedy happened on the farm, I'd expect there would be help and I know that there would be help, I trust very much that there would be help, but financially or economically if things were going down hill, I wouldn't expect our neighbours to help

Informal networks provided a critical opportunity in the generation of trust.

Meso scale social capital was developed through bonding between individuals within institutionalised activities that generate social capital. This was the forum in which people with bridging social capital may introduce new ideas and experimentation can happen through tight links of fast variables with minimum risk of perturbation to the system as a whole. Decision-making in landscape management happens through the status of influence in a system of trust accorded to key peers and the need to conform to the dictates of social norms:

> It's been a sort of peer group pressure thing. Farmers getting grants for trees and fencing and their places starting to look good. It was a role effect

> We do trust between one another, but it took just one farmer to break that trust and spoilt what had been a fairly honourable system and now we have had to change it

> As soon as we see a newcomer even look like coming in here, we've got to bring him into the group and teach him a lesson or two. Make him fit in, because just with the few bits around, if that grows, if we don't educate them as they come in then, we lose it

> During the worst water restrictions of eighteen months ago, in the morning light you could see the water {being flood irrigated illegally}. But, was I going to talk to anybody? No, …{not} until its politically correct and until its valued…I don't have an activist view!

Meso scale social capital in these catchments was evident in informal meeting spaces such as friendship networks, sporting and social clubs as well as through catchment and landcare groups, service groups and other community organisations.

Macro social capital and politics of interests

A key disquiet from communities of place and identity relates to what appears to be continual change in regional and national contexts (communities of identity and interest) that form the macro scales of social capital. This constant re-configuration dissipates social capital because changes must be consolidated and institutionalised to allow the repetitive processes that generate and maintain social capital:

> Once you get boards, then you get pressures from different political parties because they will sit and take it whatever way the like. Nothing is ever going to change that way {the continual process of change in politics of interests}

The reactive exercise of power is visible in the way in which legitimacy is allocated at micro and meso scales. Social capital at the micro and meso scale, once generated can be re-configured in the face of changes at the macro scale, but in turn the legitimacy of macro scale power is dependent on approval achieved through fairly constant evaluation at the micro and meso scales with implications for current ideals of transparent liberal-democracy (Warren 1999). Community voices, or communities of place and identity react to the exercise of power and this voice is mediated through lobby groups and formal political institutions:

> they created these new zone control groups which only meet twice a year which are really paper tiger groups because we no longer have that intimate involvement. The on-ground community involvement, knowing what they were doing and how they were doing things, and it was just a total bonding. We feel as though we don't have any ownership anymore. I think its actually coming from the bureaucratical side, not actually {the elected representatives}. I think the bureaucrats in general have a fear of community involvement (community of place and identity talking about politics of interests)

> they're saying they want community involvement but they're being very selective about who the community is and they don't actually

> want a lot of on-ground community. They will choose one or two people who might be very selective people as well, so I think we're in for a rough ride (community of place and identity talking about politics of interests)

Credibility and legitimacy are intricately bound with the notion of trust. The activities of politics of interests are not automatically afforded legitimacy and credibility by communities of place and identity (Vanclay 2004). Trust between these two community sectors is built to form bonding capital but is dependent on meso scale and institutionalised activities to facilitate the establishment of bridging capital upon which the trust might be generated.

Formal sanctions through legislative powers are used to maintain formal legal systems, but they can also be applied for informal reasons and through informal means:

> If you buck the Shire, it's like being nasty to a copper. He'll probably pull out his book and book you. So, what you do with Shires' is if you take them to task over things, you've got to live here, and you don't want to make waves, because next week they will have the health inspector there checking your house. So, you've just got to sit back and wear it

> There are strict rules {about land management} but they are hard to enforce. It's all a game of bluff to the extent that you can be very honest with them in that I just tell them: 'you know we can give you a small penalty, but that's not what's going to hurt you. The person who is going to hurt you is going to be the guy next door who sues you

> There's a lot more public awareness. The farmers are getting more aware of how the general population sees them as well as the impacts, so they are very careful not to upset people. Plus, they live in small communities. Everybody else knows. It is a game, always steering them in the right direction

The tension between solidarity and self-interested individualism are exploited by macro, meso and micro scales. The dialectic between normative and atomistic conditions ensures the expectations in the relationships between formal institutions and informal relationships are a dynamic negotiation in an active and continual re-configuration of social capital.

Conclusions

Social capital can provide an insight into the parameters of resilience in rural agricultural social systems. The social capital processes that configure, maintain and re-configure social catchments interact dynamically across micro, meso and macro social scales. Social networks, norms of reciprocity and practices of exchange, and relations of trust form three interacting elements of social capital. These scales and elements drawn from theoretical and empirical literature formed the basis for the conceptual model used to operationalise the quantitative and qualitative approaches to understanding the role of social capital in decision-making in these linked socio-ecological landscape systems.

Social networks arise through systems of personal relationships that expose patterns of communication and provide the tangible form of social capital through social networks. Social networks enable cooperation within and across the three social scales through formal, informal and institutionalised relationships in social catchments. These networks draw on a range of resources from other individuals and social scales and can contribute new ideas that are helpful in adaptive behaviour, but may just as easily limit change through social sanctions that maintain a *status quo* system.

The role of social networks in maintaining and configuring approaches in land management was assessed through family and informal friendship relationships at the micro scale. Where there were opportunities for communities of place and identity to draw on family and close friends or neighbours in their decision-making, they were usually the first point of call. In situations where extended family were not available, as it was found for communities of identity and interest, or communities of place and interest, decision-making usually drew on meso scale social capital through the institutionalised opportunities for social interaction provided in collective organisation such as sporting groups, landcare groups and other social associations. Social networks within social catchments were also able to access macro scale social capital through professional and political organisations operating at national and international scales.

The results indicated that in Katanning Zone where there were opportunities for social interaction between communities of place, identity and interest within the context of place, and this has made the facilitation of innovation and thus adaptive capacity more likely. Katanning Zone had a wealth of innovation and a positive overall attitude to the future despite the impacts of rising salinity. The degree of alienation expressed by people in the Condamine Headwaters was sometimes startling and disturbing. The qualitative analysis indicated that a lack of contact with macro social scales appears to have hampered access to scientific forms of knowledge and innovative approaches to issues in land management.

New forms of governance for resource management in Australia exemplified the relationships between abstracted policy development and local land management practices. Policy developed by communities of identity and interest acting in an abstracted politics of interests is not automatically adopted by local communities of place and identity who act or react within a politics of place to these policy decisions. Informal and locally contexted social networks provide validation of information and knowledge received from other social scales. Social capital developed by boundary organisations and institutionalised groups beyond landcare may serve equally effectively in mediating the relationships between communities of place and communities of interest.

Social networks develop social rules through consensus or through coercive influence to form norms of reciprocity and practices of exchange. These norms coordinate the processes of exchange and reduce transaction costs usually incurred in formal procedures. The atomistic and normative principles of reciprocity establish the practices of exchange and may be particularised within relationships or extend to generalised behaviour in anticipation of future exchange.

Results show that the norms of reciprocity and practices of exchange are dependent on the presence of both bridging and bonding social capital within a place context of social catchments. Bridging social capital provides the innovative capacity while bonding social capital provides the adoption capacity.

If the bridging social capital provided by communities of identity and interest is absent from a social catchment then bonding is the sole resource upon which communities of place and identity may depend. This operates as a slow variable using cultural norms as a basis for decision-making but is weak in innovative and adaptive capacity in the face of perturbation. In addition, the capacity of a social system to integrate adaptive land management policy is hampered because social learning usually acquired through the iterative interactions between abstract and local contexts of decision-making is weak.

Where there was active engagement between communities of place and identity and communities of identity and interest there was increased innovative capacity. Katanning Zone exemplified the adaptive capacity of these social systems reacting to situations of extreme perturbation while the Condamine Headwaters participants indicated that their lack of access to communities of identity and interest was limiting their capacity to adapt to changes in land management practice wrought through socio-demographic and economic change.

Order and cohesion in social systems is maintained through norms of interdependence, cultural values or relationships of power that have as a basis the third element of social capital, relations of trust. Trust rests on mutual affection as well as on instrumental reciprocity. Access to social networks is dependent on trust, but not necessarily a consequence of shared norms. The dynamic and re-enforcing characteristics of trust become a defining characteristic of social systems forming differing concepts of inclusion and exclusion. Like norms, trust can be either particularised, operating within the individual relationships in networks, or generalised trust which arises when there is confidence in a social structure that results in trust of people previously unknown and situations unencountered reaching beyond the limits of short-term interests. Trust acting with institutionalised distrust is a key dynamic that maintains western democratic political systems (Entrikin 2003).

Results indicate that trust operates in different forms at different scales. Trust is an integral part of the development of bonding social capital with local context

social scales by performing a distinct role in the generation of shared norms that contribute to integration. This form of trust was generated through informal networks in micro and meso scales. Once social capital is generated at these scales it can be re-configured in the face of changes at the macro scale, but in turn the legitimacy of macro power is dependent on credibility accorded at micro and meso scales in local contexts. The tensions in trust between communities of place and identity and communities of identity and interest were exemplified in the quotations that addressed relationships between government agencies and farmers. Power was exercised in a reactive dynamic between the three social scales in a tension of collective solidarity and self-interested individualism. The presence of strong meso scale social capital can afford opportunities for creative and free ranging exploration of ideas that capture innovative approaches offered through bridging capital linked to macro scales. This offers alternatives to the slow constraining cultural variables of the micro scale.

Social capital is a process that can provide resources, but will only be effective if considered as part of an interactive dynamic across three scales. The emergent characteristics exposed by this inquiry into social capital comprise the iterative interaction between the micro, meso and macro social scales. Bridging and bonding social capital are a necessary presence to provide innovation and consolidation of adaptive capacity. The ability to self-organise through access to resources beyond the local context provides consolidation and contextualisation within place. This constitutes the resilience in these complex adaptive systems. The tension between particular and generalised trust is an emergent characteristic that provides checks and balances for policy processes developed at abstracted scales through the politics of interests. These checks and balances are only effective if they form part of the interactive communication process between local contexts and abstracted interests.

In general, if devolved landscape governance engages more professionals (representing communities of identity and interest through environmental service groups) than it does communities of place and identity in local contexts, then special attention is required at the micro and meso scale. The introduction

of bridging capital through these new forms of natural resource governance will require consolidation if they are to provide adoption of innovation through the bonding links within and between micro and meso scales. When levels of group membership were lower, there were indications that trust was also lower across all social scales at the local context. Bonding social capital was less evident and provided insufficient resource for the consolidation of innovation that is potentially available through bridging capital. Using boundary organisations and other forms of meso scale social capital within an iterative and dynamic communicative framework may help overcome some of these potential problems for governance in landscape systems.

Interactive and dynamic relationships across three scales are a key consideration for linking communities of place, identity and interest in the process of social capital. These contrasting constructs of social capital in communities indicate the need for social capital to be considered in planning changes to landscape management. Strategies related to landscapes or places are dependent on the structures of relationships between the people involved. Social capital contributes at three scales to the implementation of strategies in landscape management: the micro, encompassing familial relationships, the meso, encompassing organisational support structures and the macro which links institutional arrangements from regional representation to national representation in governance terms. This research adopted these scales to portray the process of social capital. By using this range of social scales, in addition to the explorative analysis that provided through numerical taxonomy, revealed diversity. This approach overcomes the necessity or desire cautioned against by Stone and Hughes (2002) to collapse differences. The emergence of the statistically significant vectors to portray dichotomies of social capital in the two catchment communities, made explicit by the voices of participants through the interviews, provided a validity check for the theoretical assumptions that underpin the central tenets of the conceptualisation of social capital portrayed in this overview.

Current issues in Australian agricultural landscapes challenge society's capacity and will in problem solving. Solutions and adaptive management require access

to diverse resources that are channelled through the processes of social capital. Norms of reciprocity and practices of exchange are dialectically formed in relations of particular and generalised trust. Social networks linked horizontally and vertically within and across three social scales facilitate the creation, maintenance and re-configuration of social capital. These interactive, adaptive and responsive processes reflect the dynamics of a complex system that links people with the landscapes in which they live.

Linking sense of place and social capital to discourses of the environment

Sense of place gives an indication of the range of values that frame people's relationships and commitments within landscapes. Understanding these relationships is contingent on understanding the social capital processes that draw people into and constitute social catchments. Both sense of place and social capital share a requirement for context.

Social capital is developed, maintained and re-configured through social norms and networks in a range of social institutions and structures. An investigation into social capital through the lens of interacting dynamic relationships in a social catchment provided insight into the constituents and processes of social capital. The maintenance and reproduction of these dynamic structures is achieved through a prevailing practice that is defined and identified through a discourse held in common. Flora (1998) investigated networks and their relationship to change, innovation and resilience in communities and found that the social norms and values that accompany and define social capital are also responsible for delimiting discourses of the environment. Inkeles (2001) investigated the value orientations of trust, individualism and materialism in social capital and found that civic engagement, and thus the implementation of environmental solutions, is historically contingent and is embedded in social and institutional contexts. To identify the social constituents important in the social dimensions of land management at the landscape scale this thesis linked these discourses of the environment to the social capital that maintains and supports people's commitment to a place.

5

Discourses of the environment

Introduction

Over the past decade a worldwide concern that represents environmental and ecological issues as critical factors in socio-economic development has emerged. Forums from international to local scales are considering the environment-development relationship and the environmental discourses that frame practical policies and political debates (Haque 2000). Increasingly, coalitions of interests are forming to debate the relative merits of different forms of economic, governance, social, agricultural and ecological management systems in implementing policies on 'the environment'.

The previous two chapters show the links between the relationships people have with the diverse elements that make up landscapes, and the way in which their social relations maintain and configure those relationships. Sense of place provides an insight into the thematic elements (social, symbolic and economic landscape value sets) that contribute to perceptions of the local social and natural landscape. Social capital is developed, maintained and re-configured through the social norms and networks in a range of social institutions and structures explicitly linked and contexted in the local landscape. This chapter aimed to understand the way in which people's ideals, ideologies and practices configure, maintain and reproduce these relationships between place and people. By exploring and defining discourses of the environment in each of the two social catchments in this study, this study aims to make sense of the conflicting stories that people use in decision-making. These stories represent their interdependence with and the state of the landscapes in which they live.

Historically a diverse range of discourse analysis approaches have been applied. Some discourse analysis focused solely on the structure and form of language while other forms focused on the ethnography of communication. The analysis of language has been limited merely to actual words or more broadly to capture the discursive systems underpinning language (McHoul and Grace 1993). In the social sciences discourse analysis emerged from historical roots in the analysis of ideology, rhetoric's, the sociology of science and language philosophy to form a post-positivist interpretive tradition (Hajer 1995).

Language is a cultural tool that is formed from a set of systematised and formalised metaphors. These present as theories and guiding principles resulting from a negotiation in open systems that comprise dialogue that ultimately represents a position derived from ideals, ideology and practice. Analysis of discourses of the environment reflects an attempt to make sense of contradictory and conflicting environmental issues. These discourses represent the decisions about the relationships between scientific, moral and aesthetic truths and their form of expression. Discourses have socially shared meanings derived in a context that embeds individuals within the "fabric of a culture" (Harré, 1999 p. 4). The common threads forming each distinct discourse are the

way in which environmental concepts are created, negotiated, maintained and reproduced to encompass thematic levels of temporal, abstracted global and contexted local concerns. Discourses are recognisable by the distinct conventions through which they are defined and exposed (Harré *et al.* 1999).

To understand the role of discourses of the environment in constituting, maintaining and re-configuring people's relationships with landscapes two layers of theory are explored in this chapter: the first relates to the construct of an environmental discourse, and the second, relates to the construct of discourses of the environment. The first explores the elements that comprise an environmental discourse and the second explores the way in which different discourses of the environment relate to form distinct environmental positions across a negotiated continuum. The research in this chapter aimed to identify the way in which discourses of the environment direct, facilitate and constrain the decisions people make in the management of landscapes. Research questions included:

- What elements and scales are considered in theoretical and applied literature to comprise environmental discourse, and discourses of the environment?
- What questions and tools are necessary for identifying and describing environmental discourse?
- How does environmental discourse differentiate the three categories of the community: place, identity and interest?
- What environmental discourse variables can be identified as emergent characteristics of rural agricultural landscape systems?
- What processes can be identified through the quantitative and qualitative approaches that define the role of environmental discourse in complex adaptive systems?

This chapter comprises three sections. The first develops a conceptual model for environmental discourse through a review of the theoretical and empirical literature. This model provided the basis for developing a means for exploring discourses of the environment through a quantitative questionnaire survey. This survey was analysed through reliability statistics and numerical taxonomy, and

the results provided the focus for further qualitative exploration (section three). The qualitative results are expressed through quotes that represent the voices of the participants in each of the social catchments. The conceptual model and the results from both the quantitative and qualitative exploration provided the means of identifying the emergent characteristics and processes emanating from discourses of the environment that constitute these complex adaptive rural agricultural systems.

Section One: Development of a conceptual model

Environmental discourse: the conceptual elements

The concept of a discourse is a tool used to examine and define social form and functions (Abercrombie *et al.* 1994). Discourses are the form and function of a paradigm and the means by which differentiation is made with other paradigms and discourses. The elements that comprise a discourse represent a negotiation between the individual, society and the environment in both constraining and enabling form to form a domain of discourse (Hajer 1995). These elements represent personal ideals, the ideology of both individual and society, and the practice that is accepted within the confines of society. By using this stratified ontology to explore the construct of a discourse it is possible to acknowledge the interaction between the 'real', the actual' and the 'empirical' (Bhaskar 1978, Chalmers 1994, Sayer 2000). The 'real' represents the ideals of a philosophical framework that integrates necessity with the possible and the potential. The 'actual' represents the relationship between power and the ideology of practice in a personal philosophical framework. The 'empirical' integrates observable with unobservable concepts through the negotiated daily practice framework.

In this way, an environmental discourse represents a negotiation between an individual's ideals, their ideology and the realities of enactment of power in everyday practice relationships. More importantly, in the context of this research, this conceptual model gives primacy to neither the material nor the symbolic elements of landscapes, thus allowing a further integration and interrelationship between the three value sets of sense of place described in

Chapter Four. Symbolic elements comprise culturally bound judgements of interpretation and classification. Material elements comprise objective reality that is physically observable and measurable in consistent and predictable format (Harré *et al.* 1999). These two elements provide insight into environmental discourse and discourses of the environment.

A framework of rules for practice

The rules that delimit a discourse pertain to the production, content and circumstances of statements. This ensures that practice is simultaneously "material and discursive" (Kendall and Wickham 1999 p.42). Discourses may be identified as individual by both the "linguistic system to which they belong and the identity of the subject which holds them together" (Foucault 1991 p.54). In addition, the dynamic of "new utterances" must consider three further criteria according to Foucault (1991):

- all concepts and theoretical positions in operation
- the extent of internal modification possible and the boundary threshold of the discourse; and
- the relationships held with other discourses indicating the non-discursive context of that discourse.

Within each of those positions, the rules that exemplify a relationship with nature and the environment makes explicit each environmental discourse.

Conflict

Inherent in the study of relationships (in this case the relationships between discourses of the environment) is the study of conflict which imparts insight into differences between people, and the locus of difference. The structures of consensus and trust within an environmental discourse develops as a consequence of struggles between conflicting interests. These internal power structures "play a central role in the selection of those issues and interests that are allowed to enter the political arena" (Siisiäinen 2003 p. 188).

Struggles for the imposition of dominant principles such as those constructing positions held by the *status quo* revolve around the notion of legitimacy defined by the social position of actors (Bourdieu and Wacquant 1992). The politics of

universal values revolves around the notions of interest as opposed to disinterestedness and indifference. These values held by groups of people sharing the same discourse of the environment are durable, but constantly reinforced or modified through changes wrought by contest and experience (Bourdieu and Wacquant 1992). Environmental discourse is the expression of political conflicts of interests and identities and captures the defining elements of social capital: norms of reciprocity, social networks and relations of trust (Warren 1999). Environmental discourse is formed, differentiated and identified through different expressions of conflict:

- Cognitive conflict in which people have different definitions and judgements of a situation;
- Values conflict in which goals and outcomes are in dispute;
- Interest conflict in which the relative cost and benefits of a situation are considered; and,
- Relationship conflict in which there is a contest and resulting winners and losers in the exercise of power (Duane 1997).

The expression of the struggle for power to define legitimate positions is captured through explicit and implicit symbolic power that transforms knowledge to truth and then to power and is articulated in narrative and metaphor.

Knowledge

The relationship between ideals, ideology and practice at the individual, societal and landscape scales in mediated by three further modifiers: knowledge, truth and power. Knowledge refers to more than technical knowledge and eventuates in relation to social, historical and political conditions that mediate accreditation, legitimacy and authority (McHoul and Grace 1993, Hajer 1995).

Knowledge may be in Indigenous, local or scientific form and may thus represent distinct positions within a power dynamic in landscape management in Australia. Knowledge may also be configured to serve the interests of coalitions of interest (Brown and Pitcher 2005). Knowledge is used in a “wide sense to mean any understanding” (p. 81) derived through the inter-subjective communication of language or through sensed imagery in an interaction

between internalised values and norms (the individual scale), external reality (society) and the environment (Midgley 2000).

'Truth'

Once knowledge is accredited, it forms a central core of a discourse as a 'truth'. This definition of truth integrates scientific, moral and aesthetic positions that may be used as linguistic devices to present and represent certain positions. Frequently certain metaphorical devices are used to form and represent signifiers for scientific knowledge represented as a truth justified in moral and aesthetic form. Truth is thus the manner in which assertions are accredited and matched within the limits set by the context of the domain of discourse.

This form of truth acknowledges certain realities and dismisses others partly as a function of the concepts and intellectual stock available within the particular domain of discourse (Harré *et al.* 1999). This notion of truth correlates distinctly with the conceptualisation of scientific paradigms formulated by Thomas Kuhn (1988), but applies equally to Indigenous and local knowledge forms.

Power

The truths of domains of discourse are mediated through relations of power. Power, this third mediator in the formation of environmental discourses is the domain within which knowledge is contested as truth or dismissed as oppositional. Power needs to be transformed to right[36] and obedience into duty[37] to be effective, and power achieves legitimacy only through acceptance of both those holding power and those subjected to power (Foucault 1991, Bullock and Trombley 2000).

Power is defined relationally through the actions of actors rather than as an institutional feature. Institutions provide the means through which power is

[36] "Rights derive ultimately from what are perceived to be the vulnerabilities of certain classes of beings" (Harré, R., Brockmeier, J., and Mühlhäusler, P. (1999). *Greenspeak. A Study of Environmental discourse*, London: Sage p. 179).
[37] "Duties accrue to people just insofar as they have certain power or capacities" (Harré, R., Brockmeier, J., and Mühlhäusler, P. (1999). *Greenspeak. A Study of Environmental discourse*, London: Sage p. 179).

enacted and discourses reproduced (Hajer 1995). Power thus forms the interactive relationships between the subjugating, the subjugated and the subject[38] (Guattari 2000). Power is thus about representation as a process rather than the material content of an individual or institution (Hajer 1995).

Discourses of the environment

Discourses of the environment represent the link between natural and cultural ecosystems in a critical metadiscourse. This conceptualisation exposes the activities of normal science and institutionalised metaphors that govern new forms of practice and new identities of science in an ongoing contest between Enlightenment and Romantic relationships between people and 'nature' (Harré *et al.* 1999, Finke 2001).

Discourses that pertain to the environment exist within a range of fields and disciplines, both in support of and in opposition to forms of ideology and practice (Dryzek 1997, Harré *et al.* 1999). All those who are engaged with environmental decision-making at the landscape scale can be categorised as adherents to one or other environmental discourse with implications for practice in landscape management at a range of scales.

Environmental discourses contexted through temporal and spatial scales

The role of micro and meso scale social capital has already been shown in Chapter Four to be important in the process of decision-making. The norms that are evident in discourses of the environment have an impact on the way discrete discourses of the environment define problems and solutions over ecological, environmental, social and cultural time scales.

Discourse is a "domain of language-use that is unified by common assumptions" (Abercrombie *et al.* 1994 p.119) in the conventions that classify and represent competing positions within fields or disciplines. Convictions that

[38] Subjugating, subjugated, subject groups as defined by Guattari (2000) to denote the interactions between the holders of power (subjugating) and their power over marginalised (subjugated). The third group, subject groups, choose to construct their own group identity through commonality.

frame general beliefs about the nature of reality are bounded by “whole sets of ideas, words, concepts and practices” (Benton and Short 1999). The discourses of the environment being explored in this thesis are explored through the use of ecolinguistics as a means of identifying the frameworks and norms that constitute these frameworks.

Ecolinguistics: Romantics and the Enlightenment.

The investigation of language is a key part in understanding human relations with the environment (Harré *et al.* 1999). Language provides the link between natural and cultural ecosystems in a critical metadiscourse. Investigating discourse through language exposes the activities of normal science and institutionalised metaphors. These ecolinguistic systems of expression govern new forms of practice and new identities of science that challenge Enlightenment and Baconian formulations of relations between people and the environment (Finke 2001, Harré *et al.* 1999). Language is a shared domain through which actions are coordinated but understanding is distinct to each individual understanding. Language links Rational and emotional domains in which realities are co-constructed (Midgley 2000). Language is an example of a self-organising system. The distinct structure of a language enables communication but functions within diverse circumstances adjusting and adapting meaning within context (Cilliers 1998).

Ecolinguistics enquires into discourses of the environment through:

- the discovery of dialectical motivations of symbolic relations between people and the environment,
- the common sense that defines the dialectic forces, and
- the discursive sense created between people and nature (Carbaugh 2001).

The symbolic contrasts chosen and the systems of meanings associated show communications as anchored messages in physical place (Carbaugh 2001). Language and discourse moulds the socio-political context in much the same way as social context shapes discourse (Doyle 2000).

By examining the rules that delimit the production, content and circumstances of statements in a discourse it is possible to explicitly identify discourses of the environment (Foucault 1991, Kendall and Wickham 1999). The value in defining discourse in this way lies in identifying the distances, the differences, the oppositions, the divergences and the relations between discourses within a period. Discourses that pertain to the environment exist within a range of fields and disciplines, both in support of and in opposition to innovation (Dryzek 1997, Harré *et al.* 1999).

All those who are engaged with landscape management can be categorised as adherents to one or other environmental discourse with implications at the catchment and landscape scale. The inquiry into how language frames the definition of place and landscape management in the social catchments in this study will provide the rules that delimit and frame landscape management in practice.

The conditions and context for discourses of the environment

Macnaghten and Urry (1998) have identified four conditions, all socially constructed, which provide context for discourses of the environment:

- the notion of stewardship providing for intergenerational equity within a locale;
- maximising returns through instrumental appropriation from natural resources identified as nature in contradistinction from society;
- subjecting the environment to systematic intervention and regulation as objectified in scientific investigation; and,
- appropriation of nature as aesthetic in the form of consumption of landscape.

Each of these social domains are unified by common assumptions that are identified through examining four components of discourses of the environment. These are:

- the basic entities (or ontological assumptions);
- relationships considered natural between people and the environment;
- the agents and their motives in action; and
- the metaphors and rhetoric that make the claims (Dryzek 1997, Macnaghten and Urry 1998).

Conceptual pairs: defining nature

The intersections of explicit practice extend across a continuum of ecological through to technological environmental discourses within white, western expectations, but fall short of an acceptable Australian Indigenous context. Benton and Short (1999) mention binaries that frame the continuum, which include those of:

- time as cyclic or linear
- explanation as divine or scientific
- living and non-living values as intrinsic or nature as objectified
- interdependence or the separation of nature and culture.

Table 5.1 shows the contrasting concepts that frame environmental discourses. Though nature and the environment are often used interchangeably there are commonalities in approaches to defining the components that will be useful in linking place values to discourses of the environment in this study.

Table 5.A Binaries in ecological and technological discourses

Ecological discourses	Technological discourses
Intrinsic value of living & non-living	Anthropocentrism
Spiritual and historical attachment	Practical attachment
People & nature as one	Hierarchical
Natural laws constrain	Nature for exploitation
Sustainable economy	Growth economies
Significance of place	Place importance relative
Ecological integrity	Objectified nature
Divine explanation	Scientific explanation
Interdependence	Separation of nature & culture
Cyclical time	Linear time

According to Doyle (2000) the environment may be categorised in three loose associations in which nature:

- is a symbol
- forms a scientific necessity

- is interpreted as social phenomenon.

Eckersley (1992) claims these positions may be distributed between anthropocentric or ecocentric while Dobson (1990) distinguishes between old-fashioned conservationism, reform environmentalism or radical ecologism.

Harré *et al.* (1999) define three periods of key metaphors for nature that have been used to systematise and formalise theories and guiding principles in dealing with nature over the past 1,000 years. Nature was written by God in the Middle Ages. The Renaissance reflected on the human body as a microcosm of nature's macrocosm. Following this the Enlightenment formulated nature as a variety of machines that remain as pervasive metaphors in this century. Within recent environmental history two eras of expression of people's relationship with the environment have been noted (Hutton and Connors 1999). These eras show distinct discourses that have become lingered in various guises in contemporary positions.

Environmental practice in evolution: The Romantic and Individualistic tension

One of the defining breaks between the two eras of environmentalism mentioned by Hutton and Connors (1999) (the first and second wave) is identified by Dryzek (1997) to include a critical engagement with and rejection of industrialism. Rodham's (1983) descriptions and definitions correlate with those already described but more closely depict environmental thought within a progress orientation. By using the descriptive categories of resource conservation, wilderness preservation, moral extensionism and the still-emerging phase of ecological sensibility (Hay 2002), the threads of discourse take on an evolutionary path. This evolution reflects the consequences of notions, concepts and metaphors that have been appropriated, re-defined, re-invented and straight-out stolen from competing environmental discourses and paradigms of environmental practice. Locating the use of these linguistic devices serves to identify similarities and differences in decision-making between interacting sectors of social catchments.

Much discussion has been devoted to the breaks and discontinuities between discourses and historical eras, but the approach taken in this thesis is located in contested and negotiated positions. The only difficult philosophical and as yet unresolved debate revolves around the notion of implicit human relationships with the environment/nature that have been obvious for centuries of Western philosophy.

Earlier categorisation provided Romanticism as a defining frame, but that framing no longer applies completely. Contemporary motivations within a broad range of environmental positions appears to be Romantic in motivation, but does not adopt completely the earlier individualistic ethos. However, contemporary Romantic motivations do share with older Romantic frameworks a similar 'ecological impulse' but are now underpinned by explicit insights derived from the formal study of ecology (Hay 2002). Technological evolution has provided philosophy with empirical evidence through physics in the study of systems evolution to add further binaries to the consideration of nature. Decay and notions of ultimate entropy in systems contradict claims of hierarchical evolution in the development of perfection (Lewin 1999, Marion 1999).

Perhaps the critical difference between earlier Romantic positions - in particular the individualistic motivations - and later appearances, is linked to the reasons for idealism and the holism in these positions that might be explicitly linked to values allocated to place. This is an element of environmental discourse analysis that may offer critical insight into the means by which contemporary environmental decisions must be judged across the scales of landscape management that are located by the sampling framework for this thesis.

Metaphors

Metaphors in language act as a heuristic tool to present the descriptors of particular realities thus providing a focus and transformation for some aspects of an issue and excluding other explanations and possibilities. Metaphors are used as a tool to explain the unknown and identify dissimilarity as explicitly as similarity and may show underlying conflict between projected assumptions and accreditation (Harré *et al.* 1999). They combine surrogational scientific and non-

surrogational moral and aesthetic (evaluative) discourse (Harré *et al.* 1999, Whitehead 2003). Rhetoric is the adversarial content of dialectical debate and frequently makes claim to the expressive capacities of metaphors (Harré *et al.* 1999). Khalil (1996) classifies metaphors according to the criterion of the kind of resemblance that a metatheoretical statement is supposed to inform. These are either heterologous[39] through the description of similarity of function without necessarily reflecting the common origin; or homologous[40] in which metaphors are based on a common context or origin in which the same common law provides the basis for expression. The study of metaphors in environmental discourses helps identify:

- hindrance to discussion and solutions; and
- additional perspectives and principled limitations in contexts.

Identifying metaphors also acts as a tool that provides definitions, interpretations and is useful as an aid to negotiations (Harré *et al.* 1999). Metaphors may be traced historically in their intent to explore, re-configure or dispute. They may be literal if the accreditation of a statement is not under contest, or metaphoric if accreditation is yet to be earned. Each domain of environmental discourse has a set of characteristic vocabulary that expressed scientific, economic and moral concepts. Metaphors provide an insight into the construct of environmental discourses that are never neutral. Culturally intransigent metaphors may prohibit holistic framing thus clouding issues and obscuring solutions, but may also help reconcile different perspectives (Harré *et al.* 1999).

Narratives

Narratives provide the future with a model derived from the past. They provide continuity through linguistic, psychological, social and philosophical constitution.

[39] Heterological: "a word invented to show that there were paradoxes in language…and that seemingly reasonable definitions may contain traps…an adjective does not apply to itself" (Bullock, A., and Trombley, S. (2000). The New Fontana Dictionary of Modern Thought, London: Harper Collins Publishers, p. 390).

[40] Homology: "the relationship among corresponding parts of characteristics of different organisms…an important conceptual tool for the reconstruction of phylogenetic relationships" (Bullock, A., and Trombley, S. (2000). The New Fontana Dictionary of Modern Thought, London: Harper Collins Publishers, p. 402).

Narratives are the ordering expression of a paradigm or the domain of a discourse. Unique social and historical processes are merged through narratives into cohesive domains that integrate natural, cultural and individual assumptions. Narratives include the metaphors used to convince or differentiate and are used to make sense of experiences and provide order to accumulated knowledge. The moral component of narratives legitimates and integrates claims to rights, duties and obligations. This moral stance provides either a position, alternative or interpretation relative to others, or in relation to the internalised discourse. Narratives construct and constitute reality for individuals and groups of people. Long and institutionalised use of a particular narrative provides the transformation from knowledge to truth that provides 'natural' impressions of underpinning assumptions (Harré *et al.* 1999). Narratives may be used to:

- justify an intent,
- reproduce a pattern that forms the domains of discourse in a paradigm
- make claim to a moral position in the same way as metaphors,
- and exercise power to occlude, obscure, suppress or ignore others and alternatives (Harré *et al.* 1999).

Narratives are the subjective ordering of space and place through both memory and self-identity (Malpas 1999). Narratives store norms and provide the basis for assumptions that define, configure and maintain the norms of particular discourses.

Domains of discourses of the environment

The conceptual framework that locates each of these discrete discourses of the environment exposed by Dryzek (1997) along the continuum described by Benton and Short (1999) is used in this research as a means of exposing participants' perceived inter-connection with the landscapes in which they live (Figure 5.1). This process-based philosophy investigates the value in values (Midgley 2000). The inquiry into how discourses of the environment frame the definition of place and landscape management in the social catchments in this study exposes both subjugated and *status quo* discourses and values.

Though nature and the environment are often used interchangeably there are commonalities in approaches to defining the symbolic and material elements of the human-landscape relationship that are useful in linking place values to discourses of the environment in this study. Nature is used as a 'neutral' framing of landscape in an attempt to discover the intrinsic relationships people have with the landscape.

By interrogating environmental discourses through their basic entities Dryzek (1997) has defined and described environmental discourses that intersect the continuum. Ecological discourse is thus defined to include essentialist discourses of Indigenous peoples (Australian Aboriginal peoples fall within this knowledge frame) and Green Radicalism (which is separated into Rational and Romantic discourses). The continuum then moves toward the technological end through Sustainable Development, Ecological Modernisation, Survivalism and Environmental Problem Solving (which is distributed between Administrative Rationalism, Democratic Pragmatism and Economic Rationalism). Dryzek situates Prometheanism at the technological end, representing a denial of environmental limits and a faith in human ingenuity and capacity to solve problems. This discourse represents older cultures and civilisations, such as the Sumerians and Easter Islanders to some extent, as well as contemporary technologically dependent societies (Ponting 1991). This discourse is used to justify human use of and dominance over 'nature' and the environment.

The Green Romantic discourses show greatest inter-connection based on the assumption that people are part of the landscape, while the Promethean end of the continuum represents humans as hierarchical dominants of a nature that is perceived to be a resource to humans. The discourses in between represent a range of reactions to socio-political situations either working within an amelioration framework, or choosing a re-structuring of these frameworks. Practice entails using a range of democratic practices of participation, science, legislation and other negotiated options to deal with environmental issues. Each of these discrete discourses is defined as either imaginative or prosaic, radical or reformist, depending on the extent of reaction to the *status quo* discourse (Dryzek 1997).

The discourses of the environment

Each of the six discrete discourses presented in Figure 5.1 are described through the statements used in the survey. These statements reflect the central positions taken in ideal, ideology and practice in the domains of each discourse. Dryzek (1997) provided the key and core assumptions that defined each of these domains for the descriptions that appear here, and for the questionnaire survey used in this research.

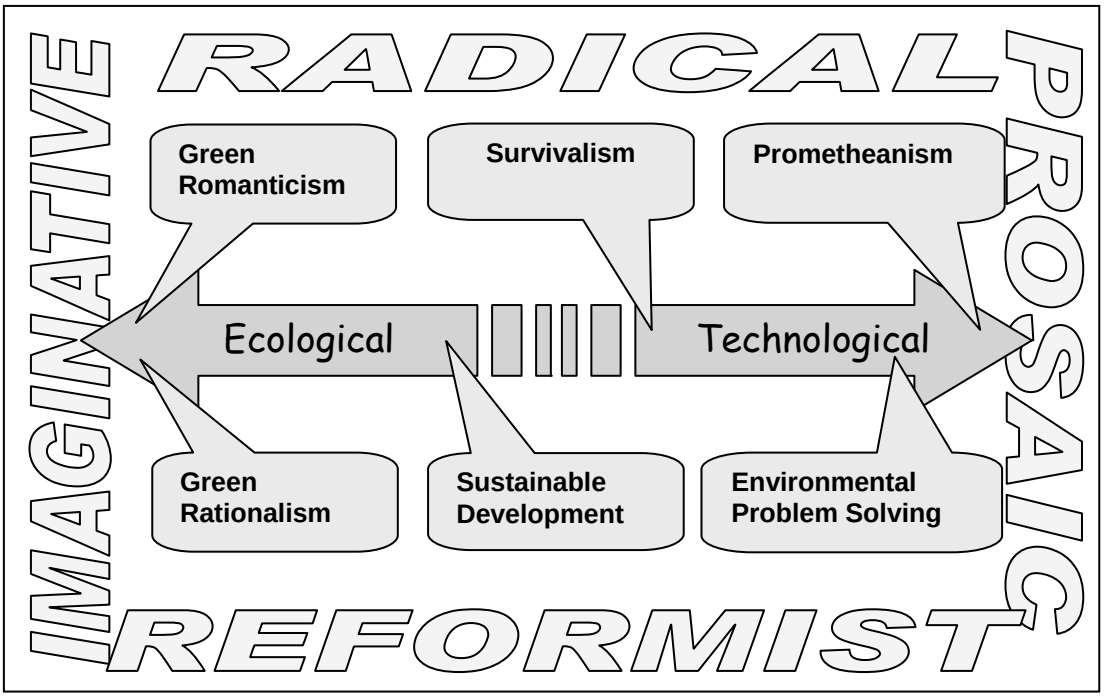

Figure 5.1 Discourses of the environment after Dryzek (1997) and Benton and Short (1999)

Green Radicalism

Green Radicalism is divided into two perspectives: Green Rationalism and Green Romanticism. Both are ecological in their primary positioning, but differing according to their advocacy in relation to the political *status quo* and in relation to the acknowledgement and rights of people as opposed to 'nature' (Dryzek 1997, McIntyre-Tamwoy 2004).

Green Romanticism is an extension of the historical intellectual movement of the eighteenth and nineteenth centuries that rejects that nature is best

understood and manipulated through scientific knowledge (Dryzek 1997). People who adhere to this discourse believe that humans have to be considered as part of nature living within the limits of ecological principles, without any privileges. While this may appear similar to that of Survivalism, this discourse has a much more intrinsic ideology that people are part of 'nature' and not separable from the cycles and ecological laws. Statements that were used to reflect the Green Romantic position in the survey are shown in Table 5.1.

Table 5.1 Green Romantic survey statements

Discourse element	Discourse statements for Green Romanticism
Ideals: Using Nature	Science has failed to provide answers, people must accept that they are a part of nature without trying to control it.
Ideals: Solutions to environmental problems	Local people must develop relationships with the environment that integrate traditional, local and regional approaches.
Ideology: Discourse of the environment	By thinking global and acting local we can achieve considered and Rational approaches to a harmonious relationship with the land.
Practice: People's relationship with Nature	Nature and people exist within the limits of ecological principles as an integral part of nature.
Practice: Managing Nature	People must develop inclusive social structures that ensure ecological principles are followed.

Green Rationalism is recognisable through the selective and ecologically guided radicalisation of Enlightenment Values. Though this discourse is radical, it falls within the reformist approach thus working largely within existing political norms and practices, but proposing solutions from a more radical ecological perspective. This position uses and reflects an Ecological Modernisation rhetoric but with the intrinsic understanding that people are not separable from nature, though they are privileged. The statements presented in the survey that captured this discourse are presented in Table 5.2.

Table 5.2 Green Rational survey statements

Discourse element	Discourse statements for Green Rationalism
Ideals: Using Nature	We need to develop partnerships that re-align human use of resources along environmentally sound lines.
Ideals: Solutions to environmental problems	Business and private enterprise in the catchment must acknowledge impact at the local level.
Ideology: Discourse of the environment	Restructuring the market economy will ensure ecological sustainability.
Practice: People's relationship with Nature	People must expect that business should be managed to acknowledge the limitations of the natural resource.
Practice: Managing Nature	Business people should ensure that business operates within ecological principles.

Sustainable Development

A discourse embedded in renewable resource management and the concept of maximum sustainable yield (Table 5.3). This discourse is widely used and now represents an inclusive perspective that draws wide membership. This discourse is often used in parallel with notions of democracy (Dryzek 1997).

Table 5.3 Sustainable Development survey statements

Discourse element	Discourse statements for Sustainable Development
Ideals: Using Nature	We need to manage the earth's resources to ensure they continue to provide for us.
Ideals: Solutions to environmental problems	Partnerships of local people and agency staff should manage the catchment sustainably.
Ideology: Discourse of the environment	Cautious and planned use of the earth's resources will ensure environmental sustainability for the long term.
Practice: People's relationship with Nature	People must manage nature to ensure that there is enough to provide for future generations.
Practice: Managing Nature	People must manage nature in partnerships to ensure Sustainable Development and use.

Ecological Modernisation

This discourse is mentioned here and is generally included by Dryzek, though it does not appear on the conceptual framework (Figure 5.1). I was unable to justify using this domain as a specific discourse in the conceptualisation or the survey questionnaire because it draws in a somewhat arbitrary way from a range of discourses depending on the rhetoric and position it is dealing with. It is possible that this position, if used by business expresses a more Promethean

position than if it defends a position from the ecological end of the continuum when it draws on the metaphors of the deep green discourses.

Like Green Rationalism, Survivalism and Sustainable Development this discourse utilises the precautionary principle and is often associated with green production principles that might reflect practice, but not ideology or ideal. By restructuring of the capitalist economy along more environmentally sound lines this discourse proves reformist within the ideal framework of Environmental Problem Solving and Prometheanism. But, this same discourse also claims that environmental degradation is a structural problem that requires a different political-economic system (Dryzek 1997).

Ecological Modernisation in general reflects a 'deliberative exchange' that does not fulfil the requirements of either a social theory or political program but contributes to discussion and negotiation between the range of discourses around institutions and the environment. Debates on the interaction and role of production and consumption frame the notion and concept (Buttel 2000, Carolan 2004, Mol and Spaargaren 2004). These notions are found to varying degrees in a range of other discourses (Reformist Administration, Sustainable Development, Green Rationalism and Survivalism in particular) and though Ecological Modernisation reflects the central issues it is not necessarily a distinct discourse position.

Survivalism

This discourse has recognisable and popularised metaphors developed by well-known scientists such as Paul Erlich. These metaphors show the discourse as revolving around environmental or ecological systems limits and systems and species survival (Table 5.4). It locates rhetoric at the global scale and focuses on issues of population growth and environmental disasters. The main focus of research and narrative revolves around carrying capacity of the planet (Dryzek 1997).

Table 5.4 Survivalism survey statements

Discourse element	Discourse statements for Survivalism
Ideals: Using Nature	If 'Spaceship Earth' is not looked after properly we will exhaust our global resources soon.
Ideals: Solutions to environmental problems	Information from scientists and experts should provide solutions to catchment issues.
Ideology: Discourse of the environment	People are reaching the limits of what the earth will provide and environmental disasters are inevitable.
Practice: People's relationship with Nature	There is a delicate balance between nature and people that must ensure that the planet's resources are not over-exploited.
Practice: Managing Nature	Scientists and experts should manage the planet to ensure that disasters do not happen.

Environmental Problem Solving

This discourse of the environment though reformist, reflects a range of three linked and related positions in keeping with the modern political state. In general the resources of the state through agencies draw on these perspectives and the professional expertise of their staff to use this range of positions to sustain the state's economic and political positioning in relation to resource management (Table 5.5). Dryzek (1997) presents this discourse position in three guises: Administrative Rationalism, Democratic Pragmatism and Economic Rationalism.

Administrative Rationalism uses and accords status to science as a means of management in the administrative state. Science is used to explain and to offer solutions to issues in landscape and resource management in general.

Democratic Pragmatism draws on democratic principles of inclusion and participation as a means of interactive problem solving that does not challenge the institutional structure of liberal capitalist democracy.

Economic Rationalism can be identified through incentive-based approaches that reflect a commitment to using market mechanisms to solve issues for public needs. This applies equally to business and natural resource management policy and legislation.

Table 5.5 Environmental Problem Solving survey statements

Discourse element	Discourse statements for Environmental Problem Solving
Ideals: Using Nature	Human ingenuity will solve all problems that arise in the environment.
Ideals: Solutions to environmental problems	Scientists and experts working with government should come up with management options for the catchment.
Ideology: Discourse of the environment	The market and science will help responsible government prevent people over using the earth's resources.
Practice: People's relationship with Nature	The planet's resources provide for people but must be managed according to the best science available.
Practice: Managing Nature	Scientists and experts provide the best management within our democratic system of government.

Prometheanism

This discourse of the environment is positioned at the extreme end of the Technological continuum. Prometheus stole fire from Zeus, and though he was punished through torture over a long period, he in effect brought technology and ingenuity to the human population. This discourse of the environment is named in his honour and reflects both faith in human capacity and resources to solve all future problems (particularly those resources that may be held in the future, such as the development of technology to solve contemporary problems) (Dryzek 1997). This discourse is considered Cornucopian in the way in which it denies the existence of environmental limits in faith of the bounty provided by 'the earth' (Table 5.6).

Table 5.6 Promethean survey statements

Discourse element	Discourse statements for Prometheanism
Ideals: Using Nature	The benefits of economic growth are outweighed by the negative consequences for the environment.
Ideals: Solutions to environmental problems	All Australian people have a right to deciding how environmental management should be conducted in this catchment.
Ideology: Discourse of the environment	The earth is resilient and bountiful and people will not exhaust the environmental supply.
Practice: People's relationship with Nature	People are in control of the planet and should be able to use it for whatever purposes they see fit.
Practice: Managing Nature	People are in control of the planet and everyone can manage as they see fit.

Dryzek's (1997) typology of environmental discourses provides a succinct encapsulation of the discourses that fall within the continuum and forms the primary investigative conceptualisation for this thesis.

The conceptual model for discourses of the environment

The conceptualisation of an environmental discourse comprises interactions between three elements: ideals, ideology and practice across three scales: the individual, society and the environment. The process modifiers of knowledge, truth and power mediate these interactions. Environmental discourses are delimited through discursive closure thus forming distinct frameworks of ideals, ideologies and practice explicitly comparable to other environmental discourses (Hajer 1995). Each discourse is formed at the broadest unit of consensus and like paradigms serve to differentiate between discourses and discourse coalitions (Hajer 1995, Ritzer 1996). To identify a paradigm the discourse conceptualisation presented in Figure 5.1 serves as a framework to make these discourses explicit in their relation to one another.

The symbolic contrasts chosen, and the systems of meanings associated, show communications as anchored messages in physical place (Carbaugh 2001). Language and discourse moulds the socio-political context of landscape-based decision-making in much the same way as social context shapes discourse (Doyle 2000). Discourses include narrative, conversation, symbolic interactions and communications. These are the cognitive activities that are used in negotiating a position. Metaphors are the symbolic elements used in expressive activities that locate the central positions of an environmental discourse (Harré *et al.* 1999).

The three elements that make up an environmental discourse – practice, ideals and ideology - interact across three scales – the individual, society and environmental – and are modified by three processes – knowledge, truth and power. These interactions constitute the factors and processes that comprise the development of and positions taken in all discourses of the environment.

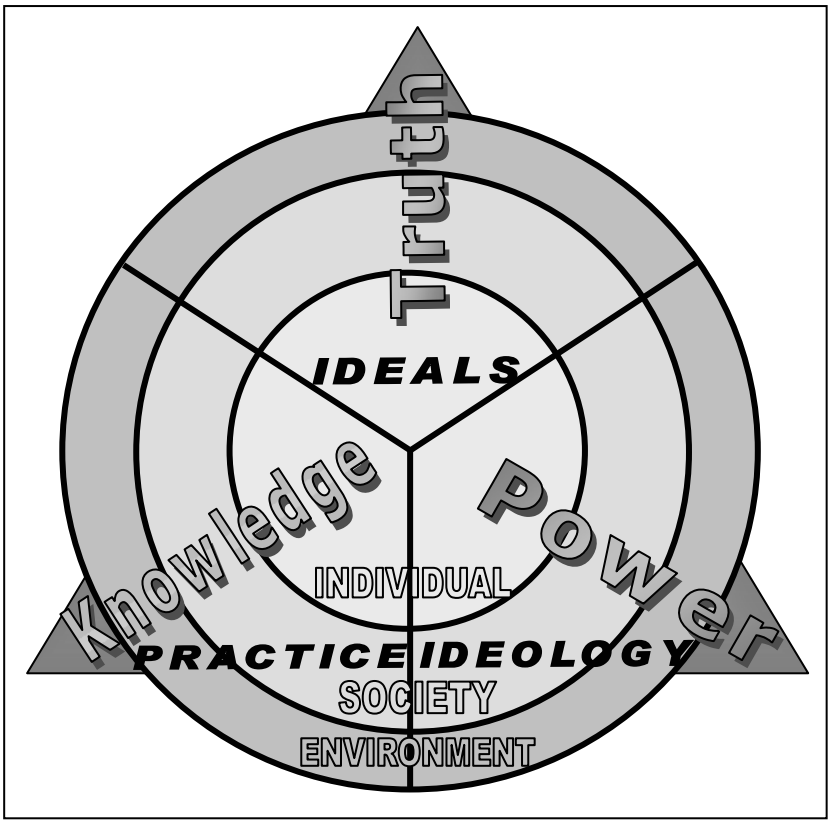

Figure 5.2 Conceptual model of environmental discourse showing scales, elements and modifying forces

Section Two: The quantitative exploration

The conceptual model of environmental discourse (Figure 5.2) derived from the literature provided the means to operationalise discourses of the environment in the survey questionnaire. The elements provided insight into the frameworks people living in the catchments in this study used to define and solve environmental problems within a landscape scale. The interaction between the discourse modifiers impacted across three social scales giving insight into the relationships between people interacting in social catchments.

The Survey Questions

The survey questions asking about environmental discourse frameworks in each catchment formed discrete sections of the survey (Appendix 2). Each question asked about a different relationship with the landscape and explicit questions about intrinsic relationships with nature, practice in relation to landscapes/nature and a set of questions about solutions that provide an insight into ideal relationships depicting the future scenario. These questions combined

to represent a framework of practice that reflects an intrinsic relationship with landscape. Two further qualitative questions followed the questions presented here. These questions asked respondents to provide their opinion on the three most significant environmental issues in their catchment. This was followed with three solutions they would propose to environmental issues. While the first series of questions on discourses of the environment were quite neutral in the located sense, they followed a detailed exploration of allocation of value to elements of the landscape in their catchment which inquired into sense of place. This included locating the different elements on a map provided. The intention of the discourse questions was to separate respondents from the landscape and explore the frames of practice that might be underpinning decisions in landscape management.

The five questions (Table 5.7) that provided an insight into the personal position, personal practice and ideal futures of discourses of the environment were answered by rating agreement (0 =none, 5 = most) with a statement that reflected each of the six discourses identified across a continuum by Dryzek (1997). The questions were as follows:

- What is your basic attitude as to how nature should be used or treated?
- What sort of relationship do people have with nature?
- Who manages nature and the environment?
- Which of these statements do you agree with?
- What sorts of environmental solutions are needed in this catchment?

Table 5.7 Survey questions and environmental discourse statements

Question	Short Variable Name	Discourse coding
1. Using Nature: What is your basic attitude as to how nature should be used or treated?		
The benefits of economic growth are outweighed by the negative consequences for the environment.	NatUseProm	Promethean
Human ingenuity will solve all problems that arise in the environment.	NatUseEnvProb	Environmental Problem Solving
If 'Spaceship Earth' is not looked after properly we will exhaust our global resources soon.	NatUseSurv	Survivalism
We need to manage the earth's resources to ensure they continue to provide for us.	NatUseSusD	Sustainable Development
We need to develop partnerships that re-align human use of resources along environmentally sound lines.	NatUseGRat	Green Rationalism
Science has failed to provide answers, people must accept that they are a part of nature without trying to control it.	NatUseGRom	Green Romanticism
2. People and Nature: What sort of relationship do people have with nature?		
People are in control of the planet and should be able to use it for whatever purposes they see fit.	NatPepProm	Promethean
The planet's resources provide for people but must be managed according to the best science available.	NatPepEnvProb	Environmental Problem Solving
There is a delicate balance between nature and people that must ensure that the planet's resources are not over-exploited.	NatPepSurv	Survivalism
People must manage nature to ensure that there is enough to provide for future generations.	NatPepSusD	Sustainable Development
People must expect that business should be managed to acknowledge the limitations of the natural resource.	NatPepGRat	Green Rationalism
Nature and people exist within the limits of ecological principles as an integral part of nature.	NatPepGRom	Green Romanticism
3. Managing Nature: Who manages nature and the environment?		
People are in control of the planet and everyone can manage as they see fit.	NatManProm	Promethean
Scientists and experts provide the best management within our democratic system of government.	NatManEnvProb	Environmental Problem Solving
Scientists and experts should manage the planet to ensure that disasters do not happen.	NatManSurv	Survivalism
People must manage nature in partnerships to ensure sustainable development and use.	NatManSusD	Sustainable Development
Business people should ensure that business operates within ecological principles.	NatManGRat	Green Rationalism

People must develop inclusive social structures that ensure ecological principles are followed.	NatManGRom	Green Romanticism
4. Environmental discourse: Which of these statements do you agree with?		
The earth is resilient and bountiful and people will not exhaust the environmental supply.	EnvDisProm	Promethean
The market and science will help responsible government prevent people over using the earth's resources.	EnvDisEnvPro	Environmental Problem Solving
People are reaching the limits of what the earth will provide and environmental disasters are inevitable.	EnvDisSurv	Survivalism
Cautious and planned use of the earth's resources will ensure environmental sustainability for the long term.	EnvDisSusD	Sustainable Development
Restructuring the market economy will ensure ecological sustainability.	EnvDisGRat	Green Rationalism
By thinking global and acting local we can achieve considered and Rational approaches to a harmonious relationship with the land.	EnvDisGRom	Green Romanticism
5. Solutions Discourse: What sorts of environmental solutions are needed in this catchment?		
All Australian people have a right to deciding how environmental management should be conducted in this catchment.	DiscSolProm	Promethean
Scientists and experts working with government should come up with management options for the catchment.	DiscSolEnvPro	Environmental Problem Solving
Information from scientists and experts should provide solutions to catchment issues.	DiscSolSurv	Survivalism
Partnerships of local people and agency staff should manage the catchment sustainably.	DiscSolSusD	Sustainable Development
Business and private enterprise in the catchment must acknowledge impact at the local level.	DiscSolGRat	Green Rationalism
Local people must develop relationships with the environment that integrate traditional, local and regional approaches.	DiscSolGRom	Green Romanticism

Discourses of the environment: developing an index

A comparison of solutions discourses between the two catchments was made as an initial exploration of the data (Figure 5.3). This comparison indicated subtle differences between the two social catchments.

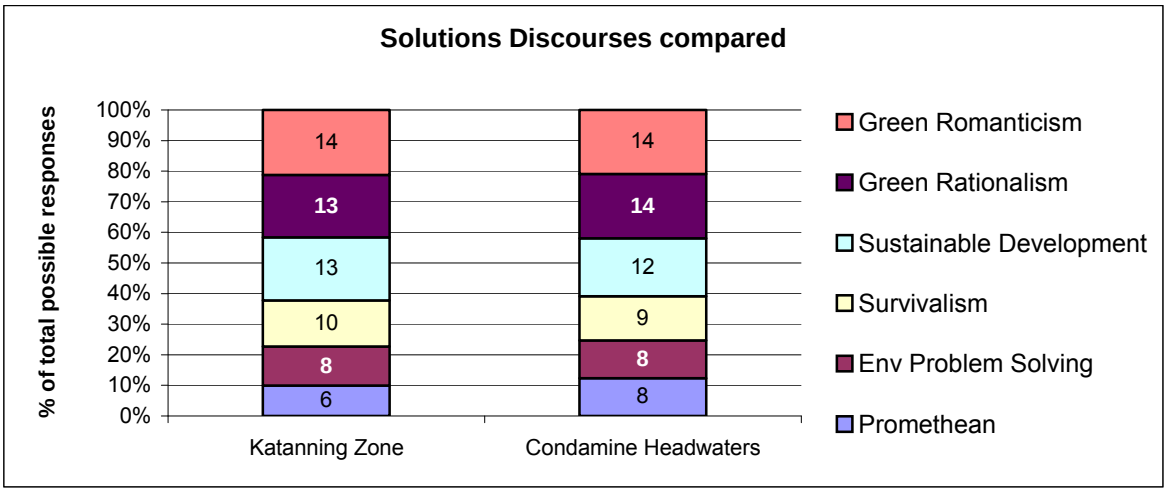

Figure 5.3 Summary statistics to show comparison of discourses of the environment for solutions (ideals)

Results of the scale reliability testing

As the survey questions on discourses of the environment represented five different ways of establishing an individual's environmental discourse, the potential for developing a useful index to evaluate environmental discourse emerged. Indexes represent a summary and composite measure through tested statements reflecting particular positions in which the values are summed to provide a numerical score. The aim of an index is to include all the most important elements of a perspective which when summed correspond to a representative position. Indexes are a useful way of assessing a particular position through indirect measurement. The five questions relevant to each environmental discourse represented a potential scale. Scales are a way of measuring attitude with a degree of reliability. Scales are the characteristics of a position derived from several relatively specific variables or indicators to represent a more abstract concept (de Vaus 1986, Sarantakos 1993, Abercrombie *et al.* 1994, Mouton and Marais 1994). The survey provided the opportunity to assess the relationships between the ideals, ideology and practices in discourses of the environment as a potential representation of a cohesive index or explicit domain of environmental discourse.

The five questions relating to ideals, ideology and practice were used as indicators to develop a scale that once tested form an index (Tables 5.1 to 5.6).

To test the potential of these questions to form an index, the data was subjected to a reliability test using Cronbach's alpha (Upton and Cook 2002). Cronbach's alpha is a coefficient of reliability that evaluates how well a set of multidimensional variables measures a single unidimensional latent construct (UCLA 2003). A scale is reliable if an individual obtains the same or similar score on more than one occasion, but is tested by assessing the consistency of an individual's response through a number of indicator variables/survey questions. As a rule, the score should be at least 0.7 to be reliable (de Vaus 1986).

Each of the discourses of the environment was tested to assess the reliability and consistency of the questions in providing a cohesive index.

Promethean

Reliability of a scale to assess Promethean discourse of the environment scored a Cronbach's standardised item alpha of .59. Factor analysis on all five questions that reflected a Promethean discourse indicated two sets of variables where the rotation converged in three iterations comprising separate scales measuring this environmental discourse (Table 5.8). Most variables tested in this evaluation proved reliable. Only variable NatUseProm (the Promethean discourse representing the ideology of how nature is used by people) did not meet the cut-off requirements.

Table 5.8 Rotated Component Matrix(a). Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization

	Component	
	1	2
NatUseProm (using nature)	.325	.635
NatPepProm (nature and people)	.759	-.125
NatManProm (managing nature)	.774	.303
EnvDisProm (your environmental discourse)	.769	.108
DiscSolProm (solutions to env issues)	-.121	.844

A repeated Cronbach's reliability test resulted in the standardised item alpha's shown in Table 5.9. These scores were not high enough to ensure reliability of this scale to form an index.

Table 5.9 Item alpha's for Prometheanism

Scale	Variables	Score
Scale One	NatUseProm DisSolProm	.2867
Scale Two	NatPepProm NatManProm EnvDisProm	.6842.

Environmental Problem Solving

Reliability of a scale to assess Environmental Problem Solving discourse of the environment scored a Cronbach's standardised item alpha of .51. Factor analysis (shown in Table 5.10) on all five questions again indicated two sets of variables where the rotation converged in three iterations comprising separate scales measuring this environmental discourse. Three variables proved reliability: variable NatUseEnvPro (the discourse of the environment of Environmental Problem Solving that represents the ideology relating to how nature is used); variable NatPepEnvPro (the Survivalist discourse relating to the ideology of the relationship between people and nature); and, the variable NatManEnvPro (the Survivalist discourse ideology).

Table 5.10 Rotated Component Matrix(a). Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization

	Component	
	1	2
NatUseEnvPro (Using nature)	.790	-.288
NatPepEnvPro (nature and people)	-.123	.885
NatManEnvPro (managing nature)	.711	.460
EnvDisEnvPro (your environmental discourse)	.627	.179
DiscSolEnvPro (solutions to environmental issues)	.288	.506

A repeated Cronbach's reliability test resulted in the standardised item alpha's shown in Table 5.11. These scores were not high enough to ensure reliability.

Table 5.11 Item alpha's for Environmental Problem Solving

Scale	Variables	Score
Scale One	NatPepEnvPro DisSolEnvPro	.3122
Scale Two	NatUseEnvPro NatManEnvPro EnvDisEnvPro	.5681

Survivalism

Reliability of a scale to assess Survivalism discourse of the environment scored a Cronbach's standardised item alpha of .42. Factor analysis (shown in Table 5.12) on all five questions again indicated two sets of variables where the rotation converged in three iterations comprising separate scales measuring this environmental discourse. Two variables achieved scores indicating some sort of reliability: variable NatPepSurv (the discourse of the environment representing Survivalism in that represents the ideology of people's relationship with nature) and NatManSurv, the variable that represents the discourse of the environment Survivalism as the practice framework that dictates how people manage nature.

Table 5.12 Rotated Component Matrix(a). Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization

	Component	
	1	2
NatUseSurv (using nature)	.630	.400
NatPepSurv (nature and people)	.794	.012
NatManSurv (managing nature)	-.016	.815
EnvDisSurv (your environmental discourse)	.681	-.196
DiscSolSurv (solutions to environmental issues)	-.005	.688

A repeated Cronbach's reliability test resulted in the standardised item alpha's shown in Table 5.13. These scores were not high enough to ensure reliability.

Table 5.13 Item alpha's Survivalism

Scale	Variables	Score
Scale One	NatUseSurv NatPepSurv EnvDisSurv	.5180
Scale Two	NatManSurv DiscSolSurv	.3977

Sustainable Development

Reliability of a scale to assess Sustainable Development discourse of the environment scored a Cronbach's standardised item alpha of .34. Factor analysis (shown in Table 5.14) on all five questions again indicated two sets of variables where the rotation converged in three iterations comprising separate

scales measuring this environmental discourse. Two scores proved reliable in this evaluation for reliability: the variables NatPepSusD (the discourse of the environment of Sustainable Development as it relates to the ideology of the relationship between people and nature) and DiscSolSusD (the discourse of the environment of Sustainable Development as it relates to the ideals that dictate the possible solutions to environmental issues).

Table 5.14 Rotated Component Matrix(a). Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization

	Component	
	1	2
NatUseSusD (using nature)	.262	.561
NatPepSusD (nature and people)	-.071	.812
NatManSusD (managing nature)	.663	.243
EnvDisSusD (your environmental discourse)	.533	.188
DiscSolSusD (solutions to environmental issues)	.803	-.257

A repeated Cronbach's reliability test resulted in the standardised item alpha's shown in Table 5.15. These scores were not high enough to ensure reliability.

Table 5.15 Item alpha's Sustainable Development

Scale	Variables	Score
Scale One	NatManSusD EnvDisSusD DiscSolSusD	.4339
Scale Two	NatUseSusD NatPepSusD	.1387

Green Rationalism

Reliability of a scale to assess Green Rationalism discourse of the environment scored a Cronbach's standardised item alpha of .67. Factor analysis (shown in Table 5.16) on all five questions again indicated two sets of variables where the rotation converged in three iterations comprising separate scales measuring this environmental discourse. All scores indicate reliability of the statements used in the survey to indicate this discourse of the environment.

Table 5.16 Rotated Component Matrix(a). Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization

	Component	
	1	2
NatUseGRat (using nature)	.769	-.157
NatPepGRat (nature and people)	.846	.072
NatManGRat (managing nature)	.833	-.173
EnvDisGRat (your environmental discourse)	-.020	.973
DiscSolGRat (solutions to environmental issues)	.712	.221

A repeated Cronbach's reliability test resulted in the standardised item alpha's shown in Table 5.17. These scores were high enough for reliability of the questions to represent two scales.

Table 5.17 Item alpha's Green Rationalism

Scale	**Variables**	**Score**
Scale One	DiscSolGRat NatManGRat NatPepGRat NatUseGRat	.7994
Scale Two	EnvDisGRat	.973

Green Romanticism

Reliability of a scale to assess Green Romanticism discourse of the environment scored a Cronbach's standardised item alpha of .64. Factor analysis (shown in Table 5.18) on all five questions again indicated two sets of variables where the rotation converged in three iterations comprising separate scales measuring this environmental discourse. Most of the scores in this evaluation provide reliability.

Table 5.18 Rotated Component Matrix(a) Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization

	Component	
	1	2
NatUseSusD (using nature)	.003	.811
NatPepSusD (nature and people)	.849	-.124
NatManSusD (managing nature)	.823	.226
EnvDisSusD (your environmental discourse)	.126	.705
DiscSolSusD (solutions to environmental issues)	.603	.494

A repeated Cronbach's reliability test resulted in the standardised item alpha's shown in Table 5.19. These scores indicated one scale (one ideal and two practice variables) scored reliability.

Table 5.19. Item alpha's Green Romanticism.

Scale	Variables	Score
Scale One	NatPepSusD NatManSusD DiscSolSusD	.7
Scale Two	NatUseSusD EnvDisSusD	.4538

What does the Cronbach's alpha say?

The results provided by Cronbach's reliability evaluation that tested the potential of the five statements for each discourse of the environment to provide a set of indicators to form a scale indicate that only the Green Rational and some of the Green Romantic discourse statements may be considered reliable. Even in this case, the statements do not form one scale, but two. There was little consistency achieved between statements across the six discourses of the environment to indicate that ideology, ideals and practice could form any sort of reliable index. This indicated that it would not be possible to combine the scores for each discourse of the environment into one summed result to represent the more abstract representation of an environmental discourse index in the numerical classification. Statements that were too broad or that contained more than one dimension possibly complicated the development of an index.

It is also likely that a quantitative approach through survey methodology is an inadequate means of capturing a single dimension that represents the interactions in a particular discourse. The interaction between ideals, ideologies and practices that make up a discourse position may be more evident if analysed through the different dimensions that form a stratified ontology of valuing and managing landscapes. As a consequence, the numerical taxonomy treated each variable separately with interesting results that are reported in the next section.

Results of the numerical classification

As there was no reliable scale indicated for the environmental discourse variables, all discourse variables were subjected to analysis through numerical taxonomy to ascertain structure in data and evaluate clustering of discourse related variables.

The column fusion dendrogram (Figure 5.4) resulted from this analysis showed the relationships amongst variables in the ordination. This indicated a grouping of responses to questions (values) by respondents. The dots next to the dendrogram variables showed the discourse frame each variable represented indicating a diverse array of associations between responses (or values).

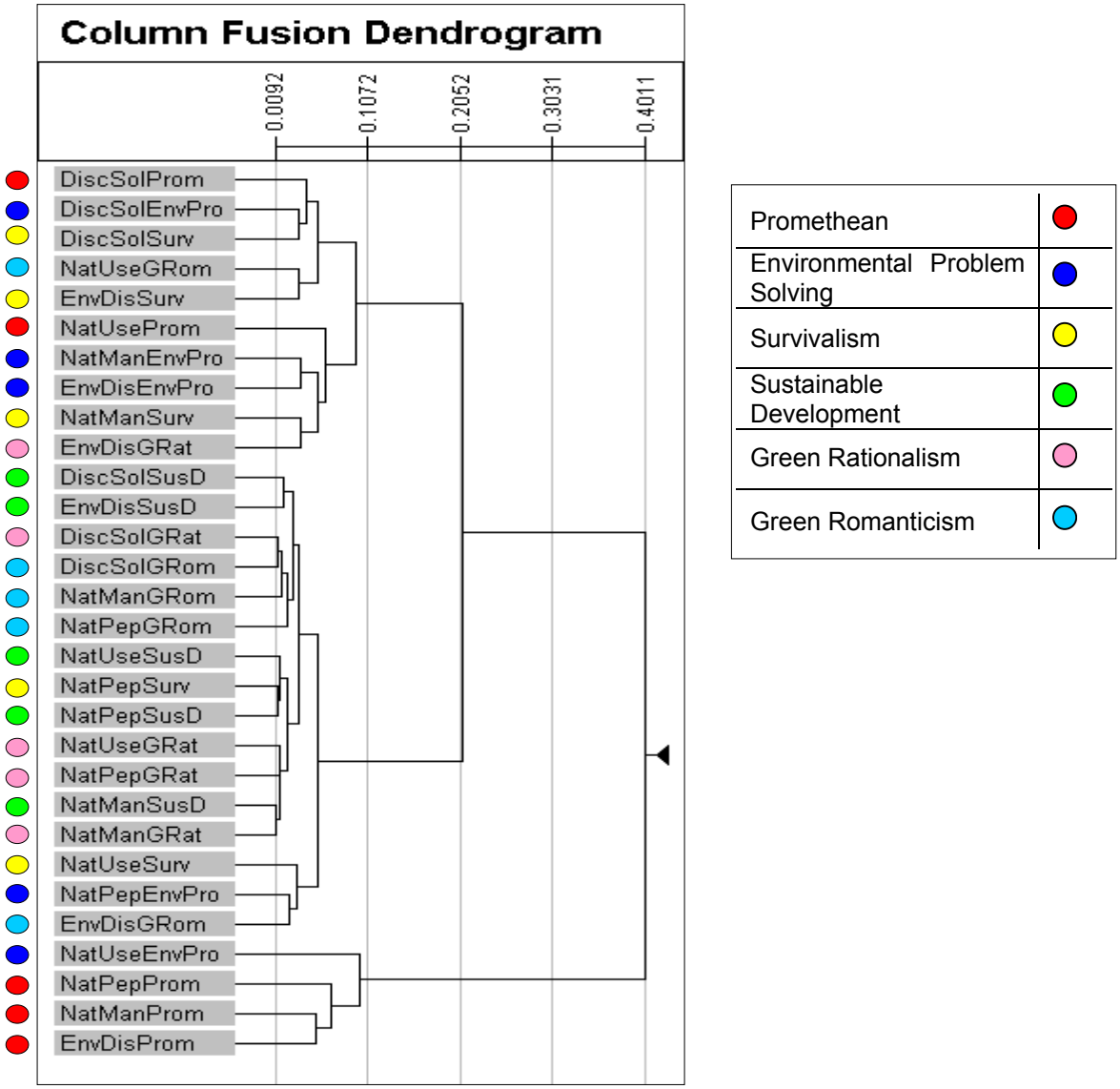

Figure 5.4 Dendrogram showing attribute clusters according to discourses of the environment

There was no consistency between the ideals, ideology or practice within any single discourse of the environment. Thus, a second numerical taxonomy evaluated the structure of the data based on the ideals presented through solutions discourses.

Thirteen social assemblages were classified through the second ordination process. The ordination (Figure 5.5) using the variable that tested the ideal through solutions in discourses (variable name: prefaced with DiscSol plus each of the six discourses) of the environmental was used as the intrinsic data. All other discourse and socio-demographic variables were ordinated

simultaneously as extrinsic variables to portray the social assemblages (represented by different colours). Their similarity in multi-dimensional space to the values held by other individuals and assemblages was portrayed through the lines linking coloured dots in the minimum spanning tree. There was evidence that some assemblages were not cohesive but showed similarity within the assemblage, while being closely related to other assemblages.

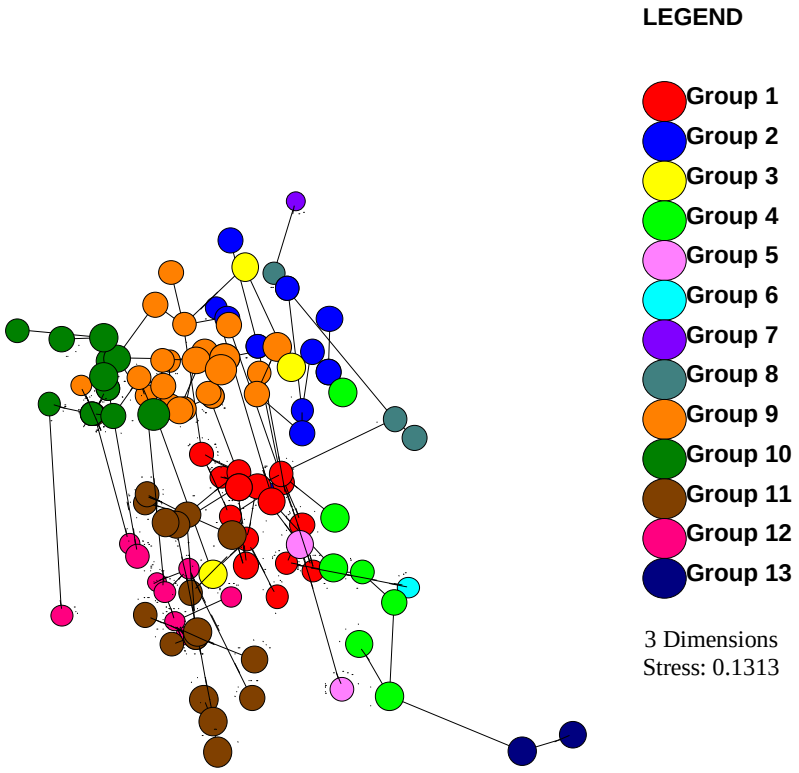

Figure 5.5 Ordination of social assemblages portrayed through the minimum spanning tree (Gower Metric, UPGMA, B=0.05, SSH)

The social assemblages

Figure 5.6 shows the total percentage of respondents classified in each social assemblage. Five of the social assemblages (SA 1,2,9,10 and 11) formed 75% of the total responses with four more contributing responses from less than 20% (SA 3, 4, 8 and 12) and the remaining assemblages (SA 5, 6, 7 and 13) forming about 5% of the total responses. This indicated that in general a number of distinct smaller groups may or may not translate to other scales.

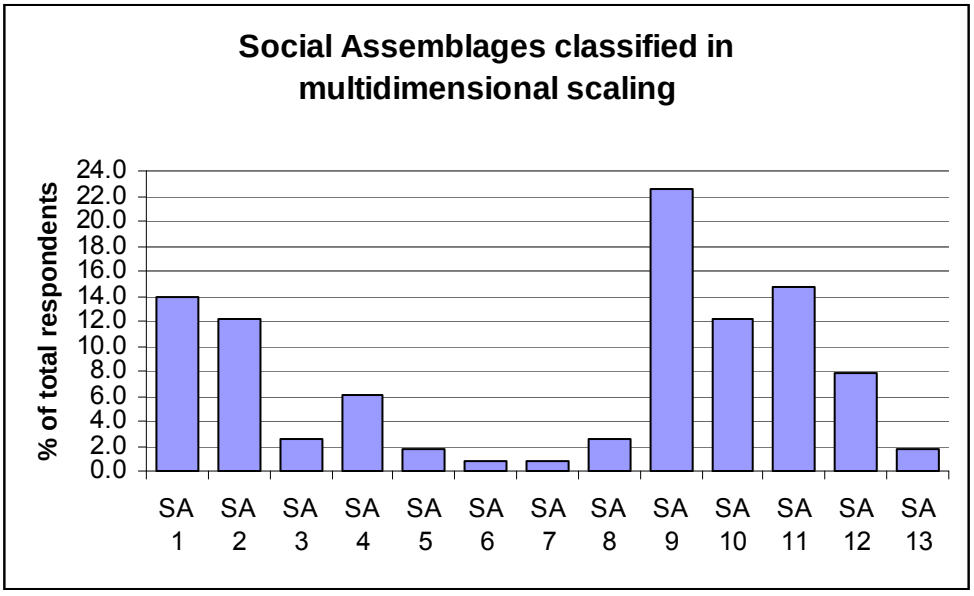

Figure 5.6 showing summary of % of respondents in each social assemblage classified in the multi-dimensional scaling

The social assemblages portrayed in Table 5.20 show a limited set of statistically significant variables that provided the most defining characteristics of each of the social assemblages (derived through evaluation of the ordination through Monte Carlo's permutations). The long-hand version listing the characteristics in full may be found in Appendix 10. Katanning Zone responses are represented by K in the Table, while the C represents the Condamine Headwaters respondents.

Table 5.20 Table showing defining characteristics of social assemblages defined in survey analysis of discourses of the environment

Social Assemblage	%	Sub-catchment	Farmers	Gov Admin	Professionals	Place & Identity	Place & Interest	Age 20 - 40	Age 40 - 64	Age 65+	Promethean	Env Problem Solving	Survivalism	Sustainable Dev	Green Rationalism	Green Romanticism
1	14	K	●	●	●											
		C	●						●							
2	12	K		None								●				
		C	None	●	●											
3	3	K									low					
		C														
4	6	K				●					none					
		C				●						low				
5 6 7 8	< 3 in each															
9	22	K							●							
		C							●							
10	12	K									+●					+●
		C									-●					-●
11	15	K	●	●	●									-●	-●	-●
		C	●	●	●									+●	+●	+●
12	15	K	●	●	●	●							+●			+●
		C	●	●	●		●						-●			-●
13	< 2															

Though in general there were no distinct differences indicated between the two catchments, or between assemblages in the discourses of the environment, there was strong statistical differentiation between the seven social assemblages that clustered the greatest number of participants. The ANOSIM tests (Table 5.21) for difference between the social assemblages showed justification in claiming characteristics of these social assemblages to be valid descriptors.

Table 5.21 Row ANOSIM showing statistical differences between social assemblages in discourses of the environment. Shaded cells are statistically different (Gower Metric, UPGMA, B=0.05, SSH)

	SA 1	SA 2	SA 3	SA 4	SA 5	SA 6	SA 7	SA 8	SA 9	SA 10	SA 11	SA 12
SA 2	0.00											
SA 3	0.00	0.00										
SA 4	0.00	0.00	0.00									
SA 5	0.03	0.00	0.32	0.03								
SA 6	1.00	0.09	1.00	0.15	1.00							
SA 7	0.05	0.05	0.37	0.11	0.54	1.00						
SA 8	0.02	0.00	0.15	0.04	0.18	0.29	0.40					
SA 9	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00				
SA 10	0.00	0.00	0.00	0.00	0.01	0.11	0.08	0.00	0.00			
SA 11	0.00	0.00	0.00	0.00	0.00	0.11	0.06	0.00	0.00	0.00		
SA 12	0.00	0.00	0.00	0.00	0.02	0.10	0.13	0.00	0.00	0.00	0.00	
SA 13	0.07	0.00	0.22	0.02	0.32	0.59	0.54	0.11	0.03	0.01	0.00	0.02

How different are the discourses to one another?

Table 5.22 shows the statistical differences between discourses and justified a further inquiry through further ordination using all discourse variables as intrinsic (Column Fusion dendrogram in Figure 5.4) and qualitative methods of the way in which discourses of the environment frame practices in landscape management.

Table 5.22 How different were the discourses to one another? Column ANOSIM with Group Pairs (Stat) showing p values. (shaded cells = statistically significant) (Gower Metric, UPGMA, B=0.05, SSH)

	Promethean	Env Prob Solving	Survivalism	Sustainable Dev	Green Rationalism
Environmental Problem Solving	0.12				
Survivalism	0.02	0.19			
Sustainable Development	0.01	0.00	0.04		
Green Rationalism	0.00	0.03	0.15	0.57	
Green Romanticism	0.00	0.05	0.12	0.07	0.42

Prometheanism and Environmental Problem Solving discourses of the environment were not significantly different to one another. Survivalism, Green Romanticism, Sustainable Development, Green Rationalism and Green Romanticism were not significantly different to one another. Survivalism appeared to be a contested discourse that was not significantly different either to Environmental Problem Solving or to Green Rationalism and Green Romanticism.

Sustainable Development appeared to be a discourse that was most easily differentiated from the more Rational discourses of Prometheanism and Environmental Problem Solving that framed nature as a resource. The results to a limited extent reflect the continuum in that there was not a statistical difference between Prometheanism and Environmental Problem Solving, but there was a difference between Prometheanism and Survivalism. There was no statistical difference between Environmental Problem Solving and Survivalism, but there was a statistical difference between Environmental Problem Solving and Sustainable Development. However, Survivalism was not statistically different to Sustainable Development or the two Green discourses.

The tensions: statistically significant vectors in discourse solutions variables

The statistically significant vectors were derived from three evaluations of the ordination. Table 5.23 shows the variables that had a statistically significant

delineation of the social assemblages. This portrayal of the participants and social assemblages showed the positive and negative association between particular variables and social assemblages. The vectors portrayed in the ordination were selected from the statistically significant variables (both intrinsic discourse variables and extrinsic discourse and socio-demographic variables) in Table 5.23.

Table 5.23 showing scores for most significant variables

Variable	Variable short name	Range of values	Kruskal Wallis: value between groups	r^2 values (derived from Principal Axis Correlation (Pcc)	p derived from Monte Carlo's permutations (MCAO)
Solution to Environmental discourse: Promethean	DiscSolProm	0 = no rating 5 = most	86.44	0.922	p < 0.001
Solution to Environmental discourse: Green Rationalism	DiscSolGRat	0 - 5	67.15	0.154	p < 0.001
Solution to Environmental discourse: Green Romanticism	DiscSolGRom	0 - 5	92.60	0.702	p < 0.001
Farmer or Farm Manager	Farm/Man	0 or 1 (presence/ absence)	16.66	0.143	p < 0.001
Industry: Grain, Sheep & Beef Farming	GrainSheepBeef	0 or 1 (presence/ absence)	22.56	0.176	p < 0.001
Environmental discourse: Sustainable Development	EnvDisSusD	0 - 5	32.56	0.046	p < 0.001
Industry: Other Livestock Farming	OtherLStock	0 or 1 (presence/ absence)	27.17	0.072	p = 0.001
Environmental discourse: Promethean	EnvDisProm	0 - 5	13.93	0.089	p = 0.001
Environmental discourse: Environmental Problem Solving	EnvDisEnvPro	0 - 5	22.80	0.075	p = 0.001
Using Nature: Sustainable Development	NatUseSusD	0 - 5	21.36	0.062	p = 0.004
Industry: Mining and Manufacturing	Min&Man	0 or 1 (presence/ absence)	35.19	0.078	p = 0.005
Using Nature: Environmental Problem Solving	NatUseEnvPro	0 - 5	9.17	0.058	p = 0.005
Using Nature: Green Rationalism	NatUseGRat	0 - 5	43.70	0.064	p = 0.005

This ordination shown in Figure 5.7 (which is the same as the ordination portrayed earlier in Figure 5.5) portrays the statistically significant vectors (variables) in relation to the assemblages. Green Rational discourse solutions (DiscSolGRat) were positively associated with Social Assemblage 10 (darker green), and was negatively associated with the Promethean environmental discourse (EnvDisProm) associated with Social Assemblage 6. People working in Grain, Sheep and Beef farming (GrainSheepBeef) were negatively associated with the Promethean solutions discourse (DiscSolProm).

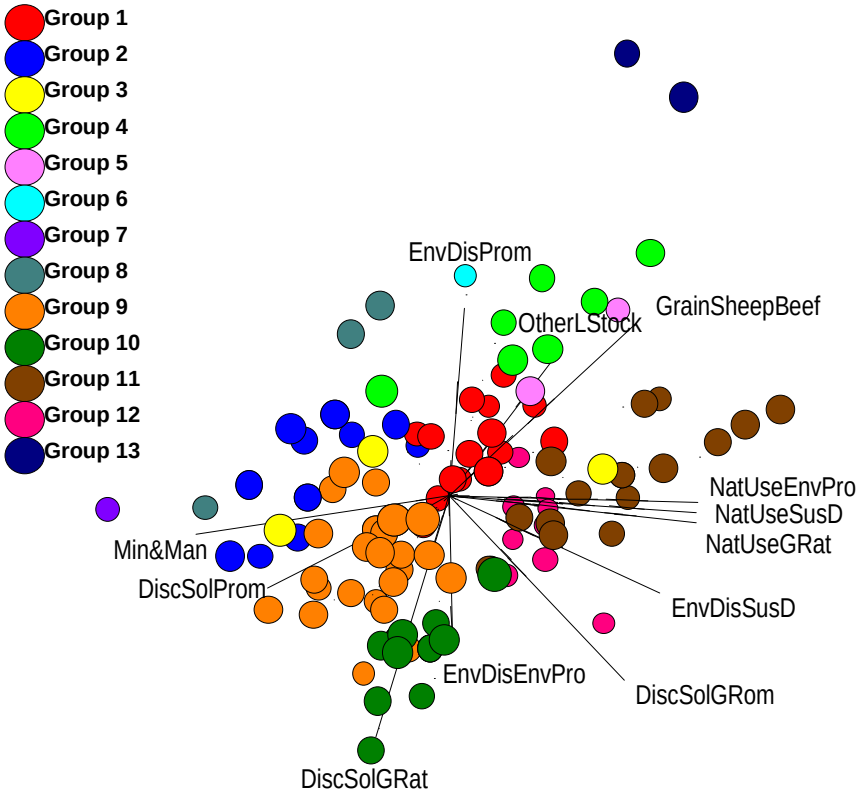

Figure 5.7 Ordination showing statistically significant variables (Gower Metric, UPGMA, B=0.05, SSH)

It was interesting to note that the question about how nature should be used (prefaced by variables of NatUse) closely correlates three discourses, Environmental Problem Solving, Sustainable Development and Green Rationalism (NatuUseEnvPro, NatUseSusD, NatUseGRat). Social Assemblage 11 (brown) associated with this integrationist approach represented respondents from both catchments and a range of industries and occupations but was negatively associated with respondents from the mining and

manufacturing sector. This group almost all clustered within the same social assemblage (the sense of place analysis) that allocated value to the full typology of landscape elements.

Discussion

Identifying the discourses of the environment that were used as frameworks of practice by local and regional decision makers provided an insight into how solutions to environmental issues may most effectively be implemented. It was clear that some sectors of the social catchment had discrete sets of values in how they situated themselves in relation to nature. These sets of values dictated their frameworks of practice, and thus their frameworks for solutions. The contrasts in how sectors situate themselves in relation to one another is clearly shown in the contrasts between communities of identity and communities of place in the analysis on sense of place, and between farmers and government administrators. These contrasting frameworks were indicated in this analysis through the industry sectors of farming and the manufacturing sector.

Discourses of the environment provide clear indicators of practice and solutions frameworks. The tensions between ideals of Green Rationalism and the ideology of Prometheanism reflect the continuum mentioned by Benton and Short (1999) and distinctions between discourses made by Dryzek (1997). The critical differences between ideals, ideology and practice that reflect a stratified ontology of the real, the actual and the empirical domains of environmental discourse (Bhaskar 1978, Chalmers 1994, Sayer 2000) were not easily exposed through the discourse statements reflecting the six environmental discourses used in this analysis. The statistical tensions between the frameworks used by different industry and occupation sectors provided a focus for further exploration in the qualitative phases of this research.

Section three: qualitative inquiry into discourses of the environment

The third phase of the research into discourses of the environment was conducted through a semi-structured interview process with participants that represented the social assemblages identified through the results of the numerical taxonomy. This provided an opportunity to explore the differences between frameworks of practice used by decision-making sectors in each of the social catchments. This section describes the questions and discusses environmental discourses by using the expression of participants through the direct quotes from interviews.

The research and interview questions

Statistically significant results from the numerical taxonomy were developed into interview questions that used the conceptualisation of environmental discourse and discourses of the environment in the local context of social catchments in both the hydrological catchments. This qualitative exploration is reported through a focus on the interacting relationships between three communities; three forms of knowledge: local, scientific and Indigenous; and the three components of the triple bottom line: economic, social and ecological.

Critical questions that emerged from the evaluation of the numerical taxonomy appeared to relate to relationships between the three communities constituting a social catchment: communities of place, identity and interest. In particular the relationship between agency staff members, as representatives of a scientific community, and communities of place and identity, as practitioners of agriculture and landcare, raised questions about the relationship between scientific and local knowledge. Though I had not been able to empirically capture Indigenous people's perspectives, I felt that Indigenous knowledge was a key part of exploring relationships between Romantic and Rational notions in landscape management, so included this form of knowledge as a third position in need of exploration in the qualitative phase.

A further means of exploring the relationships between Romantic and Rational perspectives in discourses of the environment is explored through questions relating to the triple bottom line. Landscape management that uses a triple bottom line approach requires consideration of social, economic and ecological requirements, as a holistic and integrationist approach (Mills 2003). The triple bottom line reflects a group of discourses of the environment that acknowledge that more than economic, more than social, and more than ecological perspectives are necessary in managing landscapes (Lehtonen 2004, Dibden and Cocklin 2005). Some perspectives include governance, technology or culture as part of this framework extending the notion to a Quad Bottom Line (CPA 2005). Loosely, Sustainable Development, Ecological Rationalism, some parts of Green Rationalism, and some parts of Environmental Problem Solving reflect and draw on triple bottom line rhetoric to represent their positions. Integrationist approaches attempt to acknowledge the importance of ecological perspectives, while including social and economic (human needs) within a landscape approach. The divides indicated through the vectors in the numerical taxonomy indicated a need to further explore discourses of the environment as a reflection of triple bottom line values. This inquiry made explicit differences (or similarities) between sectors of the social catchment that advocated Promethean solutions as opposed to Green Radical approaches through the values that gave primacy either to economic, social or ecological values.

Further, the results from evaluation of the ordinations through the ANOSIM (Table 5.22), and the scale reliability testing (Tables 5.8 to 5.19) indicated that two separate positions exist that separate out the Romantic and Rational perspectives, and these disparate positions could be usefully explored further through both the triple bottom line and the three forms of knowledge (local, scientific and Indigenous).

Interview and research questions representing the ground-proofing and exploration in the qualitative phase are outlined in Table 5.24.

Table 5.24 Relationship between interview questions and research objectives

Research Questions	Interview Questions
◆ What sorts of frameworks are used in decision making in this social catchment? ◆ What sorts of constraints are perceived on using natural resources etc? ◆ What limits to resources available from nature are recognised? ◆ How are environmental limits linked with sustainability? ◆ How is science used to re-frame decision making to achieve sustainability ◆ How is science used to frame or re-configure decision-making? ◆ Do people think they are directly dependent on and linked to the environment? ◆ What role does the environment have in directing the future? ◆ What is the power dynamic between the three knowledges?	◆ What do you think is the relationship between the three kinds of knowledges: local, Indigenous and scientific? ◆ What sources of learning do you use in making decisions?
◆ Are both Rational and Romantic values in landscapes acknowledged? ◆ Is social or landscape scale a consideration in decision-making? ◆ What are the underpinning ideals and ideologies in valuing landscapes?	◆ What do you feel about this landscape? ◆ Is there any part of the landscape that is more important than others, and why?
◆ What sorts of frameworks are used in decision making in this community? ◆ What sorts of constraints are perceived on using natural resources etc? ◆ What practices give evidence of particular discourses of the environment?	◆ If you think about agriculture within a triple bottom line system of ecology, economics and society, which is most important to think of first?
◆ Do people's ideals, ideology and practice coalesce around one discourse of the environment?	◆ What kinds of environmental solutions have been put in place in this catchment in the past? ◆ How do you think past solutions tried out in this catchment influence the kinds of approaches that might be considered in the future?

Capturing the discourses of the environment in relation to the use and interaction of knowledge form and the values of the triple bottom line was not straightforward or explicit in expression. An insight into the way in which an environmental discourse is represented in three interacting elements of ideal, ideology and practice with the three parts of the triple bottom line providing the discourse of the environment definition as Promethean is provided by three quotes (Table 5.25) extracted from the same 'breath' in an interview. These quotes representing a discourse position are directly linked to the expression of values in relation to the triple bottom line in Table 5.25.

Table 5.25 Quotes from a single interview providing insight into elements of environmental discourse, and discourse identification

Element	Quote
Ideal	"we believe if we had normal seasons of rainfall and our rainfall was what we believe is normal we would never have a salinity problem"
Ideology	"we haven't been keeping records in Australia for more than 200 years and we've got no idea what a normal season really is"
Practice	"if we don't get the rainfall that we Australians believe is normal we should be starting to farm as a drought country"
Ecology	"the creek is really only a gutter or a drain from where the water falls to the sea no matter whether you like it or not…"
Economics	"well if it's not economically viable, it doesn't matter how much you love the people either…and what was the other one?" {response to question about triple bottom line values}
Social	"sometimes it's difficult to get people that understand …some people are a bit more single minded and just worried about their own little group but I always try to push the point that we are all in it together, that we are all the one town and we are all working for the same thing"…"whether it's the football club or the rep club, it's the same. Its relevant to all the people in the community and it all pulls together"

The subtext of the discourse reported in Table 5.25 included references to Rational discourses but very sceptical views of science and though the landscape was lauded (during 'warm-up' and 'cool-down' discussion), it was specifically framed within a production context with little ecological value allocated. There were undertones of Survivalism, but only within an economic context. Survivalism in this framing did not include the needs of the non-human components such as ecological values and environmental flows. The other positions expressed (out of interview) drew on metaphors usually attributed to Romantic traditions in describing landscapes. To some extent this reflected the somewhat religious tonings of the norms in this social catchment that accord 'glory value' to 'God's Hand' in a 'grand' landscape, but within which people are expected to 'make the best of' the 'resources' put at their disposal. So, while it would seem that there were strong Romantic positions taken when solely judging the metaphors making reference to the landscape, the metaphors used ultimately represent a conservative Promethean perspective. This provides the basis for insight into the 'reading' of the expression in the three sections of qualitative results reported in this qualitative section of the chapter.

The qualitative results to the inquiry into environmental discourse are represented in three parts. The first part uses the conceptual elements in environmental discourse: ideals, ideology and practice as an expression of landscape management. The second part uses the triple bottom line as a way of expressing the differences between sectors of the social catchment through their values in landscape management. The third part of the qualitative results show the relationships and interactions between local, scientific and Indigenous forms of knowledge. The results of this inquiry are shown in three tables (Table 5.26, Table 5.27 and Table 5.28).

Ideals, ideology and practice: A stratified ontology of landscape management

The form and function of a paradigm are made explicit and recognisable through ontological assumptions; the assumptions about the relationships between people and 'nature'; the recognition and acknowledgement of agents in the interaction process; and the metaphors used to represent the paradigm (Dryzek 1997). The points of divide between the frameworks of practice that define paradigms are made explicit when conflict arises over the definition; allocation of values; representation of interests; and the exercise of power between competing discourses (Duane 1997).

Environmental discourse represents an interaction and negotiation between constraint and constitution of an individual's ideals, ideology and practice in relation to other individuals, their community and society. This stratified ontology of landscape management frameworks integrates the observable with experience and actual events (Bhaskar 1978, Chalmers 1994, Sayer 2000). Ideals show the integration of what is a necessity with what is possible and what is a potential. Ideology is represented through the 'actual' relationships between power and the ideology of a personal framework of practice. The third element of this stratified ontology relates to the integration of what is observable in a tangible and material sense, with what is unobservable but represented through symbolic form. These symbolic and material elements are integrated to form an 'empirical' representation in these qualitative representations.

The first set of qualitative results (Table 5.26) shows the direct quotes pertaining to the conceptual framework for environmental discourse and reports on ideals, ideology and practice in discourses of the environment. The quotes provided an insight into how these ideals, ideologies and practice frameworks were expressed in relation to valuing and managing landscapes.

Table 5.26 Conceptual elements in environmental discourse

IDEALS **Integrating necessity with the possible and potential**
"….not necessarily more efficient by going bigger…..to sustain your whole rural community that maybe is the way you should look at it…..I see industry ….is to maintain a certain level of population, the services…..secondary type of industry….to maintain opportunities"
"the people representing rural issues like water and conservation and trees, the political parties haven't got it yet, they don't get what trouble we're in, so the ruling class of agriculture, or of agribusiness is still old fashioned farmers, people who still think we can exploit the land, and that you should exploit the land because that's how you become someone"
"its very ordinary country…its very poor country…when I was young and I thought I could turn the world over…but it's time to move on"
"it's very attractive …mountains around, the flats which are normally green and interspersed with that is the cropping with the animal farming around, and the river is important"
"I just wanted to bring the children into the country, more than I wanted to go farming"
IDEOLOGY **A personal philosophical framework**
"whatever they tell you at the bin at harvest time, you cut it in half….there's no way in the world you can grow a five ton crop here because you only have 250 mls of rain in the growing season which will only grow a 2.5 ton crop"
"you've got to work with nature, its no use going against nature"
"in some government circles it is not valued as much and it is more and more important that you balance those two" {two framings of landscape: symbolic, less tangible…and economic production linked, more material}
"I just believe nature looks after itself"
"the land is quite dynamic….things that are man-made often don't last"
"I think that a lot of our landscape problems probably come from religious teaching, that this land has been put here for us to exploit, fair for us to do, you know, that point of view and the notion that we have to manage it environmentally or sustainable is still something that is new…I find that some of that is changing a little bit from the pulpit….certain barriers within those sort of core things to new ideas"
"I would be advocating sustainability….I think those hobby farms are very dangerous…there are people who come and don't understand water and how little of it there is and they just go: 'we'll rip it out of the river', or, 'I will pump it from somewhere'…you are degrading the environment without providing viable agriculture"
"if you're a farmer, you're going to look after your country well, because that's where you're going to get your bread and butter. You're not going to let it go down the drain unless you're a person that's just come into the district and you've got great ideas of making quick money"
"I think most people genuinely can try and look after the ecology within their budget"
"you can get labelled easily as a greenie, as you know and of course there is the perception of a greenie is a radical who won't listen to the economic essence of farming which is the wrong perception of course"
"as a race, as a species we are very disconnected from what really matters…and there is a sort of spiritual thing down there…maybe its actually quite dangerous that four billion out of six billion people are totally disconnected from a bigger system of which we are a part and one which we absolutely depend"
PRACTICE **Reflecting the negotiations of daily practice frameworks**
"…I suppose as a whole, to have the place functioning well is important to me and I think if there are parts that need extra work in terms of landcare, you pick those parts and work on it, but as a general rule, I feel that the whole farm is important"
"some of the solutions from the past aren't always appropriate to what we think for the future…each bit of land is going to be different…may be similar but they all need to be addressed differently"
"different kangaroos out there now….there are suckers out there and woody weeds that have come in….the gidgee trees have all grown up around the house….I think its just the way nature has been"
"the vegetation management act came in, legally it was destructive….I felt there was certainly a

backlash and the work I had done had gone backwards"
"they are natives to this area, that's what we are trying to do, whatever was growing you would replant"…"just to replant what we've used over the years…better timber"
"I think some of their ideas are too…they're not taking enough local knowledge, even though they seem to be projecting that they want all the local knowledge, but its not coming out in the wash. They're sort of saying that 'you've said this should work because you've put it all on paper', but you can't put a lot of stuff on paper to be able to put it into practice, because it changes so much even from here to Killarney"
"a group of growers got together and set up a growers organisation and its just gone from there really…its about proving that we are environmentally friendly…its sustainable farming…but it will be about proving that we aren't vandals to the land…overgrazing…over clearing"

Nature plays a key role in defining people's relationships with the landscapes in which they live (Egri 1999). It defines the philosophies of use, management and the more intangible symbolic relationships and expectations. These discourses are developed in relation to other community sectors and interact within the power relationships of current governance in landscape management. There were differences between social sectors in the two catchments in how discourses of the environment were used, and what was considered 'normal'. In general, changes that could be attributed to land management practices are attributed to nature in the Condamine Headwaters, while change in the Katanning Zone was clearly attributed to people or land management practice. The landscape itself has a powerful role in defining the ideals and the ideology that frame the resulting practice in decision-making.

While environmental discourses are more readily identified through the stratified ontology, the discourses of the environment did not emerge in an explicit and cohesive expression that represented either one or a set of discourse positions confirming the results of the numerical taxonomy shown in the dendrogram shown in Figure 5.4.

Knowledge represents distinct positions within a power dynamic in landscape management and may be configured to serve the interests of particular coalitions (Brown and Pitcher 2005). Knowledge evolves to form truth through the processes of internalisation of values and norms as part of the interaction with society and the environment (Midgley 2000). In turn this internalisation forms the ideals and ideology that frame practices and the representation of issues and solutions particular to discourse framework. Scale of inclusion

configures industry participation (e.g. “industry…to maintain a certain level of population…opportunities”; “agribusiness…people who still think we can exploit the land”) and symbolic representation (e.g. “more and more important that you balance those two” {aesthetics and production values}; “religious teaching…certain barriers within those sort of core things to new ideas”). Practice represents distinct ideals and ideologies confining approaches (e.g. in this quote to improving nature: “replant what we’ve used over the years…{to} better timber”).

While it is useful to use the discourses of the environment as a way of recognising the points over which conflicts might occur, each environmental discourse framing must include the recognition of the negotiations between ideals, ideology and practice and the mediating role of knowledge, truth and power. When considered in this way, environmental discourse and the discourses of the environment are process-based rather than forming the content of a complex adaptive system. While the quotes made each community sector position explicit it is useful to consider these positions in relation to the processes they configure and define.

Social, economic and ecological: triple bottom line values in landscape management

The second set of qualitative results (Table 5.27) pertain to the conceptual framework for discourses of the environment and report on the triple bottom line. The triple bottom line represents three contested and often conflicting values that give primacy either to social, ecological or economic values in landscapes. Current environmental governance advocates consideration of the triple bottom line, but frequently this is judged differently according to sectoral interest or social catchment sector. An analysis of environmental discourse provides an insight into the values accorded primacy and this may vary according to community or industry sector, and as these results show by gender as well. In addition, the results shown in the tables indicate the extent each community sector supports a particular position.

Table 5.27 The triple bottom line

The triple bottom line: Relationships between social, ecological and economic dimensions in landscape management.			
Communities of place and identity		**Communities of place and interest**	
SOCIAL			
"…in a social sense because you can point out the economic and ecological benefits of any particular action to any particular person but they are going to go with what they want to do and that is social….{even} if its not economically viable….{or} at the expense of the ecology and other economic decisions that they make, so socially is just huge"	♀	♀	"for me it is always people who are more important than anything else…"
"it is just that we are producing heaps more and having to be more efficient…so some farmers are the most efficient in the world and they become more efficient every year…..{future of agriculture?} its not getting better. We're surviving, but that's all…we are becoming the paupers of the industry…..it's only a lifestyle the reason we are doing it, not because we are making a lot of money"	♀	♂	"today, I don't know how you would separate them, they are all important…{agency staffer} …I think social might be very important. It is probably one that is often the last one thought of"
"yes, I really believe that farmers are interested in sustainable agriculture, farmers are not people that are there to use and abuse…in fifty years time, if that's going to be left for their grandson, its got to be viable and I think most people have a common sense approach and think about what they're doing and think about the water quality, the salinity, how much is arable, …soil nutrition…most people are trying to have their land sustained because its such a good lifestyle, because the thought of your grandson farming in 50 years time in your boots is probably quite fulfilling…I'm sure most farmers don't farm for the moment"	♀	♂	{keeping people on farms?} "lifestyle….a strong sense of community…they're always willing to help, but yes, you need the money to survive and there are these communities that will do all sorts of things to keep their communities strong"…" I suppose with community comes all those other social sides"
"it has to be economical and viable but at the same time we've got to do it environmentally friendly as well…and they've got to know about the science of the thing"…"its got to be acceptable socially….I think socially they've got to go hand in hand {economics and ecological}….so socially, economically and then environmentally"	♀		
"well, I would say society should always come first, then ecology and then economics. I mean ecology and economics can be quite closely related, but I think that people's needs should come before any enterprise…has got to be tempered by information by science…you've got to have a knowledge base in order to sustain those values"	♂		
"well, the biggest concern out of all that,	♂		

the social side of that, the globalisation and that side…its got devastating effects on the whole of the community I think….”			
ECOLOGICAL			
“it’s a balancing act to say well, economically we should be doing this, but viably we should be doing something else…because its part of the deal, its their life”	♀	♀	“I know that ecology is the one thing that can’t change, that people need to work with that and economics should recognise that. It is a little like the immovable force but they are not designed to work like that and people don’t recognise that ecology works like that either so for me that is always going to be the most important thing in the triple bottom line. But, the way society is that its not going to change. I would like to think it will down the track long term, that people would recognise that it needs to be managed in a much more sustainable manner (that horrible word sustainable) but it’s the only way we are going to have some sort of agriculture in the long term.”
“there’s lots of bird life, trees….nature at work…it gives me a reward to see that lush new fenced off part of the property that preserves some of the bushland area and its encouraging to see how its come back to life since we ….kept all the grazing animals out of it, and see all the trees there”	♂		
“I think the politicians have to get a grip on that ecology is as important as economics…but it will have to be that the government will carry it because the people don’t do it….won’t be enough of them who have enough personal resources or commitment to put ecology over economics”	♀		
“they’re all strongly integrated aren’t they, and certainly no ecology means none of the other two doesn’t it…{ecology} the foundation, then your cultural and the economic part come secondary”	♂		
ECONOMIC			
“ecology….if I was a farmer, I suppose, if I was making a living off the land, I suppose you’ve got to consider the ecology and the economics”	♂	♂	“economic comes up on top…social aspect …increasingly important…the farmers are interested in sustainability increasingly…they want to hand their farms onto their kids but also via education. Farmers are now becoming more aware of the issues associated with sustainability”
“if its not economically viable, it doesn’t matter how much you love the people either…it doesn’t matter how good the land is, if you’re not getting any money for it you can’t really keep it”	♀	♂	“the most important is the economics…..if the season runs….then the farming community tend to spend….increase the class rate at school, which means to school needs two more teachers, those teachers all shop up at Woolworth’s….its that pyramid of economic impact….the next one down the line is probably the social thing, sport and stuff like that….so

			if there is enough in the economy to support the development of these recreational things they attract it…only when things are good for a number of years is the ecology of the area thought of unless there are some ecological issues affecting…the local catchment"
		♂	"farming is price taking…farmers have to take whatever they can get….it's a very competitive business"
		♂	"the only thing is that everything you do, you've got to prove it is viable and the economic goes with it, and maybe not directly, but if you put the off-site costs into the equation"
		♀	"…but I think that just comes down to the personality of the farmer and obviously some people can see solutions and are prepared to experiment or they've got the economic ability"
INTEGRATED			
"its all a balance. Economics is very important because we have to make a living, but how we make a sustainable living is more important than just a dollar in your pocket today if you have no dollars in your pocket tomorrow"… "its interesting to see how the farmers around the place are having an improvement in their productivity but increases in looking after the ecology of the land but also working with a lot of different groups to help them get there"	♂		
"I think it all works pretty well together really because if it doesn't all work together, then nothing would be here. If you take one of those out of it, like even if you haven't got the social side, …{especially for} the young ones with the kids and that, if they haven't got somewhere to go on weekends to the footy or something, they're going to say: "I'm not staying here"…	♂		
"I think they are all probably on a par with each other, they all got to work together, you can't have any imbalance. They all got to have a part to play so I would say they are all on an equal footing as far as keeping me viable, and the area together. So, I wouldn't say any one part is more important that the other"	♂		
"I think they all work together, they should work together…you can have the economics and the land and so social interaction and still be successful"	♂		

The results from this question (Table 5.27) indicated that communities of place and identity have a greater interest in economic components of the triple bottom

line. There was an interesting commitment to integrating the triple bottom line from communities of place and identity who were male. There did appear be some indication of a gendered response to this question. There were more people interested in integration from Katanning Zone than from the Condamine Headwaters. Consistently, in the qualitative questions, when asked what is more important in the triple bottom line approach to landscape management (social, ecological and economic), most respondents answered economic at first take, then qualified with social when asked to consider the defining factors. Some placed ecological values as more important, but also, qualified to social in the second consideration.

The consultant sector, which played a stronger role in land management decision-making in the Katanning Zone than it did in the Condamine Headwaters were conduits of information. This information was a mix of experience, science and local knowledge, but more importantly the domain of discourse drew on the nexus of knowledge and truth to represent the economic power of sectoral interests in business. The environmental discourse of this group had an emphasis on prosaic, *status quo* discourses that emphasise economic (agricultural production rather than natural resource management) and Rational approaches, rather than more holistic integrationist approaches of the triple bottom line.

The state of the environment was secondary to the opportunities provided to sell products (or policies for that matter). Social capital was often used as a means of introduction and thus the power of economic market-based advice occupied a privileged point of entry. Farmers were using agronomists from hundreds of kilometres away, and often employed a range of at least five consultants. The information provided by this sector was not value free, and information provided did not necessarily reflect the science of government, nor was the science of government necessarily neutral. Many comments from agri-agency staff implied that the policy positions they implement were commensurate with the information being provided by the private agri-business sector. There was no evidence that this was the case. On the whole, the qualitative ground-proofing indicated that environmental discourse positions (as

were the results from sense of place analysis) taken by these two sectors, government administration and private sector agri-business consultants, were in sharp contrast when applied in local context (Wardell-Johnson 2005).

The importance and influence of the agri-business sector is underestimated in the current governance arrangements being implemented for the management of landscapes in rural Australia. Few governance arrangements include nominated or elected representatives of the agri-business sector in the local context. Both the quantitative and qualitative results indicated that there is a significant difference between the discourses of the environment used by communities of place and interest (including agri-business sector as well as government agency staff) and communities of place and identity (mostly farmers). The dependence on the private agri-business and quasi-private (non-government sector in land management) to provide valid and reliable information is critical. Professional advice in the form of scientific knowledge is important in any form of investments, with significant implication for the non-material or symbolic values in landscapes.

Local, scientific and Indigenous knowledge: a tripartite knowledge system

The third set of qualitative results (Table 5.28) reports on the three knowledges. The relationship between local and abstracted contexts was captured through this research in the relationships between communities of place and communities of interest. The numerical taxonomy indicated that there was a tension in value relationships between these community sectors and this was represented through the use of scientific knowledge in relation to local and Indigenous knowledge. These relationships are indicated in these qualitative results through the form of interactions (or lack of) between communities of place and communities of interest.

The qualitative insights showed that the first point of call for communities of place and identity in decision-making was primarily micro and meso scale social capital. This was in contrast with communities of identity and interest who

generally used meso and macro scales of social capital as a means of considering new ideas and innovations in land management strategies.

There was sufficient comment on the importance of Indigenous knowledge in decision-making to include this form of knowledge in the results of the analysis shown in Figure 5.30. Each of the three forms of knowledge is reported in separate tables (Local Knowledge: Table 5.28; Scientific Knowledge: 5.29; and Indigenous Knowledge: 5.30) differentiating between community sectors. The final table in this section (5.31) shows the participants' quotes that integrate the three knowledge values at the outset.

Table 5.28 Local Knowledge: access to and relationship with

COMMUNITIES OF PLACE AND IDENTITY	COMMUNITIES OF PLACE AND INTEREST
"the local knowledge is what we share amongst ourselves"	"the science and local knowledges goes hand in hand, ….local knowledge adapts science so that it can work, and it should tell science what to look at"…..{working in practice?} "not enough…we need more of that interaction"
"I think most farmers would rely more on local, they are interested perhaps in the Indigenous and scientific side of things, but they probably base more of their knowledge…they will research the scientific….but they do a lot of talking"	"a lot of it is listened to, not a lot is used {local} …more like folklore…experience {local} comes first, but also now bringing in more technology to back up what was myth or observation …they start to treat it as fact and take notice of it"
"the older generation is just going to have to disappear before anything remarkable can actually take place"	"a lot of farmers I talk to readily talk about what their Dad's did because with the farming community its so intimately related from father to son….I think they have an amazing history of the place and that's where they get their connections that they can draw on all these stories and they know the landscape and the stories associated with different parts of the landscape and the significant people…its really nice that they have that connection….farmers have a very important connection"
"the pioneers always left strips of timber and that's very evident up here. The old settlers were very conservation minded, they didn't just fall big patches and just leave it. It was felled for a reason to use as a resource mainly, then to clear it to grow cattle. That was an aim, but there was always timber left, and they never just felled it and they are the systems that were put in place right back in the old days and its still happening here today and that's been passed down to me. You just don't flatten it all. If you want to take timber out of there, you select it and what we have left here on this place will keep this place in good state and that goes for all the farms here…yes, that's still happening because while we've got those people who have been here all that time, and I think that once you do loose that…"	"the older generation…will go back three generations….they basically learnt themselves hands on….then ..another group that have more extensive schooling…they may have travelled a bit….another tier…who are quite well educated….researching…plus the technology age …then how well that information is passed on and those ideas put into place is how strong the next generation is able to control and influence"
"all the old fellows out there were the ones that actually taught me"	"they quote a lot of misinformation from contractors and scenarios they have come across. They always tend to remember the good bits not the bad bits"… "some of the contractors…are quite smart….self-taught…they've developed a system that's sort of worked on their properties and in their general area and then they try and make it applicable to everybody else and it doesn't work"

One participant who explained that experiential knowledge adds another dimension to local knowledge challenged the limiting of knowledge to three

forms. This particular form of knowledge was attributed to those who bring knowledge into a community, but who are not considered community of place accredited to claim to have local knowledge. This form of knowledge might equally represent that accrued by those working or learning outside of the local context, such as younger members of farming communities who gain tertiary training and then return to farming with their parents. Knowledge forms a central core of a discourse once it is accredited by a paradigm (or discourse framework) to be 'truth'. This accreditation is justified within the limits set by the context of a discourse (Hajer 1995). In this situation certain realities are acknowledged and others dismissed limiting the intellectual stock available within a discourse framework (Harré *et al.* 1999) and constraining the possibilities for solutions provided by one form of knowledge to another.

It was evident in the interactions mentioned by these participants that communities of place and identity regard local knowledge as concrete and explicit based on real management contexts (e.g. "strips of timber…will keep this place in a good state") while communities of place and interest talk in more general terms about local knowledge (e.g. "I think they have an amazing history of the place…a very important connection"). The power of local knowledge in contributing to an iterative tripartite knowledge system will achieve legitimacy only through acceptance by those holding power and those subjected to power (Foucault 1991). This is an interesting situation as two linked forms of power over the landscapes co-exist in which abstracted communities of identity and interest form policy and legislation for management while communities of place and identity have the power to choose the ways in which this policy and legislation is implemented.

Table 5.29 Scientific knowledge: access to and relationships with

COMMUNITIES OF PLACE AND INTEREST
“academic references, experiences in my own work life, talking to peers and related people….”
“{a government NRM agency} …fortunately or unfortunately….{has} a dual role as conservation unit and in disseminating information and helping people like landcare groups. I think they are very well respected and communicate well, but there is the unfortunate side of CALM …this enforcement role which is invariable negative” ….{less likely to take on board local knowledge?} “they are not allowed to because they are working strictly by legislation and interpretation of that stuff”
“my main contact with the community over the {30} years is via sporting groups, ….cricket and tennis mainly”
“…one is our major open day, we have every five or six years”
COMMUNITIES OF PLACE AND IDENTITY
“all these people who work for agriculture and all these scientists must be doing something coming to take their wages every fortnight….but I don’t know what it is”
“there is always someone doing a study with the scientific stuff….some of their questions were a bit way out and it was as though the bureaucrats had written out this list of questions and sort of said, ‘we’ll put these questions to the people…this is what we want to hear’ but actually what people were saying…the rising water table in Katanning isn’t making people leave its other social issues…and a whole heap of other things but its definitely not salinity”
{Scientists and acknowledging local knowledge?} “not all the time. They could take a little more notice than they do….its fine to do something in the laboratory, but to actually do something in the field and put it into practice is a different story”
“but they {a government agency involved in agriculture} have got too scared to tell you anything…they’re very hard to get any information out of…they’re too scared of getting sued or something”
“I think the field people {technically/ scientifically trained professionals}…fit well into the community, contribute well in the community but are under at times a high level of stress from the decisions made wherever they’re controlled”
“trust is hugely important…farmers don’t generally trust agencies because of the nature of agencies” where young graduates “tell the farmers that the agencies can solve all the farmers problems….they’ve heard it twenty times before”…”information that comes out of the agencies, the farmers go ‘I believe that’ but whether they will adopt it that’s where the trust comes in….different levels” {of trust}
“Nature is the greatest thing to learn from, not from science. You learn from nature and I believe that if they are willing to learn from nature which is the people who own the land, and they added their extra bits to it, I think we would be way ahead”
“quite lengthy submissions, but it was largely qualitative data and the scientists didn’t know and couldn’t incorporate qualitative data into what they were doing, and so….there are a few pissed off graziers”
“I’ve spoken a lot to Natural Resources, phoned them up. I’ve had several of them visit here, when I first moved here. I got quite disillusioned with that process because they were bureaucrats, highly scientific, but they couldn’t {supply advice or help}”…“people like me who have an education think people in the DNR are the way to go. When I came here I went pooh poohing all the local knowledge because I’m an educated person, and I go to…books….written down…they will talk my language….I guess maybe I’ve gone more local because now I go: ‘I know more about this than you do’
“the DNR people they didn’t know about that, or they certainly wouldn’t tell me, they just wonder around saying ‘how interesting…I’m trying to think, yes…we have almost an ecosystem here, I just want to build on it, but they couldn’t make the connection”
“it’s a great source of frustration for me that science and scientists often won’t use landholder information because they are not comfortable with qualitative information. They want hard numbers and things like that”
they might be promoting a particular product…then you can go back to the DPI and check some of their trials and marry the two lots of information up...until it makes sense. And we try to see what suits our project”

On the whole, scientific knowledge was developed and provided by government agencies. As there was frequently a dual role within a particular government agency that included both enforcement and education, the integration of local knowledge with scientific knowledge in a necessary iterative feedback loop was cluttered and hampered. The reproduction of environmental discourse hinges on a tension between sanctions and inclusion. Sanctions were used to maintain the norms of both social capital and environmental discourse. When governments (all three tiers of government) apply sanctions formally they are justified through legislation, but sanctions were often put in place for informal reasons. In addition, within agencies, local observation based knowledge was perceived to be displaced by technology and 'quantitatively' based scientific approaches. There was frequently reluctance by communities of place to engage and present alternative results within these contradictory institutional settings, just as there was scepticism on the part of agency staff about the value of local context insights. These results confirm those discussed by Higgins *et al.* (2001) in their exploration of the impact of governance in agricultural practice.

Government agency research agendas have an internal accountability system with little opportunity for feedback from local contexts. 'Bumping into a farmer in Woolworths' provides little opportunity for an understanding of issues and knowledge formed in the practice context that applies scientific knowledge developed in 'laboratory circumstances'. This applies equally to communities of place and identity that claim farming is learnt via local knowledge from applying information acquired from other local people. With the changes in the role of agency staff in local contexts and the disappearance of extension officers who formerly mediated knowledge forms, there is an indication that scientists contribute more frequently to the limited interactions of government agencies with farmers. This has resulted in a mismatch in scale and application.

While there has been a move away from public sector extension services (Tonts 2005), the participants indicated that the need for ongoing and frequent communications between the sectors involved in landscape management remains. In addition, the broad range of information available to landholders means communities of place and identity are more discerning and selective

about what they believe. This information includes scientific information that comes through informal channels as feedback from visiting researchers. Farmers that were interviewed expressed a keen interest in hearing of the results of research conducted in their catchments. They enjoyed the interaction of the research process and were interested in hearing about approaches and activities in other places. This shifts the balance between local and scientific knowledge (and thus the enactment of power) at the local scale. The upshot is a constant need for landholders to evaluate and integrate discourses of the environment that take a sharply contrasting position with their own predominantly integrationist, Sustainable Development and Romantic positions.

Table 5.30 Indigenous Knowledge: access to and relationship with

COMMUNITIES OF PLACE AND INTEREST
"I know that when some of the individual Aboriginal people have a reasonable standing in the community and they talk to farmers and Europeans love to talk to them and ask "what did you used to do?", "What was it like?, and just get as much information out of them as they can…and they don't say much about the area and its really interesting. Its surprising when you talk to farmers just how much that have gleaned from Aboriginals, even old timers, …they have managed to pick up along the way"
"Indigenous knowledge….is very important when it comes to almost the mythology and that's a very strong psyche…"
COMMUNITIES OF PLACE AND IDENTITY
"I still believe that in general community basis that there is a poor level of communication….its hindering appreciation by both parties of subsequent tolerance…..I get on well with a lot of the local Noongars because I'm not a club goer but a pub goer…..he won't go to CALM 'cause he's going to get the official list rather than the broader perspective"
"I've never come across any Aboriginals in this town with that knowledge….{would benefit?}….they've got a lot of this knowledge that they don't seem to want to share too much….that sort of secret stuff"
"{a small town in the catchment} doesn't really have much experience of Indigenous people. They used to live in the town fifty years ago. I think it became taboo and we don't have Aboriginal people around. There is no land owned by Aboriginal people in our area, so that would tend to probably be pushed to the side"
"I probably did because we used to live with them pretty well a while back…the old blokes that we used to live with here, cause they actually used to live on the farm, helping us clear and that sort of thing, no, the old blokes were quite good…they're all gone…some of them were really nice people"
"this place was taboo because the spirits, this was always covered in fog and mist"
"not at all, not here. A little bit in the West" "we learnt quite a bit off them just talking to them"…"of survival…but they are not a part of this culture here at all."
"it's the big missing thing. There have been very halfhearted attempts to engage Indigenous people. When they have been made its….been so cultural inappropriate, there is no understanding of where Indigenous people are coming from and also very little understanding that many of the Indigenous people who live in this catchment are either not traditional…and many of them have been removed from it for a very long time and certainly they have been disconnected from most of it" …"that failure to engage appropriate terms is starting to change but I think the white people that are driving it…find it very frustrating because time frames are just so different"…"just a whole different frame of reference…when the mob say {they} have got to go away and consult…if you want to hear what everyone wants to say, you're going to have to wait for it"
"that knowledge is priceless and we specifically ignore it"
"it would be great if we had more direct involvement with local {Indigenous} people"
"I've had this amazing experience with my children going to school of the whole Indigenous thing opening up….so I have a huge respect for that, that I didn't have even two years ago…but I certainly would now seek out, if there was information…I would use it"
"certainly have no Indigenous knowledge, that's quite unfortunate, but I think this community has been too long settled to have retained any of that sort of cultural asset …{from a non farmer} …everyone harps on about Aboriginals being attached to the land and all, farmers in these sorts of communities are just as attached to the land as any black fella and yet they're never recognised in the same way. They are always taxed, so you can understand how you get those sorts of problems happening ….{Indigenous knowledge} "I'm a bit amazed why there isn't more information out there and even why that information isn't integrated into research centres like The Hermitage and stuff. Very narrow minded and I think that they think all we need to do is genetically modify this and that crop and nothing else matters. Pretty sad isn't it?"…{Indigenous knowledge} "that sort of information would be great if you could utilise it in landcare"

The distinct expression in each of the two community sectors reported on show the difference in expectation of how each of the knowledges will be used and integrated. Communities of place and identity had a greater vested interest in their own locally derived experiential knowledge being recognised and integrated with scientific knowledge. Those who use scientific knowledge in the communities of place and interest have less concern with and respect for the role of local knowledge. The role of Indigenous knowledge appears to have been underestimated in landscape management in general, and though acknowledgement of Indigenous people's presence and connection with each of these landscapes appears slight, the importance of that form of knowledge is considered significant.

The mythology of a place (the transition from space to place) is to some extent created and mediated through Indigenous knowledge (McIntyre-Tamwoy 2004). Relationships with place were often expressed particularly through the intrinsic spiritual expressions of attachment (in the form of perceived Indigenous forms of attachment to place). In both social catchments communities of place and identity expressed a clear and distinct nostalgic longing to know more of Indigenous knowledge. Many of the Romantic discourse expressions drew on the essentialist discourse of Indigenous knowledges alluding to the 'pure Eden' of 'a time before degradation' and the 'hand of white settlement'. There was a distinct acknowledgement by communities of place and identity of their lack of environmental and ecological knowledge derived through Indigenous perspectives, which they felt would complete and provide the key to their connections to place. Indigenous Australians were considered by communities of place and identity as privileged in their knowledge of the land, but on the whole these same people had little interaction or knowledge about how to improve contact with the Traditional Owners of these two catchments. There was a contrast between the Condamine Headwaters and Katanning Zone in the role of Indigenous people in contributing to local knowledge. There was a distinct denial of prior ownership or the value of Indigenous knowledge in the Condamine Headwaters, and a correlating lack of acknowledgement of environmental history of change.

Table 5.31 Integrated approaches to the triple bottom line values in landscapes

COMMUNITIES OF PLACE AND IDENTITY
"there is a relationship between them. Aboriginals can tell us exactly what went on before and what grew there…and that is a start. …the farming knowledge, well that gives an idea of what the land actually looks like and the soil test is done and what's been conducted there. The scientific is how we can approach to get it back to a balance. It can be intertwined."
"you've got to learn from your past, but there is more scientific knowledge around and more available, so I think we've got to knit them together…to keep it going forward"

Science provides a link between local and Indigenous knowledge when landscapes loose their 'balance'. When science is unable to provide answers, then Indigenous knowledge provides an alternative perspective. Communities of place and identity used the management of regeneration through fire in remnant vegetation as an example in the local context. Translation of this Indigenous knowledge to a form acceptable in scientific terms may provide local people with appropriate approaches to issues at the local context.

Discussion

Current discourses that downplay economic components can result in the re-emergence of and re-integration of sustainability with the triple bottom line as a viable approach to land management through the integration of the three forms of knowledge. In general communities of place and identity expressed a need to increase their understanding of environmental and ecological processes to improve their land management strategies but within the local context of knowledge and landscapes. This indicated a considerable potential to engage, but within a power dynamic that uses the principles of participative democracy.

The discourse of Sustainable Development that includes an emphasis on ecological values changed sense of place values. More 'naturalness' as found in remnant vegetation and 'messy' woodlands is now considered acceptable due to the change from economic to ecological and from engineering solutions to integrated solutions. Though environmental discourse may be based on memory or previous experiences, it loses context over time due to changes (such as technology, economic imperatives etc) but maintains form regardless (Stedman 2003). Often an environmental prompt, such as the occurrence of

frost served to link context to memory and thus brought the temporal scale to the fore.

Trust between communities of place and identity and communities of place and interest has a key role in reproducing knowledge and consolidating truth. This reflects the potential for iterative and interactive relationships between local and scientific knowledge that close the loops between theory and practice and build resilient adaptive agricultural systems.

Conclusions

Each discourse of the environment is discrete, but not easily discernable through simplistic statement based assessment. The assumptions built into each domain of discourse require explicit framing to consider the elements and modifiers that construct each environmental discourse. This makes the task of disentangling discourses of the environment very difficult without the central use of the conceptual framework for environmental discourse that relies on the differentiation between ideals, ideology and practice. These three elements were mediated at the individual, social and environmental scales by knowledge, truth and power.

The ideals in discourses that drive solutions do not necessarily reflect the mediation of power that produces an ideology, or the integration of tangible and experience based local knowledge that frames practice. The economic discourse framing pervades but was taken with a pinch of salt within the social catchments. Yield was used as a benchmark for production and the basis for comparison of approach in landscape management but was heavily critiqued through an ecological lens of biophysical environmental limits. The ecological variables of rainfall and soils still set expectations for potential and limits in a constant iterative interaction between ecological and economic components in an agricultural system.

Without the use of numerical taxonomy, and reliability evaluation through Cronbach's Alpha, the collusion of the rhetorical metaphors would have clouded

a more straightforward and traditional social analysis. The quantitative reliability and survey based approach was inadequate in this case in exposing the structure and content of ideals, ideology and practice in an abstract domain of environmental discourse. However, the numerical taxonomy was a useful approach in exposing the value tensions within the social catchments. The focus these quantitative results provided for the qualitative ground-proofing provided both explanation for the tangled quantitative results and explanation of the construct of environmental discourses. These discourses were exposed through the social relationships between the tripartite knowledge system within catchments, and between ideals, ideologies and practice in relation to the processes of the triple bottom line. A more detailed description of the discourses of the environment might have been possible through further text analysis drawing on both interviews and literature. This approach was limited by the breadth of this study that integrates a range of theoretical literature in a complex systems approach in a process orientation. This has limits for the content descriptions necessary to provide detail in environmental discourse.

In the final analysis, results exposed through the sense of place analysis were confirmed here that the economic is a learned imperative accorded importance in a *status quo* situation of dominance, but did not truly reflect the positions taken in personal relationships with landscapes. The subjugated discourses were reflected in the more intrinsic relationships with landscapes and related to the spiritual, aesthetic, therapeutic and cultural domains. The Romantic discourses of the environment that included to some extent a rejection of science in framing this relationship, emerged only when the full range of positions were assessed. Ordinarily, these discourses are not talked about, mentioned in policy or environmental solutions, and are thus accorded little credibility in everyday talk. These subjugated discourses clearly require greater consideration than they have been accorded. While the more conservative discourses reflected in Prometheanism and aligned to an economic consideration have had great credence in the past, there is clearly a change towards a practice that acknowledges, though quietly, the value of more intrinsic and symbolic relationships with landscapes.

Strength of Green Radical positions correlated with the strength of Romantic landscape values representing intrinsic relationships people have with landscapes. These positions are at odds with much contemporary environmental policy that emphasises economically rational incentive-based perspectives. While production values are seen to be critical in the rural agricultural sector, the intrinsic and social values are shown in these results to have more significance and importance, and more importantly to provide the key to entry and implementation.

Explicit acknowledgement of the subjugated values provides early identification of commonality engendering a more Romantic notion of landscape thus diluting the dominance of the Enlightenment in contemporary decision-making. In this way, symbolic landscape values such as biodiversity, aesthetics and the spiritual, critical to the resilience of rural agricultural systems, will be acknowledged and effectively integrated into decision-making at the landscape scale.

Landscape management that intends to bring about amelioration of landscape degradation must depend on and be located within the frameworks of acceptable practice in the communities in which it is to be implemented. Identifying the discourses of the environment used as frameworks of practice by local and regional decision makers provides an insight into how solutions to environmental issues may most effectively be implemented. It is clear that some sectors of the community had discrete sets of values in how they situate themselves in relation to nature. These sets of values dictated their frameworks of practice, and thus their frameworks for solutions. An awareness of the contrasts in how sectors of social catchments situate themselves in relation to one another was clearly shown in the contrasts between communities of place and identity and communities of place and interest in the analysis on sense of place and correlates with the value tensions between industry sectors in the environmental discourse analysis.

These contrasts in sense of place and discourses of the environment have the potential to cause significant conflict in contemporary policy and governance

approaches that advocate devolution of funds to regional bodies with local scale input. It is critical that differences are identified explicitly and included in the decision-making process, in addition to clearly identifying common ground within sectors of implementation. This explicit inclusion of the full range of decision-making sectors in a social catchment identified through this analysis is critical if new initiatives are to be successful both in the sense of participative democracy and if adaptive and resilient landscape systems are to be maintained and fostered.

Policy in landscape management that intends to bring about amelioration of landscape degradation must depend on and be located within the frameworks of acceptable practice in the communities in which solutions are to be implemented. People living in the same landscape and working on the same sets of environmental issues can be effectively differentiated to form a starting point to implementing solutions. The basis for information is not necessarily science or professional occupation, but how people frame their relationships with the landscapes in which they live. Discovering these frames of ideal, ideology and practice are more critical to finding common ground than particular frames of knowledge such as those that drive the implementation of government based policy imperatives. Discourses of the environment provided very clear indicators of practice and solutions frameworks and correlated quickly and easily with the way landscapes are valued and sense of place derived.

Social practices are discursively ordered and embodied principles that are situated in time and place, involving human models of risk, agency and trust. At the local agency scale, these practices produce and reproduce tacit notions of agency, nature, the future and other related human activities. Investigation through qualitative methodologies has led Macnaghten and Urry (1998) to claim these practices and associations with the local context to be:

> opposed to, or contradicted by, official bureaucratic, scientific and managerial discourses, such discourses often becoming part of the problem rather than the solution (p.2)

Enquiry into discourses of the environment exposes definitions, interpretations and negotiations in environmental affairs. Discourses help constitute and re-

constitute the world in the same way as institutions and material economic forces are maintained and reproduced (Dryzek 1997).

Bringing the three concepts together

In advocating a need for changes in land management practices in rural Australia an understanding of the relationships between these three dimensions of social relationships with the landscape is critical. Sense of place, the social capital upon which relationships with place depend, and the means by which relationships with landscapes are constructed and managed through environmental discourses require explicit definition. The conjunction of these three social dimensions as defined through this research is a distinct relationship with landscape that constitutes a relationship that is not reducible to that of each individual constituent.

The final relationship discussed in Chapter Six explored emergent domains reflecting the complex interrelation and interconnection of people in the landscape. This approach moves from the content of complex adaptive systems identified and described through the detailed exploration of sense of place, social capital and environmental discourse, to a process based exploration. The interactions between decision-making communities in social catchments, the interactions in these tripartite knowledge systems, and the triple bottom line values of landscape management collude to configure, maintain and re-configure these complex adaptive socio-ecological landscape systems. These emergent characteristics are explored in relation to the construct and maintenance of resilience in Chapter Six.

6

"Things derive their being and nature by mutual dependence and are nothing in themselves."

Second-century Buddhist philosopher: Nagarjuna (Schiller 1994).

Complex adaptive systems

Introduction

Resilience in human communities emerges as an interaction of relationships, values and practices between people and the landscapes in which they live (Marion 1999, Holling 2001, Gunderson and Holling 2002). These dynamic and complex relationships with landscapes encompass both symbolic and material values (Brown and Reed 2000). Both perturbation and diversity are necessary processes if systems are to be capable of learning, evolving and responding to change (Berkes *et al.* 2003). To manage for adaptive and resilient agricultural landscapes, we need to identify these relationships and values, and acknowledge non-linear connections and diversity.

In this research, an attempt was made to reduce *a priori* assumptions about the critical factors in these relationships. Broad conceptual frameworks were developed to integrate spatial, temporal and social scales in the three

dimensions examined: sense of place, social capital and environmental discourse. These social dimensions describe the content of processes that form these interactive complex adaptive rural agricultural systems.

This chapter reports on the integrated use of a number of approaches categorised in Eoyang's (2004) typology continuum for exploring and describing these complex systems. These approaches range from qualitative approaches to quantitative and abstract mathematical portrayals of these systems. The methodological objectives in this phase of the research included the location of processes and patterns of values in these rural agricultural social systems by using numerical taxonomy. The research rationale was heuristic and based on an explorative analytical approach through the accumulation of knowledge to expose structure and process (Midgley 2000, Kleining and Witt 2001). This methodology transforms the somewhat reductionist cause-effect structuralist approaches often used in social science, to provide an explicit and bounded systems approach that exposes process-based form for post-structuralist analysis. Numerical taxonomy provided an integrated approach with qualitative heuristic methods to demonstrate a rigorous means of identifying patterns in systems. This approach formed the focus for describing and understanding deep structure through the statistically significant variables that defined the emergence in these complex adaptive social systems.

The requirements for exposing structure using numerical taxonomy included ecological sampling[41] and a broad operationalised conceptual framework. Structure in these complex adaptive systems was located through the identification of statistically significant attribute descriptors grouped in abstract ordination space. The value tensions between these groups of attribute descriptors formed domains of attractors that provided the basis for the identification of process. These analysis results exposed through numerical

41 Ecological sampling draws on biophysical and social descriptions of process in systems and captures the locus of recurrent behaviours that structure complex adaptive systems. This sampling explicitly acknowledges relationships of power (coercive and collaborative) at play through two contributors to social decision-making applicable in local landscape contexts that operate at three scales (individual, community and society; communities of place, identity and interest) within the geographic diversity of landscapes and landuse (drawing on continuum and community concepts) in a comparable paired replication in two hydrological catchments.

taxonomy provided guidance and focus for the qualitative exploration of the structures and processes in these social catchments.

The qualitative ground-proofing explored three critical domains of attractors: the three knowledges (local, Indigenous and scientific), the three communities (place, identity and interest) and the triple bottom line values (social, economic and ecological) as the structures that encompassed the processes of rural agricultural Australian communities. Each of these critical domains was portrayed through the quotations and insights in relation to the elements that comprise a complex adaptive system: the emergent characteristics; adaptive capacity; and self-organising characteristics.

Specific research questions included:

- How can complex adaptive systems be conceptualised to integrate content with process?
- What theoretical options exist for integrating incommensurate symbolic and material values that link social and ecological systems?
- What quantitative and qualitative methods can be integrated in order to expose the dynamic structures of resilient processes in complex adaptive systems?
- What role do the three elements of complex adaptive systems play in configuring, maintaining and re-configuring resilient systems?
- What are the emergent domains of attraction that define and constrain the functions and processes of rural Australian agricultural systems?

This chapter focused on the emergent characteristics that become apparent through the results of the analyses of sense of place, social capital and discourses of the environment. Results from each of the accumulated analyses indicated the need to understand the processes of interaction between three discrete domains of attractors that maintain resilience and systems integrity in these complex systems. This was achieved through research questions that identified the interactions between the decision-making communities (communities of place, identity and interest) in social catchments that formed one domain of attraction. The second domain of attraction was explored through focus questions that differentiated between local, Indigenous and scientific knowledge forms that constitute processes of interaction and exchange in

tripartite knowledge systems. The third domain of attraction that emerged was the triple bottom line landscape value system comprising social, economic and ecological values in decision-making. The processes of interaction between these three domains of attraction were identified as a means of defining the configuration of boundaries and constraints of parameter phase space of resilience in these socio-ecological landscape systems.

The first section of this chapter defined and identified the elements constituting complex adaptive systems. Section two combined and synthesised the variables identified as contributing to the emergent characteristics in an analysis through numerical taxonomy. These interacting domains of attraction were further explored through qualitative analysis in section three. These accumulated results were developed through qualitative metaphors in section four. This section presents the final conceptual model that provided key insights into structure and processes in rural agricultural systems in Australia. This forms the synthesis of accumulated research in this thesis presented as an integrated expression of the three interacting social dimensions, along with the elements of a complex adaptive system and emergent characteristics that form interacting domains of attraction.

Section One: defining complex adaptive systems

The notion of complex systems has emerged from Chaos theory and accounts for non-linear relations in which changes cannot be explained by simple linear cause and consequent effect (Byrne 1998). Complex systems theory resonates with a general post-structural framework in which causally based determination is not usually expected as the determinant or explanation for phenomena. Urry (2002) claims that:

> complexity stems from the dialectic of mobility and moorings, whereby systems are neither anarchic nor ordered, neither exhibiting free will nor determinism, neither total presence nor complete absence (Urry 2002 p. 7).

Complex systems theory is linked with the Gaia hypothesis and portrays a non-linear arrangement of elements that form adaptive, complex organisation at the edge of Chaos (Lewin 1999). It combines both Aristotolean and Platonian

perspectives in which mechanism flows from bottom to top, and vitalism flows from top to bottom. The science of complexity provides an insight that links both directions in a tight, never-ending feedback loop. The whole system represents a dynamical pattern with energy dispersed through it (Lewin 1999).

Complexity is based on the recognition of the non-linear character of reality and concerned with the implications of local context on spatial and temporal scales (Byrne 1998). Complex systems theory provides a distinct opportunity to develop new empirical tools to examine the processes that define the dynamic and interacting relationships between social, physical and ecological systems. This theory is applied in research in a broad and diverse range of disciplines from physics, ecology through to organisational psychology and sociology. While it is convenient to have a 'hold-all theory', this theory is also a useful way of integrating approaches and disciplines if non-linear explanations are possible and simulation modelling for future options is desirable. Hypotheses can be generated and tested through scenario modelling to explore both temporal and utility approaches in optimal landscape management approaches (Brinkley *et al.* 2001). Complexity modelling can contribute to the understanding of relationships and interactions between people, society and the landscapes in which they live.

Narratives of complex adaptive systems

The history of science parallels the evolution of two concepts of the structure and behaviour of reality that contribute to current approaches framing the discourse of complex systems. These two realities reflect the contesting philosophies of evolution, catastrophe and equilibrium, and, fluctuation, integration and succession, drawing on Romantic and Baroque traditions for explanation (Kwa 2002).

Each of these traditions has a different point of entry in devising questions that are used to explain complexity. The history and philosophy of these two approaches to the science of complex systems are traced by Chunglin Kwa (2002) in an engaging and illuminating exposure of the paradigms and discourses of each. Kwa (2002) traces the use of metaphors for holism and

unity in the Romantic traditions back to the debates between Romantic and Enlightenment approaches that are linked to a long tradition of Western Philosophical traditions. Kwa (2002) claims Romantics recognise hierarchy and abstract higher order principles but within whole systems. The emphasis in complex systems approaches is on the sum of the parts in a higher order individuality of the whole, looking from a whole to the parts. In contrast, the Baroque discourses emphasise material detail and direction that does not distinguish between individual and the environment but acknowledges a multitude of entities comprising systems. The emphasis in complex systems approaches is usually paid to the detail of individual items that constitute the interaction and process of complexity at a broader scale (Kwa 2002).

Kwa (2002) claims that the Romantic and Baroque paradigms of complexity are both available simultaneously, and neither approach is a new conception of reality. While Romantic approaches to explaining complexity are more straightforward in the identification of emergent wholes delineated from their environment, Baroque traditions are more dependent on the identification of context and sensitivity to provide explanation and illumination. Baroque traditions are allegoric in their representation of systems, using narrative to describe. While it is important to expose the starting points of each of these narratives, the approach taken in exploring the recurrent behaviours that structure the rural agricultural systems in this study has not been so ambitious as to finally classify a whole system, but merely to identify the potential constituents in the interactive processes of a system. Harré *et al.* (1999) claim that:

> a monocultural Western scientific perspective on the natural environment contains numerous blind spots…by pooling the resources of many understandings that more reliable knowledge can arise…..western scientistic discourse, whether or not combined with Western economic or moral discourse, is insufficient as a means of understanding many aspects of the environment (Harré *et al.* 1999 p. 159).

The differentiation between Rational and Romantic systems of values is evident in complex systems theory as it was in environmental discourse. This has

implications for the framing of research questions as well as for the insights gained through analysis.

What are complex adaptive systems?

Complex adaptive systems rest at the interface between simple and chaotic systems. Simple systems are not able to produce innovative and adaptive responses to perturbation[42], thus have little or no internal integrity, and chaotic systems that have a rich array of responses to perturbation and a high degree of innovation but with no predictability in response to perturbation, thus no ability to adapt or maintain integrity[43]. Unlike simple and chaotic systems complex adaptive systems maintain internal integrity through three defining elements that structure resilience[44]: adaptive capacity; self-organisation; and emergent characteristics (Holling 1973, Lee 1993, Lewin 1999, Marion 1999, Midgley 2000, Gunderson and Holling 2002, Berkes *et al.* 2003). Complex systems are constituted by a range of simple components that form domains with a high level of non-linear connection. These systems maintain constancy but are non-repetitive (Cilliers 1998).

Complex systems are non-adaptive if they do not change over time. The complex adaptive systems in this research reflect evolutionary relationships between people and the biophysical environment (Brinkley *et al.* 2001). The ideals, ideology and practice frameworks intrinsic to socio-ecological systems occupy certain parameters within phase space and maintain the resilience and

[42] Perturbation: a force of disturbance in a system that impacts on the usual functioning within phase state parameters. This might be any event that could force change. Change is dramatic if it results in a phase state shift or less dramatic if the system is resilient enough to absorb the change and continue functioning within the pre-existing parameters of the phase state. Parameters of phase space describe "the fluctuation of a system whose concentration of constituent variables is not altered by outside forces" (Marion, R. (1999). *The Edge of Organization. Chaos and Complexity Theories of Formal Social Systems*, London: Sage. p. 18)

[43] Integrity "the state of being whole, entire, or undiminished" (Macquarie, L.P.L. (1981). *The Macquarie Dictionary*, Sydney: Macquarie University p. 921).

[44] Complex Systems theory includes the notion of slow and fast variables that contribute dynamically to maintaining resilience in systems. Resilience is achieved when a system is able to self-organise following perturbation through memory that allows adaptation. These systems can be identified through emergent characteristics that are not exhibited by individual agents but comprise a unique entity created by non-linear interactions (Marion, R. (1999). *The Edge of Organization. Chaos and Complexity Theories of Formal Social Systems.*, London: Sage, Holling, C.S. (2001). "Understanding the Complexity of Economic, Ecological, and Social Systems", *Ecosystems*, 4: 390 - 405).

constancy of these locally adapted systems. They are not isolated from external driving forces but protected through the resilient functions of the slow and fast emergent variables (Tengö and Hammer 2003). According to Byrne (1998) this space comprises:

> {all} possible states in which a system might exist in theoretical terms…{and} ...elements within the system and the general character of the system itself in relation to these parameters (Byrne 1998 p. 24).

These systems are "not reducible from the sum of the parts to the parts of the sum, and nor are they easily assembled from the parts of the sum" (Ritzer 1996 p. 423). These systems are entities of explicit emergent characteristics with distinctive processes.

Adaptive capacity

Adaptive capacity "resides in aspects of memory, creativity, innovation, flexibility, and diversity of ecological components and human capabilities" (Walker *et al.* 2002 p. 10). Adaptive capacity "can apply to the same defined system, but adaptations that bring in new variables effectively redefine the system" (Walker *et al.* 2002 p. 19). Adaptive capacity is "a component of resilience that reflects the learning aspect of system behaviour in response to disturbance" (Carpenter *et al.* 2001 p. 788). Resilience reflects the extent to which a system is capable of learning from and adapting to disturbance or perturbation (Deutsch *et al.* 2003). Capacity emerges in these systems when opportunities for bridging and bonding social capital link across social scale to facilitate innovation and adaptive capacity. Capacity cannot be enforced or implemented; it emerges as an output or result of the process of social capital. Social structures that facilitate the exchange of resources and transmission of knowledge, such as the elements of sense of place (the formation of identity and development of place attachment), social capital (norms of reciprocity and practices of exchange, social networks, relations of trust) and environmental discourse (discourse frameworks) are examples of adaptive social variables that can contribute to the resilience in a system.

Adaptive behaviour includes "conscious and unconscious activities that are based on past experiences and often, anticipated outcomes" (Marion 1999 p. 7). This accumulated knowledge of trial and error (Tengö and Hammer 2003), Marion (1999) goes on to claim is the kind of information that social systems use to re-configure social and environmental systems to accommodate change. Adaptive capacity means systems are able to adopt innovative solutions and transform them to "generalised responses to broad classes of challenges" (Walker *et al.* 2002 p. 8). According to Brinkley and colleagues:

> people use adaptive strategies to best achieve their individual goals within environmental constraints (Brinkley *et al.* 2001 p. 247).

Constancy is a product of the interactions within and between domains of attractors producing adaptive capacity in systems. Factors that facilitate and maintain adaptive capacity include practices that address the functioning of a system (process based) rather than content of a system directed at outputs (Tengö and Hammer 2003). Constancy is a consequence of decentralisation within a nested system of fit coupling that can shield a system from disturbance and mediates responses across scale and attractor domain.

Self-organisation

Complex adaptive systems have the capability to self-organise which enables adaptation of system structure. Adaptation is not possible if the capability to self-organise is not present. Self-organisation represents an emergent characteristic of complex adaptive systems (Cilliers 1998). Self-organisation is not a feature that is imposed by external forces; it exists as an intrinsic capability within a system (Deutsch *et al.* 2003). Self-organising systems are mutually accommodating and internally consistent with regular interactions that display recurrent behaviours. The spontaneous generation of higher levels of structural organisation gives rise to emergent attributes through this patterned behaviour (Brinkley *et al.* 2001).

Self-organisation co-creates institutional learning by governing what learning is possible and by creating the circumstances within which learning will take place. Social capital and norms of practice both constrain and facilitate in this process.

The ability to self-organise is "attributable to the {system's} capacity to 'map' the energy of the environment" (Marion 1999 p. 71). Knowledge is generated through self-organisation (Midgley 2000). Learned and remembered stimuli are referenced over time and into the future, which allows the evolution of persistent relationships that are the capacity to self-organise. Memory in these systems provides both a history and an increase in complexity that defies entropy but has the potential for saturation (Cilliers 1998).

These self-organising interaction patterns or processes are identifiable through ordered and categorised informal organisation within formal social or institutionalised arrangements. These links between social scales provide reference sources that enable the maintenance of relationships over extended temporal scales. These relationships also define the domains of discourse that are possible. This form of mapping is the basis of memory and memory is possible because of the capacity to self-organise (Marion 1999). Cilliers (1998) provides a succinct definition for self-organisation:

> "The capacity for self-organisation is a property of complex systems which enables them to develop or change internal structure spontaneously and adaptively in order to cope with, or manipulate, their environment" (Cilliers, 1998 p. 90).

Emergence

Interaction serving collective needs and processes results in a certain ordering in complex adaptive systems that is called emergence. The properties of emergence are revealed only at particular levels of organisation and cannot be found in their constituent assemblies of subsystems or attractor domains (Keen *et al.* 2005). Relationships between variables that comprise the constituent assemblies of attractor domains are based on interaction that alters causal propensities (Byrne 1998). Cilliers (1998) advocates using the term 'relational properties' rather than 'emergent properties' which he regards as a means of de-mystifying the concept. The key to acknowledging emergence is the

dynamics of interaction that allow change within a system, but within the parameter spaces that set the boundaries of a system.

Emergence allows processes of flexibility and change and the transfer and adoption of innovation without the negative impacts of cascades of collapse. Marion (1999) differentiates emergence from the evolutionary sense of natural selection: emergence defines while natural selection refines in a secondary interaction in the process (Marion 1999). These interactive processes involve iteration between the system and the environment (in both the physical and symbolic sense).

Uni-directional cause and effect does not allow explanation of emergent properties (Midgley 2000). To identify the emergent properties of complex adaptive systems the focus must orient towards the processes that integrate both subjective and objective examination. This approach allows the components and relationships between symbolic and material entities to emerge as non-linear interactions and relationships. This approach is particularly valuable for examining the relationships within social systems and the way in which these systems are linked to ecological systems.

Boundaries

Spaces and thresholds imply boundaries. The identification of boundaries is a critical process in delineating systems from their environments, and identifying the attractor domains that constitute complex systems. Boundaries include the differentiation between social, spatial and temporal scales and set the limits on applicability in such activities as environmental policy co-operation and implementation (Montgomery 2001, Black *et al.* 2003). Identifying boundaries makes transparent what is included and what is excluded to differentiate between one system and another. Shared decisions and consensus define the value systems that identify boundaries (Miller 1998). Boundaries can optimise insight into the process and functioning of a system and decisions about boundaries are central to subjective, intersubjective and mathematical

approaches to exploring and exposing the autopoeisis[45] in systems (Midgley 2000).

Identifying boundaries is a process-oriented approach to complex systems analysis. Identifying difference allows a process-oriented approach while identifying similarity constitutes a content-based explanation (Midgley 2000). Identifying boundaries from the inside provides the focus for attention on process while identifying boundaries from the outside provides the focus on content. This perhaps provides the keenest differentiation between the value systems of Romantic and Baroque conceptualisations of complex systems science.

Boundaries and bifurcation walls frequently occupy the same space (rather than point) in which change differentiates between one system and another. Tracking and monitoring resilience in complex adaptive systems requires that the parameters of the resilience processes are identified. Once these parameters are transgressed, the system changes to something else and it is often difficult to restore the functioning processes that maintain resilience in the previous system. The parameter space of resilience encompasses the interactions of variables that determine the potential for phase state shift to cross a bifurcation wall. Distances to the boundary are not linear and the parameters do not capture information about the magnitude of disturbance required for change, but are instead identified through the interactions (often non-linear) between domains of attractors that define the energy space of a basin of attraction (Carpenter *et al.* 2001).

[45] Autopoeisis means self-producing…a system acts to maintain its internal organisation…its actions are determined by its current structure…the structure of a system is its arrangement of components in such a way that is organisation (that which gives it identity) is maintained. Change over time is governed within the limits of the organisation…environment cannot be a cause, only a trigger. The environment causes perturbations…meaningful if allowed by structures in the system to be received (Midgley, G. (2000). Systemic Intervention: Philosophy, Methodology, and Practice., New York: Kluwer, p. 54).

Homeostasis[46] in complex adaptive systems reflects a state flanked by equilibrium that tends towards stable simplicity on one side, and on the other constantly changing unstable systems. Change happens within the parameter spaces[47] across a range of values in the system allowing normal fluctuations and reproduction that does not cross bifurcation walls[48] into different parameter spaces that form other systems. Rather fluctuations move between parameter regions that contain different forms and domains of attractors (Marion 1999). Thresholds are critical in recognising the limits of phase state parameters and define the zone in which threshold effect is likely to significantly alter a system (Fraser *et al.* 2003). Rural agricultural systems that maintain ecological, social and economic integrity are an example of complex adaptive systems that retain resilience through a certain amount of fluctuation within parameter space. Once the processes of these systems reach a bifurcation point that changes parameter space, which might be a change in the socio-demographic distribution of people and thus land-use, then parameter phase state changes mean the systems require a different set of policy and management strategies.

Conventional tools and datasets used to identify and measure boundaries of social and environmental systems lose context through abstraction and fail to identify vulnerabilities and critical phase state parameters. Once these bifurcation walls are crossed the resulting change is significant and often undesirable in linked social-ecological systems (Fraser *et al.* 2003). The re-framing of the notion of system boundaries will be more effective and provide a

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[46] Homeostasis is represented as a stable attractor (Marion, R. (1999). *The Edge of Organization. Chaos and Complexity Theories of Formal Social Systems*, London: Sage); and all "systems that maintain critical variables within limits acceptable to their own structure in the face of unexpected disturbance" (Bullock, A., and Trombley, S. (2000).The New Fontana Dictionary of Modern Thought, London: Harper Collins Publishers, p. 401). These stable attractors are the emergent components in a system.

[47] Parameter space includes the set of attractors which define "the fluctuation of a system whose concentration of constituent variables is not altered by outside forces" and fall within bifurcation walls (Marion, R. (1999). *The Edge of Organization. Chaos and Complexity Theories of Formal Social Systems.*, London: Sage p. 18).

[48] Bifurcation walls provides the boundaries of a system that result in the system acting 'as a whole' (Law, J., and Mol, A. (2002).Complexities. Social Studies of knowledge practices, London: Duke University Press); "internally self-similar, but contiguous regions can be dramatically different from one another…adjusted until a region of parameter space is found in which all pertinent variables are appropriately maintained" (Marion, R. (1999). *The Edge of Organization. Chaos and Complexity Theories of Formal Social Systems*, London: Sage, p. 57).

greater insight into interacting domains if cast as a social catchment that includes biophysical and social dimensions. This provides a discursive focus for the processes identified in the systems in this study that expects more than the politics of interest or the politics of place and "beyond the narrow boundaries of local stakeholder groups" (Midgley 2000 p. 140).

Evolving variables

The variables that define the boundaries of these systems evolve at different temporal scales as either fast of slow variables and contribute in different ways to maintaining integrity and resilience (Marion 1999, Midgley 2000, Janssen 2002). Slow variables act to moderate the impact of change and thus provide constancy in a system. These variables structure complex systems through the bifurcation points past which faster variables are unlikely to transgress (Davidson-Hunt and Berkes 2003). Fast variables are able to react more flexibly to evolve and develop innovative and experimental responses to perturbation but are constrained by the slow variables that maintain phase state parameters and resilience. Thus a dynamic state is maintained that allows flexibility in response to perturbation but without sacrificing all memory and learning in favour of a dramatically different system. In social terms, culture is a slow variable that maintains a constant state in which:

> despite, and because of, its interactive nature; it protects its own integrity and it lends that stability to the society that emerges from it. Social structures do respond to social activity, and consequently culture can be dynamic and alive; yet it responds sluggishly, thus it possesses constancy (Marion 1999 p. 133).

Coupling and links

Systems integrity is maintained through a combination of coupling systems that contribute to innovation and responses to perturbation in order to sustain resilience. Complex adaptive systems comprise variables that are coupled to form fit systems that accommodate innovation and stability and absorb perturbation. Coupling refers to the links between different components, elements and sub-systems within a system, and includes the strength of relationships between the units and the way in which dependence and connection facilitates information exchange (Marion 1999, Davidson-Hunt and

Berkes 2003). These networks of variables play a range of roles in relation to perturbation, allowing experimentation, the development of new approaches or innovation, or coordinating activity and the sharing of resources.

In complex adaptive systems this sharing of resources maintains sufficient stability to remain within the parameters of resilience but allow sufficient learning and self-organisation to respond to perturbation. Experimentation and innovation generally happens within tightly coupled systems operating within the system but is sufficiently confined and constrained through loose links to other parts of the system, so that in the event of failure (or the evolution to chaotic behaviour) the broader system to which it belongs does not collapse. These links facilitate exchange but are able to neutralise behaviours that jeopardise the resilience of the system (Marion 1999).

The options for experimental behaviour and the adoption of innovation in the face of perturbation are dependent on diversity and redundance. Redundance ensures there is sufficient experimentation that might or might not be important in the face of perturbation but does not impact in a significant way on the totality of the system in the face of failure or collapse within the experimental domain. In this way, a range of approaches might be attempted in something like new forms of governance in natural resource management, and the best of those might be adopted, but the remainder provide a diversity of experimental insights without the collapse that might be caused in an 'all in one basket' approach.

Attractors, Basins and Domains

> People certainly can make history because reflexive agency can influence crucial information changes in systems where the modulating role of information over energy is absolutely significant, but they do so from a given starting point (not in circumstances of their own choosing) (Byrne 1998 p. 6).

The order that comprises a complex system is described in terms of the domains of strange attractors that characterise the system (Byrne 1998, Holling 2001). Withstanding change and external force determines the domain of attraction within which a system functions (Carpenter *et al.* 2001). Domains of

attraction include the strange attractors that provide key variables that drive the tensions and maintain the configuration of history, processes and productivity (Eoyang 2004). The trajectory within which the motion of processes travel is called an attractor (Marion 1999). These trajectories form processes that constitute the central characteristics that define a complex system.

Change is transformative and identified when attractors are described quantitatively by the set of Feigenbaum numbers[49] (Byrne 1998). The trajectory in which the motion of these self-replicating variables gravitates can occupy a range of states. Perturbation causes changes in trajectory and attractors are stable if they return to their original position. They are known as periodic attractors if their motion follows the motion of a pendulum, and finite if their behaviour is bounded in a predictable motion. Strange attractors follow a patterned geometric motion that remains within an identifiable phase state and may be stable within periodic or semi-periodic motion parameters. Their behaviour never repeats itself, and relationships with other variables or domains are asynchronous. Their behaviour is unpredictable but sensitive dependent on initial conditions. The resonance and correlation of their kinetic energy makes them difficult to measure but their bounded behaviour and characteristics remain within behavioural limits (Lewin 1999).

Marion (1999) claims that "nearly all social activity can be metaphorically described with a strange attractor" (p. 22). While the mathematical approaches such as those pioneered by Kaufman and others (Lewin 1999, Marion 1999) conventionally used in the physical sciences have identified these complex processes, the social sciences are dependent on other tools that more effectively draw out the symbolic elements in addition to the more measurable tangible components of systems. These tools are necessary to identify both boundaries of systems and the strange attractors that comprise the domains within the systems. The strange attractors in a system give the best insight into the critical variables that maintain a phase state in a system through domains of

[49] Feigenbaum numbers relate to the fundamental way in which changes from one system's parameter space to another are mathematically mapped. Feigenbaum numbers are used to describe sequences of numbers "representing proportionate changes in the control variable, which describe successive bifurcations and correspond to successive strange attractors". They also describe the "value to which the ratio of successive changes tends" (Byrne 1998 p. 22).

attraction. It is these domains that claimed the focus for the results of the numerical taxonomy in this research. The processes between the critical axes of tension defined through the statistically significant biplot vectors provided the best insight into the domains of attractors that interact to form the social processes that contribute to the maintenance of resilience in the complex adaptive rural agricultural systems in this study.

The Adaptive Cycle

Complex systems theory has spawned many approaches to explaining complex systems and phenomena. The Resilience Alliance, and particularly the work of Gunderson and Holling (Holling 1973, Holling 1978, Gunderson *et al.* 1995, Gunderson *et al.* 1995b, Holling and Meffe 1996, Holling 2001, Gunderson and Holling 2002) has particularly explored ecological systems and some of their relationships with the social systems to which they are linked. Their development of the adaptive cycle and Panarchy is particularly useful in tracing the non-linear relationships between social and ecological systems in rural agricultural Australia.

As a brief description of the adaptive cycle, Holling (2001) describes three properties that shape the cycle and the future state of a complex system:

- Potential, or wealth, sets limits for what is possible (determines the number of alternative options for the future):
  - includes accumulated ecological, economic, social and cultural capital, and unexpressed chance mutations and inventions.
- Connectedness, or controllability, determines the degree to which a system can control its own destiny, as distinct from being caught by the whims of external variability:
  - Stability increases with connectedness.
- Resilience, as achieved by adaptive capacity, determines how vulnerable the system is to unexpected disturbances and surprises that can exceed for break that control:
  - Fosters novelty and experiment,
  - High resilience allows tests of those novel combinations because the system wide costs of failure are low,
  - Creative experimentation,
  - Reconciles the paradoxes of conservative nature versus creative nature; sustainability versus creative change.

This cycle has two separate objectives that function in sequence alternately either to maximise production and accumulation through growth and stability, or maximise innovation and reconfiguration through change and variety. Holling (2001) goes on to claim that human social systems include three features that are unique and that change the character and variability in a complex system to enhance their own potential: 1. foresight and intentionality, 2. communication, and 3. technology.

These Adaptive Systems have four linked and interacting phases that are cyclically nested across spatial and temporal scales:

1. (r) Rapid growth and exploitation
2. (K) conservation
3. (Ω) collapse or release (creative destruction)
4. (α) renewal or reorganisation

There are times when social capital is conservative, hierarchical and consolidates systemic social learning, and other times when perturbations contribute to the development of creativity and innovation and draw on horizontal systems that cross social and landscape scale. This process of innovation and renewal alternating with consolidation outlined in Chapter Four exemplifies this complex adaptive cycle. This cycle has been extensively explored and exemplified in a range of systems that are portrayed and extensively discussed particularly in Gunderson and Holling's edited book, Panarchy (2002). This set of literature has provided an exemplary insight into the potential for describing and understanding rural agricultural social systems in Australia that endure various boom and bust scenarios in relation to population and other more subtle variables such as social capital. While further exploration of social capital through this lens is beyond the scope of this thesis, it suffices to say that social capital defines environmental discourse (and thus the way in which environments and landscapes are used and managed) within this cycle.

In recommending the use of a complex adaptive systems approach to landscape management, Low *et al.* (2003) claim:

> Complex adaptive systems are composed of a large number of active elements whose rich patterns of interactions produce emergent

> properties – which are not easy to predict by analysing the separate system components (Low *et al.* 2003 p. 103)

Complex adaptive systems

> …are products of positive feedback and path dependence (sensitive dependence on initial conditions)…the inertial system that emerges from interaction and positive feedback may not represent the best possible solution to the problems it addresses, but its accretion of resources make it fit nonetheless (Marion 1999 p. 82).

Three dimensions of decision-making interact to form linked socio-ecological systems that are not reducible from the sum of the non-linear relationships. While people depend on landscapes for their symbolic, social and economic needs to be met, their relationships with landscapes in turn dialectically define these landscapes. Three social dimensions (sense of place, social capital and discourses of the environment*)* form the basis for the research and the location of emergent components of these resilient agricultural social systems.

Sense of place is a distinctive way of defining community within three social scales of decision-making: the individual; the collective, expressed at the community scale; and society. There are three key interacting elements that comprise sense of place: identity, attachment and the physical landscape. Over time, the processes that define sense of place ideally result in an evolution from belonging, through attachment to commitment in landscapes. Relationships with place are forged through ties over time (Tall 1996), defining elements of the past, future, identity and memory (Kaltenborn and Bjerke 2002). This conceptual framing integrates both temporal and spatial scales.

Results from exploration of sense of place in Chapter Three indicate a range of landscape elements forming three value sets:

- Social: cultural, historic, recreation and learning;
- Symbolic: spiritual, aesthetic, therapeutic, intrinsic, life sustaining, biodiversity and the future; and,
- Economic: economic and subsistence values.

Sense of place develops in relation to other people that is expressed as the relationships that generate social capital.

Social capital has evolved out of a broader conceptual framework of capital and may be distinguished from economic, human, cultural, physical and natural capital. Resources are developed and made available through micro, meso and macro social support structures (Field 2003). Three elements constitute social capital: norms of reciprocity expressed through practices of exchange; social networks; and relations of trust. Social capital contributes to norms of practice in landscape management and is defined and constrained by frameworks of private and institutional practice that are conceptualised as environmental discourse.

Environmental discourse represents the link between natural ecosystems and cultural systems in a critical metadiscourse. All those who are engaged with environmental decision-making at the landscape scale can be categorised as adherents to one or other environmental discourse with implications for practice in landscape management at individual, societal and environmental scales. Each discourse is comprised of three interacting elements that negotiate a final position based on ideals, ideology and practice. These elements operate at three scales from the specific context of the individual, through to more abstracted norms defined by society and constrained by the overarching environmental scale. The interactions between these elements and scales are modified by interactions of knowledge, truth and power.

In using numerical taxonomy as an analytical approach the social assemblages emerged, and provided description of the tensions that produced systems in communications and management through the statistically significant biplot vectors. These results provided the focus for closer questioning that explored the relationships (and thus domains of attractors) in these systems during the qualitative interviews. The quotes from these interviews are provided in table form as results in Section three of this chapter.

Section two: quantitative exploration through numerical taxonomy

The analyses of social dimensions that form the focus for this thesis formed the statistically significant definition of social assemblages and attribute clusters. These variables comprising the accumulated results of the three social dimensions were collated to form the data for an analysis likely to capture the critical dimensions of a rural agricultural social system.

The survey data was subjected to an explorative analysis to assess simultaneously relationships between cases and variables that portray relationships of people with values through clustering, ordination, networks and statistical evaluation. This application of numerical taxonomy provided a robust and process based validation that emphasized characterization of sets of cases (individuals clustered into social assemblages) rather than variables as causes. The phase state of the system was portrayed through the co-ordinates of cases (participants) with variables (research questions) in a matrix within abstract dimensional space. The ordinations were revolved manually to most effectively portray the distribution of critical biplot vectors, thus exposing value tensions that exposed the domains of attractors in ordination space. Each of the ordinations portrayed in this section depict the same ordination resulting from the numerical taxonomy. Differences in appearance are the result of manually altering the angle from which the ordination is viewed to best capture the results visually.

Results of the numerical taxonomy provided row and column ANOSIM tables that showed the degree of statistical difference between social assemblages (people = row ANOSIM) and attribute clusters (variables = column ANOSIM) (Tables 6.1 and 6.2).

Table 6.1 Column ANOSIM showing degree of statistical difference between attribute clusters (variables) at the p<0.05 cut-off for significance

	Group 1	Group 2	Group 3	Group 4
Group 2	1.00			
Group 3	0.00	0.05		
Group 4	0.04	0.52	0.02	
Group 5	0.02	0.31	0.00	0.27

Table 6.2 Row ANOSIM showing degree of statistical difference between social assemblages (clustered individuals) at the p<0.05 cut-off

	SA 1	SA 2	SA 3	SA 4	SA 5	SA 6
SA 2	0.00					
SA 3	0.00	0.00				
SA 4	0.00	0.00	0.00			
SA 5	0.00	0.00	0.00	0.00		
SA 6	0.00	0.03	0.07	0.01	0.00	
SA 7	0.00	0.06	0.06	0.04	0.00	0.36

The second visual form showing the results of the numerical taxonomy was a two-way table that showed actual relationships between individual cases and variables (Figure 6.1). The degree of correlation is depicted through colour in which black is most correlation and white is no correlation. Intensity in shades of blue provide the gradient between. Variables are shown across the top, while participants are shown down the left hand column. Coded identity numbers include the letter w to show Condamine Headwaters participants, and b to show Katanning Zone participants.

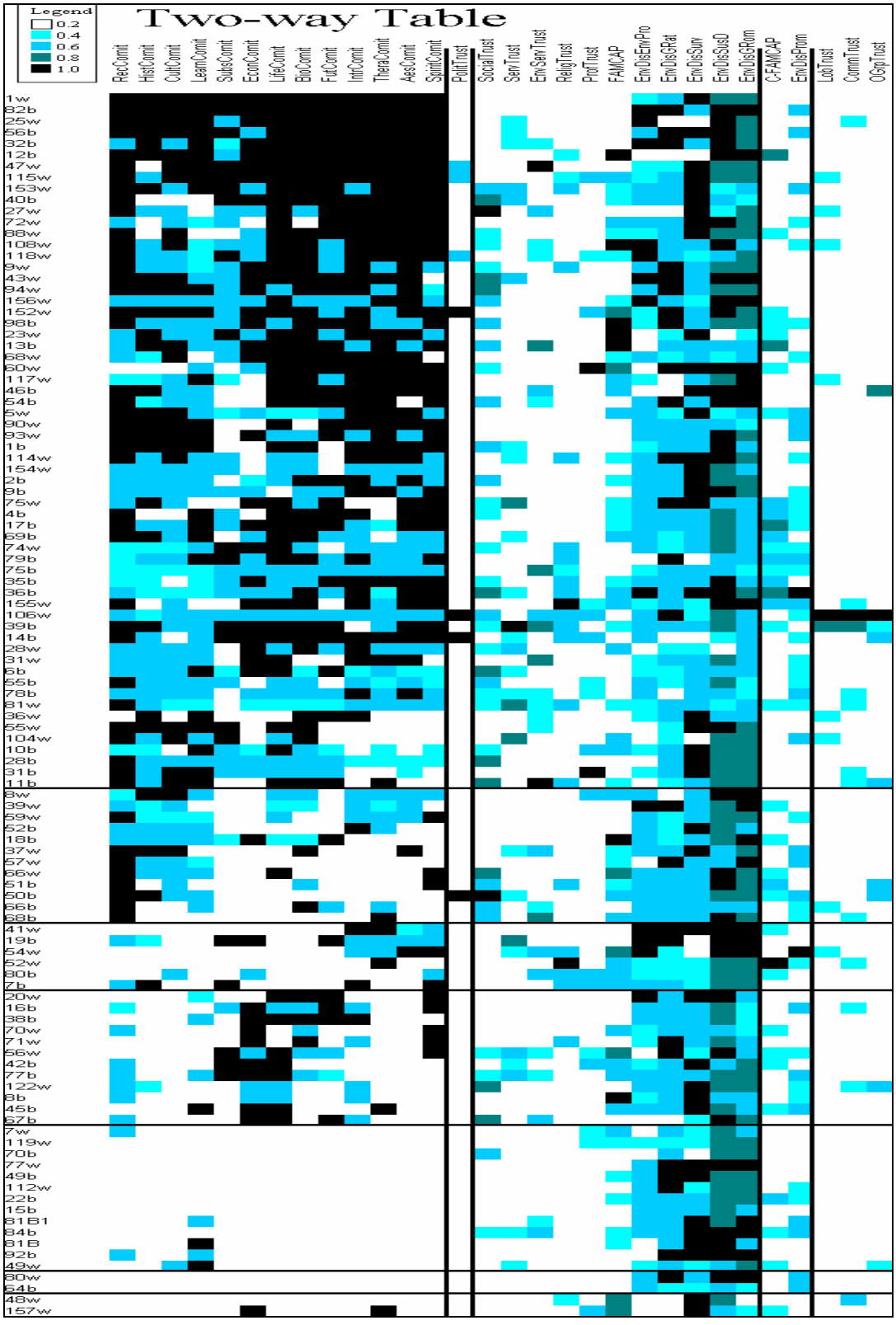

Figure 6.1 Two-way table showing relationships of association between cases and variables. Black blocks show association (1.0), white blocks show no association (0.2). Dark blue shows strong association, lighter blue some association. Lines show divisions between social assemblages (7) and variable clusters (5) (Bray Curtis, UPGMA, B=-0.05, stress 0.18)

Row and column dendrograms portray visually the statistical clustering of participants (individuals) and variables (Figure 6.2 shows clustering of intrinsic variables in the column dendrogram.) Variables ending in Comit pertain to sense of place values, variables ending in Trust pertain to meso and macro level social capital, variables beginning with EnvDisc pertain to discourses of the environment, and FAMCAP and C-FAMCAP reflects micro scale social capital.

The way in which landscape values clustered in the sense of place analysis (Chapter Three) which focused only on landscape values is confirmed through this analysis. Landscape values again cluster into three value frameworks pertaining to the social landscape (recreation, historic, cultural and learning values), the symbolic landscape (life sustaining, biodiversity, the future, intrinsic, therapeutic, spiritual and aesthetic), and economic landscape (subsistence and economic).

Most of the discourses of the environment variables clustered to form a discrete group (Figure 6.2), but the discourse of Prometheanism clustered with catchment based family social capital (micro scale). A discrete group of social capital relating to meso level social capital clustered (lobby groups, community groups, and other groups) while the remainder of the social capital values clustered together and included family based social capital from outside of the catchments (social groups, service groups, environmental service groups, religious groups, professional groups). An interesting exception to the general clustering of forms of social capital linked political groups with landscape values rather than with environmental discourse or social capital values (v=PolitTrust).

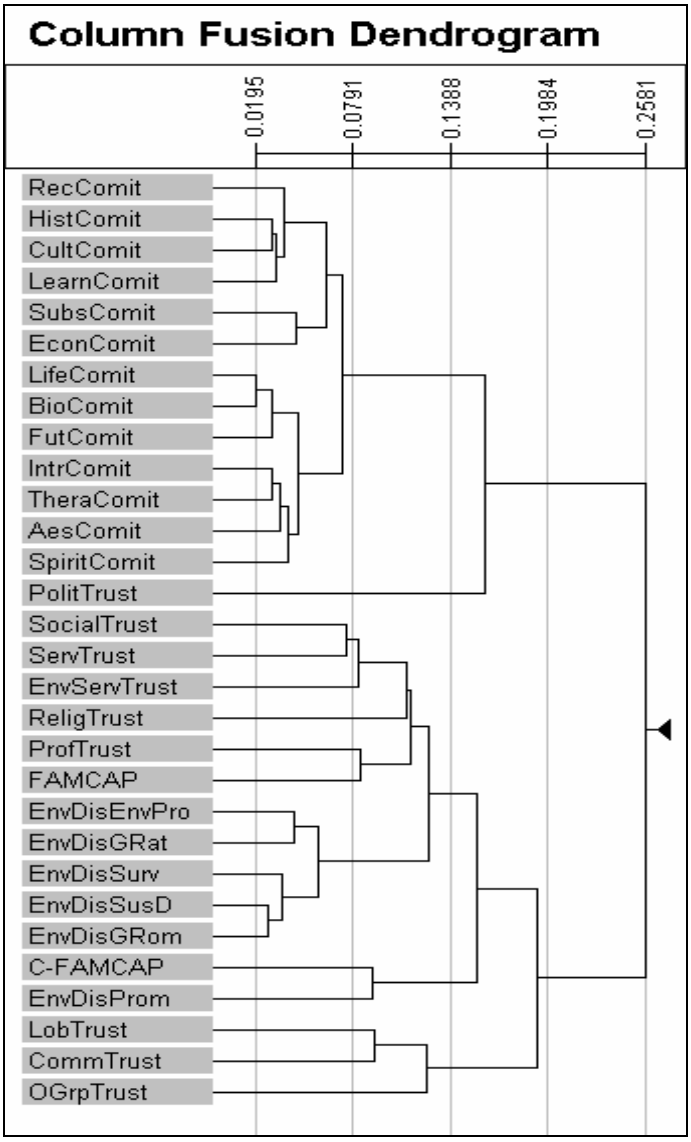

Figure 6.2 Column dendrogram (variables clustered into attribute clusters) showing clustering of column variables representing sense of place values, social capital, and discourses of the environment (Bray Curtis, UPGMA, B=-0.05, stress 0.18)

The row dendrogram (Appendix 11) shows the clustering of participants into seven social assemblages according to values and attributes in common.

The fourth visual form was a minimum spanning tree showing the network of relationships between individuals (each dot) and social assemblages (defined by colour) (Figure 6.3). While there was statistical justification for the clustering, it is clear from the portrayal that not all participants connect in explicit and obvious associations. For example, social assemblage 7 had two members that were not directly connected through the minimum spanning tree. This indicated

that even though there were similarities within the assemblage that distinguished members of this assemblage from all other participants, the questions in the survey did not necessarily expose those similarities. This result would have required more investigation if the assemblage had been bigger, but while there were only two people in the assemblage the notion of diversity justified no further close inquiry.

Social systems are notoriously difficult to classify with any degree of certainty, which accounts for the reliance on reductionist or aggregated approaches that can exclude outliers. This result showed all the outliers, and was justified as a search for diversity, which produces the innovation, and creativity that maintains resilience in social systems. It is necessary to identify the diversity in communities to understand the options available within social systems for alternative visions and practices in times of perturbation. Clearly these two social catchments were able to draw on this form of diversity.

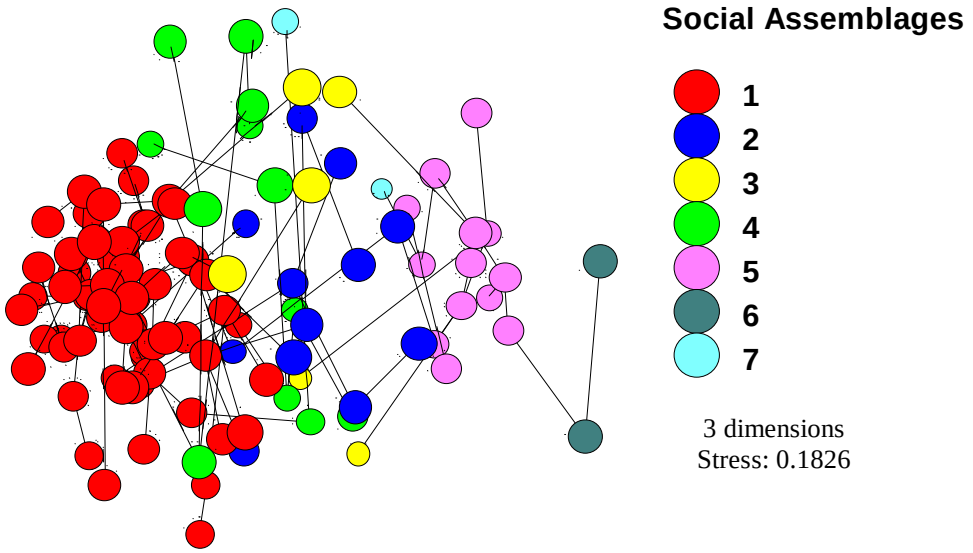

Figure 6.3 Minimum spanning tree, ordination (multi-dimensional scaling) and clusters (social assemblages) (Bray Curtis, UPGMA, B=-0.05, stress 0.18)

The final visual form was ordination (each dot represented one person and colours represented clusters of people with common values or social assemblages) with overlaid statistically critical biplot vectors that indicated statistically critical tensions within the social catchments (Figures 6.4 and 6.5). Each biplot vector shows direction of correlation with ordination axes (positive association with individuals and social assemblages). Positive association lies in the direction of the biplot label and emanates from the centre of the ordination space. Negative association of the variable with the individuals and social assemblages lies in the opposite direction from the biplot vector label across ordination space. The neutral zone is in the centre of the ordination space (Figures 6.4 and 6.5).

A full list of statistically significant variables resulting from the numerical taxonomy that comprise the biplot vectors is provided in Table 6.3. Only three out of a possible nine of the meso and macro level social capital variables were important (community groups, service groups and religious groups). Both intrinsic and extrinsic variables for micro level social capital were significant (extensive family living in the catchment, no family living in the catchment, strong in-catchment micro social capital, and strong out of catchment micro social capital). The two occupations that achieved statistically significant ratings were General Managers (representing both private and agency sector) and Farmers or Farm Managers. The three industry groups that achieved statistically significant ratings were Grain, Sheep and Beef farming, Dairy farming and Services to Agriculture. The community category defining social scale for each participant rated statistically significantly in only two out of the six possible categories*:* community of place and identity, and, community of place and interest. Decisions to include variables based on the results of previous analyses proved appropriate when judged by the statistical significance scores.

Table 6.3 Statistically significant variables

Variable	Variable short name	Range of values	Kruskal Wallis: value between groups	r^2 values (derived from Principal Axis Correlation (Pcc)	p derived from Monte Carlo's permutations (MCAO): p = 0.005
Commitment to Recreational values	RecComit	0 - 5	53.5	0.4	p < 0.001
Commitment to Historical values	HistComit	0 - 5	51.8	0.5	p < 0.001
Commitment to Cultural values	CultComit	0 - 5	55.4	0.4	p < 0.001
Commitment to Learning values	LearnComit	0 - 5	41.4	0.4	p < 0.001
Commitment to Life Sustaining values	LifeComit	0 - 5	62.5	0.6	p < 0.001
Commitment to Subsistence values	SubsComit	0 - 5	33.7	0.3	p < 0.001
Commitment to Biodiversity values	BioComit	0 - 5	56.2	0.6	p < 0.001
Commitment to Intrinsic values	IntrComit	0 - 5	49.8	0.6	p < 0.001
Commitment to Aesthetic values	AesComit	0 - 5	62.6	0.6	p < 0.001
Commitment to Spiritual values	SpiritComit	0 - 5	35.7	0.5	p < 0.001
Commitment to Therapeutic values	TheraComit	0 - 5	49.0	0.4	p < 0.001
Commitment to Future values	FutComit	0 - 5	44.3	0.6	p < 0.001
Commitment to Economic values	EconComit	0 - 5	38.3	0.3	p < 0.001
Rating for trust in community groups	CommTrust	0 - 5	5.8	0.1	p < 0.001
Rating Family capital in the catchment	C-FAMCAP	0 - 5	5.8	0.2	p < 0.001
Rating Family capital	FAMCAP	0 - 5	10.3	0.2	p < 0.001
Environmental Problem Solving Discourse	EnvDisEnvPro	0 - 5	13.8	0.2	p < 0.001
No of family living in the catchment	famno	0 - 5	8.4	0.1	p < 0.001
Community of Place and Identity	place&id	0 / 1	17.6	0.2	p < 0.001
No extended family living in the catchment	fam-no-0	0 / 1	5.1	0.1	p < 0.001
Rating for trust in Service Groups	ServTrust	0 - 5	3.5	0.1	p = 0.001
Occupation: General Manager	GenMan	0 / 1	8.6	0.1	p = 0.001
Green Romantic environmental discourse	EnvDisGRom	0 - 5	23.3	0.1	p = 0.002
Occupation: Farmer or Farm Manager	Farm/Man	0 / 1	8.2	0.1	p = 0.002
Rating for trust in religious groups	ReligTrust	0 - 5	16.4	0.1	p = 0.003
Sustainable Development environmental discourse	EnvDisSusD	0 - 5	5.1	0.1	p = 0.004
Industry: Grain, sheep and beef farming	GrainSheepBeef	0 / 1	7.3	0.1	p = 0.004
Industry: Dairy farming	DairyFarm	0 / 1	17.2	0.1	p = 0.004
Industry: Services to Agriculture	ServAg	0 / 1	14.9	0.1	p = 0.004
Promethean environmental discourse	EnvDisProm	0 - 5	7.9	0.1	p = 0.005
Community of Place and Interest	place&int	0 / 1	6.8	0.1	p = 0.005

The statistically significant variables amounted to nearly one third (n = 31) of the total variables in the analysis (n = 104) that were statistically significant in

defining the social assemblages. Out of the total variables in the analysis (104), thirty were intrinsic (values that defined the social assemblages and attribute clusters) with the remaining 74 extrinsic variables clustering to provide information on socio-demographic descriptors such as industry, occupation, gender, age, length of residence in catchment and ethnicity. Nearly three quarters of the intrinsic variables proved statistically significant (22 out of 30). Only seven variables drawn from the socio-demographic data proved important in defining the social assemblages.

Community category self-definition: is there a difference?

Results indicated explicit contrasts between communities of place and interest, who generally represented the private sector and government agencies, and, communities of place and identity, who generally represented grain, sheep and beef farmers (Figure 6.4). People who worked in the private sector providing advice about agronomy to the farming sector (Services to Agriculture) showed some association with communities of place and interest and contrasting value frameworks with communities of place and identity. General Managers were those people who manage in both the public service and in the private sector and were associated with communities of place and interest.

Both occupation and industry contributed to the value tensions that maintain the parameters of phase space in this system. Each of these clusters of variables: Grain, sheep and beef; farmer/ farm manager; communities of place and identity; and Services to Agriculture, General Manager and communities of place and interest, formed distinct domains of attractors within this system. The value tension that develops between these domains may result in a process of management or communication, and thus options for the future, which maintains the phase state within the parameters of this system.

Testing for resilience would require simulation modelling that is capable of including a temporal scale not available through once off survey based research. The advantage of using numerical taxonomy is the explicit and rigorous testing of variables in relation to participants in a single operation that exposes structure effectively.

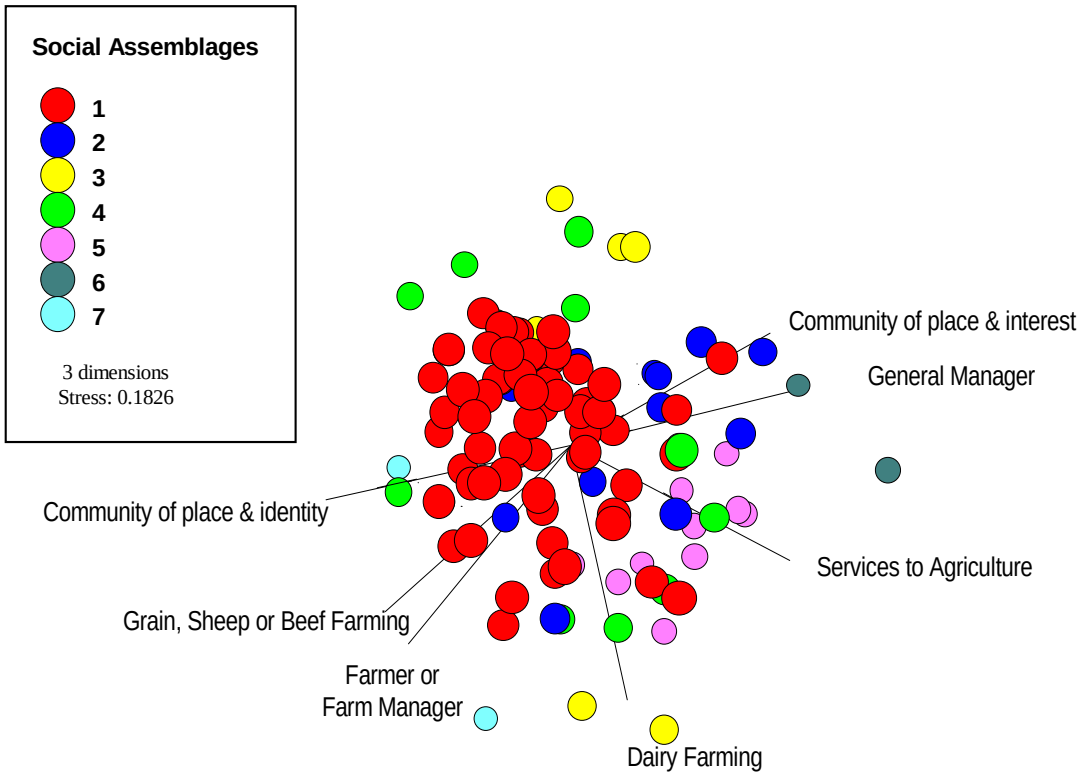

Figure 6.4 Ordination (SSH MDS, Bray Curtis metric, B= -0.1, Stress = 0.18) showing statistically significant biplots (PCC, MCAO) that are evaluated as statistically significant vectors for industry, occupation and community definition

Relationship between sense of place values

The statistically significant biplot vectors for sense of place values (Figure 6.5) derived through the variable rating participants' commitment to maintaining values in landscapes were all associated with one sector of the participating population. In other words, as in the results from the analysis in Chapter Three, the largest social assemblage valued all elements that make up a landscape. Their sense of place values linked across social, symbolic and economic domains. The other sectors of the sampled population did not value or show strong commitment to landscape values indicating that their level of commitment to place was low.

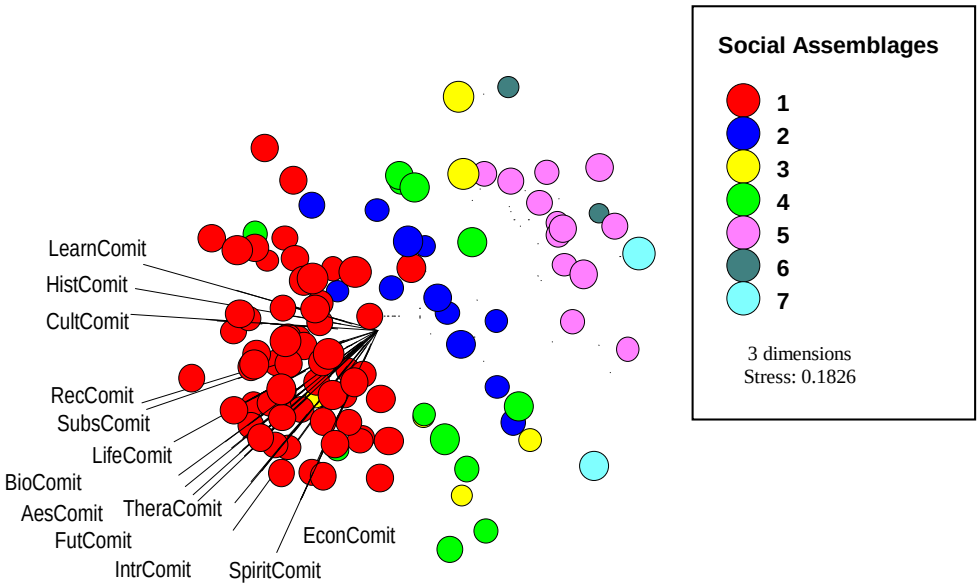

Figure 6.5 Commitment to maintaining landscape values distributed in ordination space positively associated with social assemblage one (Bray Curtis, UPGMA, B=-0.05, stress 0.18)

Contribution of social capital

Different community sectors had contrasting types of social capital (Figure 6.6). Communities of place and interest had few members of their extended family living in the same catchment (Extended Family = 0), in contrast to communities of place and identity who had high levels of family support (+Family no, Family Capital in c/ment and Family Capital outside c/ment). Communities of place and identity also had many members of their extended families living in the catchment and in general indicated high levels of trust within the service, community and religious groups they were members of (+Family no, Service Grp Trust, Community Grp Trust, Religious Grp Trust). The people in these catchments who considered themselves to be communities of place and identity had strong links in the catchment and could rely on strong family and social support structures. This indicated an association between the development of sense of place values with strong social relationships that is linked in the theoretical conceptualisation.

These results indicated that extended family play an important role in supporting and maintaining social systems in these catchments. The contrasting positions between those who have extended family and those who do not indicated that

the tension between approaches as a consequence of this kind of support (including the correlating norms of environmental discourse that are maintained through this form of social capital) may result in certain approaches to landscape management being maintained and supported.

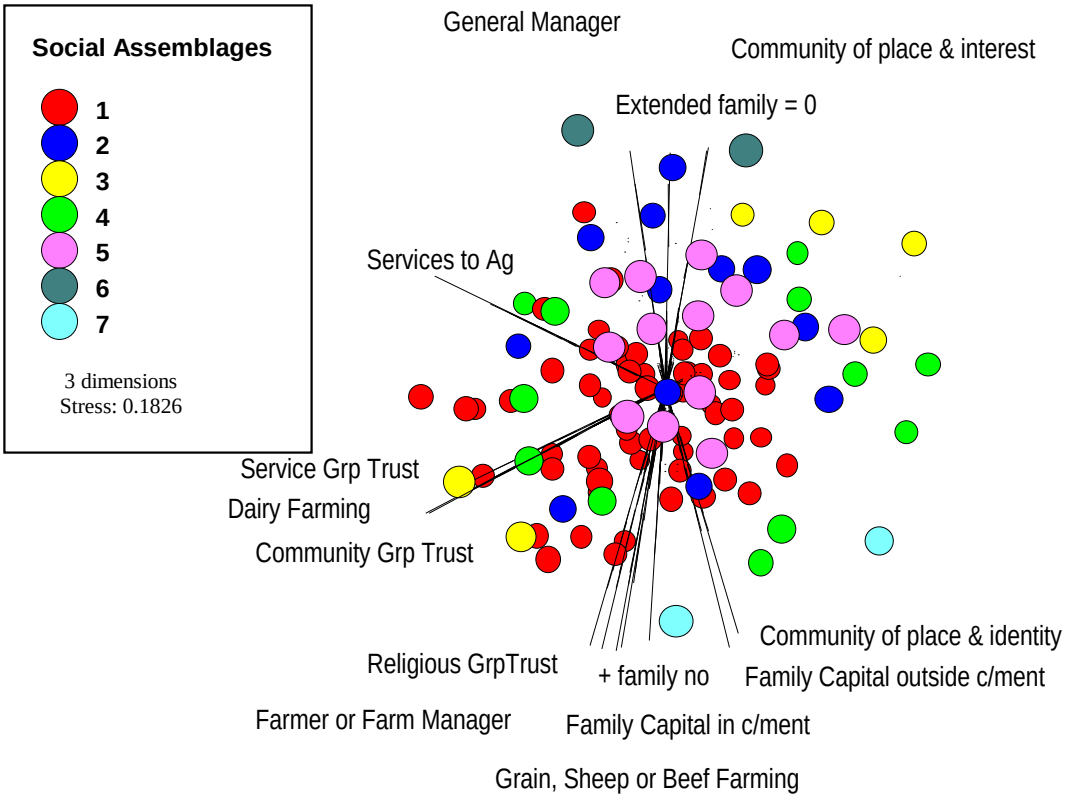

Figure 6.6 Ordination (SSH MDS, Bray Curtis metric, B= -0.05, Stress = 0.18) showing statistically significant biplots (PCC, MCAO)

Environmental practice frameworks

In exploring the discourses of the environment associated with the contrasting positions held between the farming sector and the private sector it became clear that the 'actual' frameworks of practice were also in sharp contrast (Figure 6.7). Communities of place and interest, identified as those who provide information on farming strategies and management were associated with the status quo based discourses of Environmental Problem Solving and the more Rational discourse of resource exploitation reflected through Prometheanism (Env Discourse: Env Problem Solving, Env Discourse: Promethean). In contrast, farmers that defined themselves as communities of place and identity adhered to Sustainable Development and Green Romantic discourses of the

environment (Env Discourse: Sustainable Dev, Env Discourse: Green Romantic).

The proximity of Commitment to Economic values (which denotes a high rating of commitment to maintaining economic elements of the landscape) to communities of place and identity and opposite communities of place and interest would indicate that sustainability and economic viability were associated with the farming community and practice (Figure 6.7).

The tension between the attractor domains of economic and integrationist approaches to land management were illuminating examples of the way in which systems maintain diversity of approach and creative solutions in both abstracted (or scientifically derived knowledge) and concrete (locally developed and evolved knowledge) interpretation and use of this knowledge.

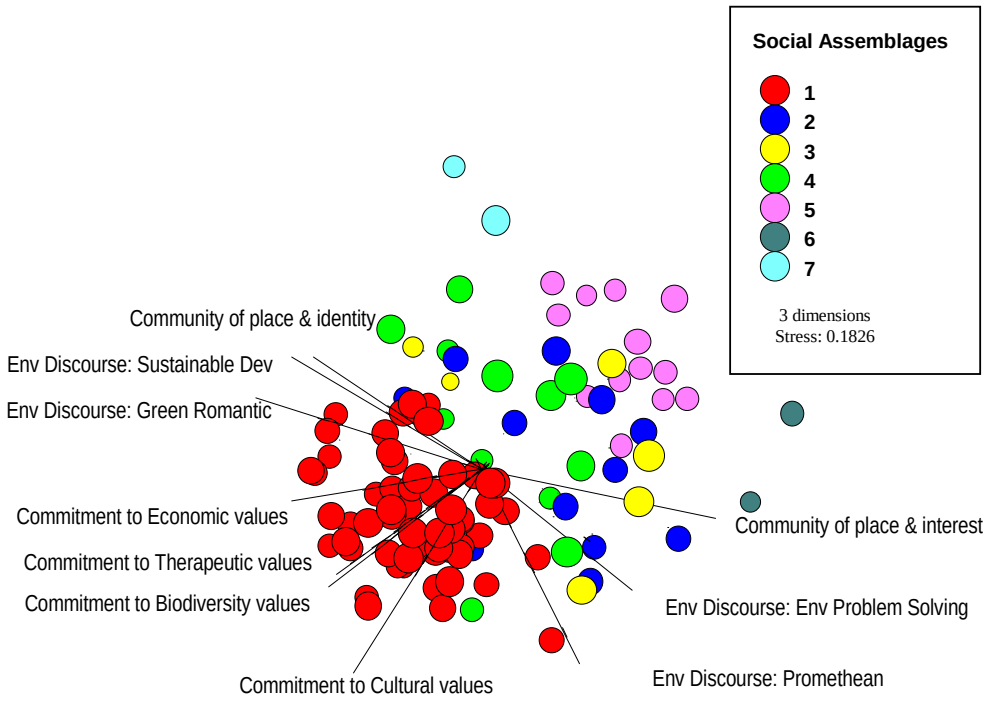

Figure 6.7 Ordination (SSH MDS, Bray Curtis metric, B= -0.05, Stress = 0.18) showing statistically significant vectors (MCAO) statistically significant vectors relating to community self-definition, discourses of the environment and commitment to maintaining selected values in landscapes

The results shown in Figure 6.7 indicate that there were contrasting frameworks that concur with the ecological-technological continuum divide that constitute

tensions between domains of attraction. These distinct domains of attractors were clearly constituted by a range of values that are explicit and ideologically obvious content of this system that form the basis for interaction, and thus process.

Discussion: the domains of attraction

The numerical taxonomy indicated that there were likely to be three critical processes that interact to form the domains of attraction functioning to constitute and maintain resilience in these rural agricultural social systems. Three distinct domains of attractors were formed through the social dimensions (sense of place, social capital and environmental discourse). These social dimensions constituted the variables that contributed to the critical processes of interaction between 1) the three categories of community: community of place, identity and interest (or a combination); 2) the three forms of knowledge: Indigenous, local and scientific; and 3) the three components of the triple bottom line: social, ecological and economic. Thus, the domains of attraction are formed through the interaction of constituents of each of the social dimensions, the processes of interaction that result within the elements of complex adaptive systems: 1) Emergent characteristics; 2) adaptive capacity; and 3) self-organisation and with the individual and social and environmental constituents of the triple bottom line that contribute to the formation of community and the use and representation of knowledge.

Folke, Colding and Berkes (2003) claim in their chapter on building resilience and adaptive capacity in socio-ecological systems that: “scientific understandings of complex adaptive systems and their change could be enriched by insights from local management systems” (p. 374). They advocate a “sequence of knowledge systems for ecosystem management” (p. 374). Framing through the approaches taken in this research defines complex systems as interactive with domains of attraction that integrate communities, knowledge and values across spatial and temporal scales to ensure that the conventional approaches used in science and environmental planning more adequately incorporate local and Indigenous knowledge. Institutional and social learning accumulated over time (Lee 1993, Brown 2005) within each knowledge

form, and within each social scale are thus available to re-configure in the face of perturbation through the values of the triple bottom line.

These tensions that configure, maintain and reconfigure domains of attraction require constant input to ensure that feedback loops maintain the resilience within parameter space. More importantly, these results have indicated clearly that the values and thus positions taken by each of these sectors were contrasting and the processes resulting will require careful consideration in environmental policy development and implementation. It is important to ensure that closed feedback loops allow continued mediation across social scale to maintain the import and integration of new ideas and innovations. In governance terms, and thus the representation of interaction between social scales representing landscape management in hydrological catchments, representation (politics of place and politics of interests) must acknowledge this diversity of position to be able to draw on the components of the system that facilitate resilience. The propensity for government to nominate representatives to natural resource management governance frameworks and the lack of social opportunity for local scales to integrate other knowledge forms limits and constrains diversity. This denies the options provided by diversity in resilient systems that accommodate the symbolic and material values that extend well beyond the economic valuing in landscapes. The domains of attraction explicitly integrated a range of landscape values with discourses of the environment. These results were not predictable and were not simply interpreted to reduce dimensions and diversity.

Section three: qualitative insights for resilience in Complex Adaptive Systems

Using the results of the numerical taxonomy, research questions were developed to provide a focus for further fieldwork involving in-depth interviews over the course of three months. Key informants representing the range of social assemblages were contacted and interviewed to provide depth and detail to the quantitative results. This approach changed the emphasis usually used in

qualitative inquiry from explorative to confirmative ensuring a more focused form of inquiry rather than that usually has a broad range.

The interviews were re-analysed building on the initial layers of information gained in earlier analyses to capture the processes of interaction between each of the scales and elements that contribute to the constitution of the domains of attraction. Quotations extracted from the interviews are presented in this section to represent the three domains of attraction and are structured to reveal insights into each of the elements in these complex adaptive systems (emergent characteristics, adaptive capacity and self-organisation).

This analysis approach revealed a more complete depiction of the positions adopted in the various communities in these catchments, along with the reasoning behind the positions. The relationships between interacting knowledge forms and the configuration and re-configuration of triple bottom line landscape management values formed the focus for the qualitative analysis. A concrete insight complementing the survey analysis results was provided through this accumulation of knowledge thus illuminating positions adopted and interactions between people and landscapes. The outcomes of both the quantitative and qualitative analyses provided a rich source of information to develop the conceptual model that forms the basis of the final conclusions for the research.

The community domain of attraction

Decision-making in landscape management includes concrete and abstract relationships with landscapes that integrate application and practice, with political policy developed at a national and regional scale. This differentiates between decision-makers who engage based on the politics of place (at the local and perhaps regional scale) and politics of interests (who engage in more abstract practices that do not necessarily locate practice in the context of a particular landscape) (Gray and Lawrence 2001, Cheng *et al.* 2003, Whitehead 2003). Each of the social catchments in this research are comprised of three self-defined categories of community that reflect these interactions and contributions as defined and described by Duane (1997) as:

- communities of place: the people who live in a place
- communities of identity: those people who have a relationship with a place but know don't necessarily live in that place, and
- communities of interest who derive a source of financial benefit and contribute to the environmental state of a place in some way.

Each of these categories of community is not mutually exclusive and the participants in the research generally defined themselves to reflect a combination of relationships with each hydrological catchment to form social catchments.

Emergent characteristics

A key result that formed an interactive and dynamic process constituting phase space of a rural agricultural social system was through the relationships and interactions between these three categorisations of community. Diversity was a key variable forming an emergent characteristic that required that all three categories of community were engaged in the processes of interaction and practice in decision-making at the local scale. The tensions inherent to democracy prevail to maintain trust and the social monitoring of democratic practices that represent the cumulation of trust. A selection of direct quotes from the participants in each of these social catchments provides a grounded insight into diversity and the relationships between three communities:

> **Community of place talking about diversity:**
>
> it's a multicultural town and people come from all over the state to see how we get on…it's a good feeling around town and with each other….we're always consulting the different ethnic minorities to find the differences….then we all pitch in together and go and do it….we all have our own contacts….making stronger ties throughout the community…{formal network?} that's right….so its open door…and…we can help each other
>
> **Community of identity and interest talking about community of place:**
>
> they've got the right motivation and good ideas, but they're just not thought through well…it should be given to people with more expertise to be able to manage the problem. It is still small town thinking where they should be much more bigger thinking to deal with the problem
>
> I do see the role of the artist as a specific role….of giving information back to our community and what they experience and how we push things further down the track or make something, maybe pull it out of

> something and put it into a different situation….I am consciously looking at it as a social thing….making things better
>
> **Community of place talking about community of identity**:
>
> {are they belonging to groups and getting information?} no, I don't think so, but I enjoy talking to those blokes
>
> **Community of place talking about community of interest:**
>
> that's been a real plus because it has helped the economy in the area and with rationalising, if the business leaves here there will be a lot of people unemployed and won't have a job and the transport business is tied up with Woollies and Big W and things like that. Well, that will have a huge impact as well. Because, if you take one player away, well then the transport part of it will have to stand alone, its like a puzzle, they work together
>
> I belong to a cricket team…I have quite a bit to do with those fellows {professional agronomists}…mainly knowledge to begin with, that's how I met them….years ago…What they got out of me, I wouldn't know…many times we used to have discussions….everybody got a bit out of it

Resilience and phase state shifts when the collaboration, cooperation and integration between these three categories of community fails at the local level:

> **Community of place talking about community of interest**:
>
> all the little {businesses} get closed up and the big monopolies just dictate where they want to
>
> **Community of place talking about community of identity**:
>
> I think everything revolves around honesty and with what you do with them…you tell them straight and if they don't take what you think….in the end you just gave up trying…they just did things differently, looked at things differently …
>
> **Community of place talking about community of interest and identity**:
>
> {agency staff members down the street?} …oh, you never see them, mainly you see councillors, because they are within that web, but you would never see a government person, you've got buckleys…
>
> they felled trees that they shouldn't have felled on our neighbour's place, we thought we would go back and be able to use the timber, but they had chopped it all up into bits…just ruined it in spite. So, its bad enough cutting the trees down in the first place, but then go back and chop it all up so you can't use it…
>
> its still got this perception behind the background that it's the farmers that are doing all the damage and I think that is why they're not getting the people along to participate
>
> **Community of identity and interest talking about community of place**:
>
> so much has been trial and error, {they} are always looking for the silver bullet …its really frustrating, they're always just looking for the

> one perfect solution to this problem, …it's a multiple choice of things that you need to apply that they don't quite get yet
>
> {contact with the local community?} field days…one is our major open day, we have every five or six years"…"formal links….committees"…"use the local press as a means of engaging community…we don't actually target {the local town/ regional centre}, we target the state or Australia

The role of social capital in decision-making includes bridging social capital to provide information, and bonding social capital to provide the trust to accept, include and integrate the information. Bridging social capital that was based on iterative and integrated relationships in feedback loops between communities of place and identity and communities of identity and interest was important to facilitate the development of bonding social capital that brings with it commitment and constancy. Bridging social capital needs to be both formal and informal. Informal relationships facilitate the transfer of new and 'risky' knowledge between communities, but these informal relationships require a formal setting through institutionalised meso-level social capital arrangements to facilitate the transfer. Interactive technology is facilitating bridging social capital, but the innovation and adaptation is dependent on bonding social capital for implementation.

The balance between diversity and trust is dependent on integrated local context relationships between the three categories of community. The emergent characteristics that were exposed by this inquiry into the interactions between the three categories of community relate specifically to the relationships between bridging and bonding social capital within the context of place. While environmental discourse did not represent a shared value amongst the community sectors, the tensions between the values provided a locus for communication that resulted in an emergent property in the form of social capital. Place and place values act as a communication mediator between the three communities

Adaptive capacity

This element of complex adaptive systems reflects the ability of systems to adopt innovative solutions and transform them to a broader and more

generalised scale (Walker *et al.* 2002). Adaptive strategies are the means by which individuals achieve their goals within environmental constraints (Brinkley *et al.* 2001). Adaptive capacity is facilitated through bonding social capital that allows sufficient experimentation and latitude to explore alternatives within fit coupling links that do not allow collapse at a larger scale in the face of failure. In addition, bridging social capital that crosses from individual through community to societal scales allows the capture of innovation and creative approaches to solving problems.

> **Adaptive capacity facilitated by community of place and identity and bridging capital through formal institutions**:
>
> a couple of local fellows put their money together and got it going again, so there are three fellows working there full time now, just getting it going {small scale timber mill}
>
> **Adaptive capacity (informal social contact through institutionalised organisation) facilitated by community of identity and interest and bridging capital**:
>
> some of them have bought the farm after and then they get involved in all these government projects so they get to know how and can write heaps of reports so they are taken on board as the committee cause they can do all that sort of work
>
> **Adaptive capacity (formal institutions and formal contact) facilitated by community of identity and interest**:
>
> {field days run by?} industry groups, but often it's a landcare group….really practical information that other people can benefit from
>
> **Adaptive capacity that links across social scales to adopt solutions applicable at other scales. A good example of the impact of the global scale on the local in a very small country town**:
>
> moving the bowsers to ensure that terrorists cannot blow them up

Adaptive capacity is hampered, and thus the resilience of the system declines when bridging social capital is unavailable or when bonding social capital is not developed. This is often as a consequence of the reduction of community interaction that forms through informal social networks operating in institutionalised meso-scale social organisations are not able to develop bonding social capital.

> **Adaptive capacity is being hampered by new forms of natural resource governance that are selective in including the participation of communities of place thus inhibiting the formation of bridging social capital**:

> they're saying they want community involvement but they're being very selective about who the community is and they don't actually want a lot of on-ground community. They will choose one or two people who might be very selective people as well, so I think we're in for a rough ride
>
> **Adaptive capacity is dependent on the bonding of community of place to the community of identity and interest**:
>
> sometimes the innovators also have personality traits that antagonise their neighbours
>
> I think its good socially to know your neighbours to begin with. I think that is the first chink that breaks down really, but then I think it is the new people that don't want to come in.

Trust is a key variable in introducing innovations or alternative approaches. The process of social capital in decision-making operates when bridging social capital provides information and bonding social capital provides the trust to apply the innovation. In some farming communities, trust and social cohesion provides innovative approaches. Some farmers are pooling resources to provide housing and employment between them in order to keep reliable labour and staff. This maintains viability in both economic and social terms, potentially generating bonding capital, capacity and trust.

When relations between politics of place and politics of interests expressed through government policy that inhibits the provision of resources and information via extension and other similar services, trust and social capital is not generated, adaptive capacity is reduced, the consolidation of innovation is reduced and thus resilience declines. Social capital begets capacity, but capacity has to be used on a repeated basis for trust to generate, before it can be translated into social capital. Capacity does not equate with resilience and has to be coupled with trust for resilience to emerge.

Trust can thus be considered one of the emergent properties in a resilient social system. Conservation of resources must include the conservation of social capital, which is a key social resource that maintains and develops resilience in rural agricultural communities.

Self-organisation

This element of complex adaptive systems is facilitated within the constraints of social norms, and the solutions held in social memory allow re-configuration in the face of perturbation. Formal and informal relationships within the three scales of social capital (micro, meso and macro) govern the way in which systems configuration is possible. Environmental discourse configures the ideals and ideology that maintain norms of practice and define solutions within this systems configuration. The interaction between self-organisation and adaptive capacity is intrinsic and the constituting variables cannot easily be separated.

> **Community of place and identity commenting on the self-organising options offered through involvement with communities of identity and interest**:
>
> committees are really good forums to find knowledge

> **Communities of place and identity commenting on self-organising opportunities offered at the local social scale**:
>
> I think those are pretty important forums for people to work together to develop projects and have a bit of a social life. They have barbies {BBQs} attached to meetings and things like that to share information, support
>
> once people get into something, it might take a little while to get them interested, but once everybody's decided they're going to do something, they will do it

The constraints of social norms also facilitate self-organisation that precludes the adoption of alternative approaches. New governance arrangements are being resisted in rural agricultural Australia and norms of self-organisation, tempered by memory and mediated by the interaction of power relationships are resulting in a consolidation of existing forms of self-organisation and excluding attempts to intervene in existing parameters of phase space.

> **Community of place and identity commenting on attempts by community of identity and interest to implement policy developed at the national scale in the local context**:
>
> like neon signs. All the farmers have got the same idea talking to them. They will go along, but they are not really interested in it. They know its going to happen cause its coming from the big boys. You can see the {local regional natural resource management body} is only a small cog in the wheel but they're sort of coming down and

saying we got to have this report done by then and all the farmers are saying 'why?'

they had a {local regional body} meeting in {local regional centre}, …and I went in there because they were trying to get {people involved}…I couldn't make head nor tail, and I could see where it was going, so I didn't go to any more…too much admin money being wasted

Members of captured community involved with the implementation of policy developed at national scale:

I agree that our decisions take a long time, but I don't think that we've got consultation really sorted. I don't think it's really meaningful to many people and sometimes I think they are pretty selective about who they consult with and I find that very frustrating, just rubber stamping

the regional process has got pretty toey about whether communications are actually getting back on the ground. There is not enough progress and direction at the regional level up to date, so relaying back to the community all the conflicts is bad for the regional process….there has been very little actually to take back to the land manager that is real

Community of place and identity commenting on current implementation of regionalisation and community of identity and interest:

I think it is a bit of a retrograde step…what they've done in the past has worked well…hands on right from the start {local people}

they created these new zone control groups which only meet twice a year which are really paper tiger groups because we no longer have that intimate involvement….the on-ground community involvement….knowing what they were doing and how they were doing things and it was just a total bonding…feel as though we don't have any ownership anymore…..I think its actually coming from the bureaucratical side not actually {the elected government}…I think the bureaucrats in general have a fear of community involvement.

These quotes indicated that policies of regionalisation were too far removed from the local in situations dealing with environmental issues. There appeared to be a mismatch between scales for communication, evaluation and adoption of policy. Boundary organisations[50] (Cash and Moser 2000) holding significant amounts of social capital within local landscape contexts had been dismantled

[50] Boundary organisations: "institutions which serve to mediate between scientists and decision-makers, and between these actors at different scales" (Cash, D.W., and Moser, S.C. (2000). "Linking global and local scales: designing dynamic assessment and management processes", *Global Environmental Change*, 10: 109-120 p. 109).

or disempowered and marginalised in the new forms of regional governance currently being implemented at the national scale. In one case a long-term member of the community of identity and interest from a small regional government office was unable to provide information on the local landcare officer (boundary organisation) that had been stationed in the same office for more than three years. These boundary organisations provided the critical bridging links between social and geographical scales that facilitated the exchange of information and the development of bridging capital within an institutionalised setting.

The domain of knowledge

The accumulated analyses revealed that the categories of community use different values that expose their knowledge frameworks. This research focused on three distinct and interacting forms of knowledge to capture the interaction between social and landscape scales. Local knowledge is developed in an experiential process that draws on personal ideals, ideology and daily practice frameworks (Benton and Short 1999, Harré *et al.* 1999, Sayer 2000). Scientific knowledge is primarily derived through formal learning processes but again mediated through the stratified ontology of the real, the actual and the empirical (Bhaskar 1978, Callon and Latour 1981, Lockie 2004). Indigenous knowledge is developed over long time frames and reflects intrinsic relationships with place that usually encompasses a subsistence relationship and interconnection with ecological processes through spiritual connections (Dryzek 1997, Benton and Short 1999, Davidson-Hunt and Berkes 2003, McIntyre-Tamwoy 2004). Other conceptualisations divide these forms of knowledge further and include specialised knowledge and strategic forms of knowledge (Dept. of Primary Industries and Energy 1996, Brown and Pitcher 2005).

These three distinct forms of knowledge (and thus enactment and expression of power) interact to reflect a domain of attraction that revolves around processes of communication, credibility formation and integration by the three categories of community all contributing to decision-making in the local context of a landscape. The mediation of power serves to transform knowledge into ‘truth’

and thus constitutes and constrains the socio-political context of environmental discourse (Doyle 2000).

Emergent characteristics

The emergent characteristics in this complex adaptive system include the presence and interaction of these three forms of knowledge as a reflection of the integration of the three categories of community. This interaction ensured iterative processes of closed feedback loops that integrate practice, with theory and experience based on information exchange between the three categories of community. This knowledge domain of attraction includes the three value sets identified through the exploration of sense of place (social, symbolic and economic) (Chapter Three) as further tempering decisions in landscape management. Agricultural viability is defined within this domain and reflects the differences between the three categories of community that drive process and set the parameters of phase space. These quotes show the interaction between the three communities and exchange of knowledge that forms the emergent characteristics of this domain of attraction:

> **Communities of place and identity and local knowledge**:
>
> we have a local newspaper and there's quite often, if somebody's doing something, information goes in that and if you've got any suggestions or queries, ….so there's communication about different issues. The Shire might have a little piece, so there's always an exchange of information in {the local small town}
>
> I think an important thing seems to me is {my son} plays football in {the local small town}…that's where a lot of people talk….I think this is a pity that a number of small community's are loosing those groups, they haven't got enough people to make a football team

> **Communities of place and identity drawing on knowledge from communities of identity that live outside the sub-catchment**:
>
> I'd use friends and family …they are completely uninvolved and I think that's quite nice to get ideas from somebody that's not within the community

> **Communities of place and identity drawing on scientific knowledge from communities of identity and interest**:
>
> {landcare groups?} we get a fair bit of feedback from them, they keep us fairly well with what farmers are doing. We don't have to ask too

> many questions, they keep us fairly well informed, sending out information but occasionally field days
>
> **Communities of place and identity drawing on scientific knowledge**:
>
> we use all the local blokes as well {agronomists}…but only one that's really into the landcare bit …he's always very interested in whether you're going to raise your ph and he's the only one that's ever told us really what you should and shouldn't put on this….that has certainly improved the soil too
>
> **Communities of identity and interest drawing on local knowledge across social and geographical scale**:
>
> there is the political information, talking to some people in the political sphere….it is a bit more than gossip….informal and formal as well… (in decision-making)
>
> **Communities of place, identity and interest drawing on Indigenous knowledge:**
>
> {Indigenous knowledge of how the natural systems work?} much better than the non-Indigenous people ever realised….you will find there is a lot there which they don't tell….we have to know what they need to communicate…

The exchanges of these forms of knowledge constitutes the processes that form the knowledge domain of attraction. While the integration of these three forms of knowledge is recognised as important in local context decision-making, access is not always easy or guaranteed.

Adaptive capacity

Perturbation requires that a range of options are available within a complex adaptive system to contribute to solving problems and retain resilience within phase state parameters. The two hydrological catchments in this research have endured contrasting environmental impacts due to the biophysical constraints on the strategies for land management in the past. Katanning Zone is considered the most heavily salinised agricultural landscape in Australia (Beresford *et al.* 2001), and has thus drawn on the resilient components available within their linked social-ecological system to solve problems. These resources have consolidated with use to integrate innovative approaches and move from the collapse or release phase (Ω creative destruction) of the

adaptive cycle to the renewal or reorganisation phase (α) (Holling 2001). The evidence of resilience is in the national awards for both landcare and for agricultural production and the confident and positive attitude to the future of the industry (often expressed through the desire to see children inherit farms and continue farming) in the hydrological catchment.

In contrast, the Condamine Headwaters appears to be moving towards the end of the conservation phase (K) towards the collapse or release phase (creative destruction Ω) due in some part to changes in available knowledge forms as a result of changes in agricultural and natural resource policy and governance, as well as changes in the socio-demographic make-up of the social catchment. More people with little local knowledge and experience in local systems of land management are moving to the sub-catchment thus depleting the available pool of knowledge resources to contribute to global economic and political perturbations to agriculture. While the state of the landscape has endured considerable perturbation through the governance of vegetation management and the cumulative impacts of water quality changes, it has not reached the crisis point that Katanning Zone had reached. Thus, the differences in perturbations between the two complex adaptive systems operating in each of the hydrological catchments are different, but none the less, draw on the same constituents of the knowledge domains of attraction to maintain resilience. The Condamine Headwaters participants expressed reservation about the future of the agricultural system in their catchment, and particularly required their children to have other options in the future.

The decline in interaction between local and scientific knowledge is exemplified through participants' remarks during interviews:

> **Community of place and identity:**
>
> we've had a couple of turnovers with officers and that, and its sort of become very disjointed and has just recently started up again
>
> {landcare group} its fallen to bits, disrepair, but yes, a lot of people have done projects you know, tree planting and things like that

they're just taking little snippets out of it that will fit into their plan that they know they can just ride over that as they mean. The really important issues of it have been over-ridden

they're saying to the farmers: 'you don't know how to do it', you will have to get the experts to do it for you

he was excellent and now he's moved, so he must have moved to a better job. He's gone to Goondiwindi or something. As soon as you get one good one they go

Community of identity and interest:

our major open day, we have every five or six years {community of identity and interest}.

Examples of the state of the adaptive cycle are shown in these participants' comments:

Katanning Zone showing changes in adaptive cycle:

a lot of farmers don't get along with their sons around here, because they don't want to change at all. But me and {my son} get on fairly well…see a lot of young ones don't get on with their fathers and …they borrow millions of dollars to buy farms and a lot of them in the next couple of years are going broke….see I've been through it all before {the role of local knowledge}.

I would love our son to be a farmer.

Condamine Headwaters showing changes in adaptive cycle:

Community of place and identity

people who are retiring are coming into this area with big bags of money and they can throw a couple of million dollars at a small piece of dirt because they just want to live there. But, what its doing is its just taking away the viability of the other farmers because if the rates keep following that…

fifteen new houses come to Killarney in the last two years…school numbers are increasing…no new farms being established

they still have to have an education to allow them to make up their minds to do that

They are interested in the land, but I don't think there is much to encourage them to take over really. Only the lifestyle, the dollars and cents are not enough to encourage them

it's a bit sad to see farmers falling by the way, its probably the most efficient way to farm, but the economic side of it, well what do you do?…we are now price takers not price setters…we've just got no control over it

Community of identity and interest:

I still don't have a fire break around my place…I didn't do a lot of fencing, I need fences to keep the neighbours out {about farming in the traditional sense}.

Adaptive capacity is dependent on the transfer and exchange of knowledge across horizontal links of bridging social capital that facilitates the transfer of knowledge and innovation across scale, and between the three knowledge forms. The qualitative results of the social capital analysis provided insights into these interactions and the consequences for failures in these interactions. Local knowledge that draws on memory and experience will retain vibrancy in innovative capacity if it is able to draw on scientific and Indigenous knowledge to experiment with new approaches. Scientific knowledge loses vibrancy and adaptive innovation if interaction and integration with local context based knowledge is absent. Indigenous knowledge contributes to commitment and belonging in landscapes through ecological knowledge and spiritual links but looses its contexted role in a social system if silenced or withdrawn.

The recognition of cross-scale dependencies between communities and knowledge frameworks is required to ensure socio-ecological resilience (Folke, Colding and Berkes 2003). If one form of knowledge is silenced, withdrawn or becomes inaccessible within a social catchment, then the solutions available in the face of perturbation within a hydrological sub-catchment are also depleted. The consequence is decline in resilience of the linked social-ecological system and if adaptive and self-organising capacity is near the edge of the parameter space then the emergent characteristics of the system will shift to occupy a basin of attraction in an alternative phase state.

This collapse or phase state shift (might for example be based purely on depletion of local knowledge) might not be a desirable outcome for Australian rural agricultural systems. The ability of a system to self-organise following a change in phase of the adaptive cycle will ensure that the parameter phase state of the system does not change to exhibit different domains of attractors.

Self-organisation

Self-organisation to a large extent reflects the existing social capital and social norms within these complex adaptive systems. If the existing social capital and social norms reflect the diversity and strengths of each of these dimensions,

along with representation of the three sets of landscape values (social, symbolic and economic), then the resilience within the system will facilitate self-organisation that allows flexibility and adoption of innovation. If social capital and social norms reflect a limited set of the elements that constitute each of these concepts then it is possible that the linked social-ecological system might be occupying the conservation phase (K) of the adaptive cycle. This would be cause for systemic intervention (Midgley 2000) that builds adaptive capacity (as opposed to conventional understandings of capacity building (Andrew and Robottom 2005) to reconfigure emergent characteristics to ensure that self-organisation following perturbation remains within the parameter space and avoids phase state shift into alternative basins of attraction. Access across social scale to a range of knowledge forms facilitates flexible and adaptive approaches:

> there are not many farmers who do not go off their property anymore….see them down the club socialising and at field days…if the farmer feels, if he acknowledges, that his land needs work and he needs to change its like a very personal thing

> I think that's because we work together, and its not as if everybody knows what everybody is doing but there are a lot of young fellows here and they get chatting to one another and…you don't find in reading, you know {my husband}, absorbs everything from his farming magazines…reads the other newspapers….the young fellows….get together and talk, they have their fire meetings and they chat when they see each other down the road

Recognising the necessary (or optimal) constituents of the processes that define the domains of attraction is important to maintain resilience in rural agricultural systems in Australia.

The triple bottom line domain

The evolution of environmental discourse to reflect changing social expectations in relation to the environment has resulted in a finer defining of sustainable development to include three explicit interacting components: social, ecological and economic (Dryzek 1997). This so-called triple bottom line has evolved with an ethical stance taken by the private sector in recognition of the resource that

supplies the basis for economic sustainability. In addition, the evolution of the notion of 'ecological footprint' to include off-site impacts of production (both industrial and agricultural) has ensured that impacts on ecological systems are increasingly acknowledged and considered as part of concepts of sustainability (Wackernagel *et al.* 1999, Lawrence 2005). The results from the sense of place analysis (Chapter Three) revealed divergences in how different elements of the landscape are valued according to community sector. These divergences reflect divergences in the values of the triple bottom line.

Emergent characteristics

While the triple bottom line distinguishes between the social, ecological and economic dimensions of landscapes (Measham and Baker 2005), it is more appropriate and useful to consider the components of the triple bottom line as a domain of attraction that indicates interconnected and irreducible relationships between the three dimensions:

> I think the politicians have to get a grip on that ecology is as important as economics
>
> but it will have to be that the government will carry it because the people don't do it….won't be enough of them who have enough personal resources or commitment to put ecology over economics
>
> I think they all work together, they should work together…you can have the economics and the land and so social interaction and still be successful
>
> you can get labelled easily as a greenie, as you know and of course there is the perception of a greenie is a radical who won't listen to the economic essence of farming which is the wrong perception of course.

Communities of place and identity view the input of the government sector as critical to implementing and applying the concept of the triple bottom line. This further confirms the importance of considering these variables as domains of attraction that do not attempt to separate the engagement of the three communities from the forms of knowledge within the context of a viable local landscape. It is useful and important to recognise the links between these values even though these relationships as forms of capital (social, economic and environmental-natural) are given little consideration and currency by the landscape management policy sector (Tonts 2005):

> unfortunately those sort of people {some guy who will knock out all his trees}….they only tend to see the light when they are being educated by the government as to positive practices in land management…the older person wouldn't think that really mattered to him at all
>
> well, I would say society should always come first, then ecology and then economics. I mean ecology and economics can be quite closely related, but I think that people's needs should come before any enterprise…has got to be tempered by information by science…you've got to have a knowledge base in order to sustain those values
>
> it's all a balance. Economics is very important because we have to make a living, but how we make a sustainable living is more important than just a dollar in your pocket today if you have no dollars in your pocket tomorrow"…"its interesting to see how the farmers around the place are having an improvement in their productivity but increases in looking after the ecology of the land but also working with a lot of different groups to help them get there.

An interesting insight provided through taking this approach is that most agricultural communities consider viability as a better indicator or more appropriate indicator of sustainability. Viability explicitly includes the three elements of the triple bottom line and is a more useful point of discussion and evaluation due to the meaning provided through local context and use.

> yes, I really believe that farmers are interested in sustainable agriculture, farmers are not people that are there to use and abuse…in fifty years time, if that's going to be left for their grandson, its got to be viable and I think most people have a common sense approach and think about what they're doing and think about the water quality, the salinity, how much is arable, …soil nutrition…most people are trying to have their land sustained because its such a good lifestyle, because the thought of your grandson farming in 50 years time in your boots is probably quite fulfilling…I'm sure most farmers don't farm for the moment.

The quantitative research generated the specific hypotheses through sense of place values that people intrinsically operate in a practice framework that situates them ideologically within a triple bottom line framework (three landscape value sets: social, symbolic and economic). The qualitative ground-proofing assessed and explored the interactions of power between the three components in a discourse sense to show a dynamic system without distinct cleavage between the three interacting elements of the triple bottom line. The ecological variables of rainfall and soils still set expectations for limits and

potential, but a constant iterative interaction between ecological and economic components in a farming system drives decision-making within the constraints of social norms and expectations.

Adaptive capacity

To maintain viability, farming communities integrate social capital with natural, physical and economic capital. This provides the adaptive capacity to deal with perturbation. Science forms a link between local and Indigenous knowledge when landscapes 'loose their balance'. Local knowledge 'works' with social capital at the micro and meso scale to adapt macro scale policy for application in local context.

While numerous initial responses to the inquiry on the triple bottom line produced economics as the driver, this was invariably, and often quite quickly qualified with social or ecological considerations. I detected a transition phase in which economics (as so often driven by agricultural policy as the *status quo* discourse) is making way for a more integrated inclusion of ecological and social elements:

> the most important is the economics…..if the season runs….then the farming community tend to spend….increase the class rate at school, which means to school needs two more teachers, those teachers all shop up at Woolworth's….its that pyramid of economic impact….the next one down the line is probably the social thing, sport and stuff like that….so if there is enough in the economy to support the development of these recreational things they attract it…only when things are good for a number of years is the ecology of the area thought of unless there are some ecological issues affecting…the local sub-catchment

> I think there are still a lot of people who think that landcare is separate to their land management ….the groups that get together in our area are aware of where they fit in their little catchment, we've got them in whole of catchment rather than end of line…..five or eight years ago someone who was obviously active involving good land management practices was the one who was talked of as 'being green', … now the group has really moved that way and it's the one who doesn't take part in any good land management practices who is talked of as "Oh he's not doing anything" and that to me is a huge shift

> its all to do with values and attitudes and survival, if people don't value the land and ecology beyond the buck that they can make out of it then we're not going to have a change and get long term thinking…ecology is really the driver

> …in a social sense because you can point out the economic and ecological benefits of any particular action to any particular person but they are going to go with what they want to do and that is social….{even} if its not economically viable….{or} at the expense of the ecology and other economic decisions that they make, so socially is just huge.

Discourse claims to have economics as the driver, but the reasons for farming and connections to place are driven separately. Aesthetics and lifestyle are very important. The constant claim that farmers will go to inordinate lengths to stay on the farm beyond the economic viability indicates that social factors are very important. In Katanning Zone the average number of trees planted annually by each landholder is in the region of three to five thousand. These trees are planted as amelioration with strong considerations of habitat and ecological value as well as integrated production planting that will bear economic fruit through the Oil Mallee Scheme and other innovative approaches to diversification in these landscapes. Though there is a diversity of agricultural approach in the Condamine Headwaters, attempts to introduce agro-forestry have not amounted to much. The integration of ecological values in a landscape that is relatively in-tact may well depend on the point of crisis similar to that which rising salinity has introduced to some agricultural landscapes. The phase state of the adaptive cycle in each of these hydrological catchments reflects different positions.

Self-organisation

Generational shift is not necessarily the reason given by the three communities for landcare not being adopted by younger farmers. There are indications that triple bottom line value integration and a move away from economics as the defining notion may play a role. If viability is the critical expression of sustainability in the minds of this new generation, then perhaps the self-organising capacity within the triple bottom line domain of attraction has moved to integrate viable social communities within eco-agri landscapes.

By downplaying the economic components it might be possible that sustainability within the triple bottom line will re-emerge to represent viable linked social-ecological landscapes. Sense of place was a key factor in how the

three interacting communities contributed to the framing of the triple bottom line. Communities of place and identity tended to have longer-term commitments to landscapes with higher scores of symbolic sets of values than communities of identity and interest. This intrinsic connection (often subjugated by the economic *status quo* discourses) was not often formed by communities of identity and interest. With the help of bonding social capital to form stronger social links at the local scale, the abstract understandings of landscapes may become more concrete and allow the development of sense of place values that provide macro scale policy with local scale contexts for understanding and application.

Conclusions

Sense of place constituted three sets of values (social, symbolic and economic) that form belonging and commitment in a landscape. Social capital comprised the constitution and constraint of both bridging and bonding links that form the relationships between people who contribute to the decision-making about a landscape. Environmental discourse encompasses the integration of ideals, ideology and practice that underpins the possible in decision-making in landscapes. While this dimension was not easily evaluated and tested empirically in this study, it captures the essence of the underpinning frameworks of practice well. Each of these three social dimensions interacts to evolve and form emergent characteristics that maintain the integrity of these systems through adaptive capacity and the ability to self-organise following perturbations.

The three domains of attraction that contribute to the key processes that define these systems reflect the negotiations between the values of the triple bottom line in landscape management (social, ecological and economic), and the way communities of place and identity communicate and interact with communities of place and interest. This interaction is most easily evident through the negotiations that constitute the development of knowledge and the adoption of ‘truth’ through the three interacting forms of knowledge.

As with all complex adaptive systems, relationships are non-linear, frequently show unexpected links and are not easily reducible from the sum of the parts. The conceptual model (Figure 6.8) developed with reference to the theoretical literature (already discussed in detail earlier in this chapter), the results of the numerical taxonomy and through the heuristic exploration of the qualitative approaches, reflects an attempt to integrate the elements of complex adaptive systems, with the domains of attraction in these systems and the processes that configure and maintain parameter space.

Figure 6.8 Conceptual model showing the critical domains of attraction, social dimensions and elements of complex adaptive systems

Ecological sampling and the methodology of numerical taxonomy allowed the acknowledgement of complexity and diversity in a portrayal of free associations between nature and humans. This approach allowed interpretations to emerge, rather than imposing in advance *a priori* assumptions on human/nature interactions. This paved the way to identifying the important features that define emergent characteristics that form resilience in these linked social-ecological systems. In a synthesis resulting from accumulated results from numerical

taxonomy that exposed the intrinsic structure (both surface and evident deep structures), the subtle deep structures were exposed and interpreted through qualitative approaches in the research.

Sense of place values allocated to different elements of the landscape are maintained through forms of social capital, and the associated discourses of the environment that maintain the resilience of the system. The historical relationships between the community categories in social catchments (place, identity and interest) drive systemic tensions and productive potential linking micro, meso and macro social scales. This analysis exposed cross scale links operating at the local scale, thus locating a discrete rural agricultural social system. These deep structures, thus exposed were then open for further exploration. The results of numerical taxonomy conducted at the outset provided a focus for qualitative research questions that provided a rich source of detail. By combining both approaches, the broad survey analysed through numerical taxonomy exposed the emergent characteristics and located the research questions that become the basis for rich detail that is more representative of broader scales.

This analytical approach exposed structural dichotomies such as differences between occupations and industry in relation to land management decision-making that are not always acknowledged at the surface level (Eoyang 2004) in these social catchments. Abstract ordination space showed the relationships between values within social catchments and the socio-demographic descriptors that give a face to the values.

Resilience is maintained in these systems through the memory that sustains the form of re-organisation possible following perturbation. This memory is maintained by the micro and meso level social capital that forms communities of identity and place in each of these social catchments. This has implications for relationships between politics of place and politics of interests working for change in land management. Strategies to maintain resilient ecological and economic systems that operate as part of the functioning rural agricultural system would benefit from acknowledging and including both positions.

The approach used in this analysis allowed for connections within a complex systems framework of emergent characteristics and strange attractors to define domains of attraction. Identifying these attractors and domains of attraction is usually difficult and fraught with uncertainty (Cook *et al.* 2005). The variables that statistically defined these domains are useful for simulation modelling (Campbell *et al*. 2005) that may provide insight into the parameters of resilience that are explored through the temporal dynamics in complex social systems. All three domains of attraction (community, knowledge and the triple bottom line) show the inter-relationships between sense of place, social capital and the social norms that underpin environmental discourses.

7

Conclusions

Contemporary Australian agriculture is built on an ancient biophysical substrate that has had long ecological association with Indigenous cultural practice (Neil 1998). More recent European cultural traditions of agriculture have imposed rapid change and this has developed into considerable concern in the wider Australian community (Beresford *et al*. 2001). Current changes in natural resource governance reflect this concern. This focus increasingly involves attempts at a more inclusive involvement of all Australians in decision-making, and attention to notions of resilience and viability in rural agricultural landscape systems.

This research was a comparative study in which the voices of people were given context in two environmentally contrasting hydrological catchments. The Katanning Zone in the Blackwood Basin of Western Australia has undergone substantial land management change primarily due to the deleterious effects of rising salt levels in the soils due to the removal of indigenous vegetation (Brockman 2001). The people who live in the catchment are a culturally diverse community who have a strong commitment both to agriculture and to reversing

the effects of environmental degradation. The Condamine Headwaters is the start of the Murray Darling Basin which is Australia's longest river system. While much of the Basin has endured the impacts of changes in land management over the past two hundred years, the Condamine Headwaters has outstanding potential in agricultural production and has a relatively stable and intact environment. The people who live in the catchment reflect a changing demographic due in part to proximity to the rapidly expanding metropolis in south east Queensland. This catchment has less cultural diversity than the Katanning Zone.

The recurrent patterns of interaction between scales, values and practices that form socio-ecological landscape systems formed the focus of this research. Explorative methodologies and heuristic methods that integrate theoretical, quantitative and qualitative approaches were developed to expose boundaries, diversity and social patterns in these landscape systems. Three interacting social dimensions that contribute to decision-making at the landscape scale were used as a focus to explore notions of adaptive capacity, self-organisation and the emergent characteristics that constitute resilience in complex adaptive rural agricultural Australian systems. The methods and approaches were discussed in Chapter Two.

This numerical taxonomy explored the positions people held in their relationships to the landscapes of these hydrological catchments (sense of place), the social ties that link them to those places (social capital) and the frameworks of practice that underpin decision-making (discourses of the environment). The patterns that emerged provided clarity to the commonalities between sectors of the population as well as the underlying tensions that posit further questions about the processes that drive these relationships. The results of the numerical taxonomy also gave an indication of positions that had been inadequately explored or expressed in the survey, such as the development of an index for environmental discourse, but that required clarification through correlation statistics or qualitative approaches.

Social assemblages in these hydrological catchments were thus defined by the values that contribute to the participant's decision-making in these landscape systems. Further, these social assemblages were made recognisable in application terms by socio-demographic descriptors. This research used a complex systems framework based on a broad theoretical conceptualisation and non-linear pattern based analysis to provide an effective means of bridging conventional divides between social and physical/natural sciences. People and their values were given context within a complex adaptive landscape system with explicit links between social and ecological functions. This form of analysis provided an expanded insight beyond simplistic and reductive socio-demographic divides to an understanding of the social values and domains of attraction that drive decision-making in rural agricultural landscape systems and define parameter space that maintains resilience.

Sense of place

The development of sense of place was identified as an interaction between the three elements of identity, attachment and the physical landscape. These three elements interacted over three scales ranging from the concrete and contexted individual social scale, with collective community scales and with broader, abstracted scales of society. These interactions included both symbolic and material social relationships with landscapes. This research used a typology of landscape values developed by Brown *et al.* (2000) to explore these interacting symbolic and material relationships. In addition, the ideal of commitment to place as a development through temporal scale that evolves from belonging into attachment and then to commitment in these landscapes was explored. This research was outlined in Chapter Three.

The integrated results of the quantitative and qualitative research assessed individual commitment to specific landscape values. Results showed a clustering of sense of place values into interdependence between symbolic, social and economic sets of values. This irreducible interaction reflected triple bottom line values of social, ecological and economic values as an emergent process of these complex adaptive systems.

Sense of place developed differently for different community sectors. Results indicated that communities with a more developed attachment to place often had a greater commitment to viability in landscape systems that integrated the triple bottom line elements. Communities with a stronger interest-based relationship with landscapes often had a less integrated sense of place that reflected a limited set of triple bottom line values.

There was a strong indication that the development of sense of place developed from belonging through to commitment as a result of interaction and stewardship activities, and, a confidence in the future in these landscapes. This interaction of stewardship corresponded directly with the development of social relationships between people in the context of place and was expressed through social capital.

The basis of 'respectful conversations' (Farley 2003) should be framed by an explicit acknowledgement that both symbolic and material components of sense of place drive the environmental discourses that frame approaches to solutions. Finding similarity and making difference explicit is a critical basis for identifying the positions that are taken in negotiating landscape-based solutions to environmental issues. Holistic acknowledgements of the full range of landscape values that tap intrinsic relationships with landscapes are also more likely to contract conciliation and tolerance. Commitment develops as the Australian sense of place passes from undifferentiated (and unlimited) space to strongly valued place.

These results provide an insight into possible re-enchantment in relationships with place, which may shift the landscape gaze to a more intrinsic relation that integrates a range of symbolic and aesthetic with biophysical and economic values.

Social capital

Through the development of a conceptual model for social capital, the interacting processes that form social capital were identified. These were based on norms of reciprocity and associated practices of exchange, social networks through which these practices occur and relations of trust that constrain or facilitate the interactions. These interactions were identified in both formal institutionalised and informal situations. Formal institutions were comprised mainly of slow variables that were less flexible while informal institutions had both slow and fast variables showing more flexibility. These institutions operated at the micro, meso and macro scales of social organisation.

The social capital process depended on both generalised bridging social capital to develop and particularised bonding social capital to consolidate, depending on the state of the complex adaptive system. The social scales and networks that influenced decision-making relationships in these landscapes were explored in this research through this theoretical conceptualisation of social capital. This research was explored and presented in Chapter Four.

The integrated results showed that the interaction of three forms of communities (place, identity and interest) that constitute a social catchment results in the development of social capital. Resilient rural agricultural systems depended on active, engaged and repeated interaction between these sectors of the community for social capital to constitute the adaptive capacity, and provide the ability to self-organise following perturbation. The interactions between these three categories of community in the social catchment of a landscape formed an emergent process, thus characterising resilience.

Social capital constrained and facilitated informal and formal institutional practice in landscape management. These practices were identified through the expression of discourses of the environment.

Discourses of the environment

The conceptualisation of environmental discourse exposed the interaction of ideals, ideology and practice. These interactions constituted the development of knowledge and framing of truth with the interaction of power as an explicit ecolinguistic system. Benton and Short's (1999) ecological-technological continuum was used as a basis for locating Dryzek's (1997) typology of environmental discourses in order to expose norms of social practice. Interacting social sectors base their defence of environmental positions and decisions on these environmental discourses. This was presented in Chapter Five.

Environmental positions were held and defended differently reflecting the interaction of social scale (individual, community and society) and the position held in relation to the status quo. The imposition of power located subject and subjugated communities in relation to the *status quo* and defined both action and reaction but within the context and constraint of the biophysical environment. Sense of place formed in relation to these discourse frameworks and social capital developed and functioned within the constraint of these paradigms of practice.

Resilience

Resilience in complex adaptive rural agricultural systems reflects the interacting and complementary environmental discourses of local, scientific and Indigenous forms of knowledge. These three knowledge bases offer translation of abstracted forms of scientific knowledge to local contexted application and the development of alternate approaches in the face of perturbation through bridging between abstract and concrete characterisations of issues. Acknowledging and integrating symbolic and material portrayals of landscape elements grants access to an integration of triple bottom line values. This integration was carried out and reported in Chapter Six.

Integration and interaction are processes in the same complex adaptive system. Resilience is less likely if these two processes are not interactive. It is

necessary to identify both the content and processes in these systems but it is the processes that locate the boundaries. This approach required a new angle on the constitution of structure that moved from the rigidity of content to include the interactive, non-linear and unexpected relationships available through post-structuralist approaches. This is structure that is interactive, dynamic and exhibits recurrent behaviour that is not repeated but maintains integrity and the adaptive capacity to re-configure and self-organise in the face of perturbation.

To identify the content, processes and boundaries of complex adaptive rural agricultural Australian systems it was necessary to identify the social catchments that contribute to decision-making in hydrological catchment contexts. Relationships across social and landscape scale constituted processes of integrated interaction between communities of place, identity and interest. These three interacting community sectors weighted social, symbolic and economic values in landscapes differently. It is these diverse weightings and contrasting positions that constituted available terms of reference in framing problems and developing solutions. Explicit acknowledgement of this diversity and the power relationships between the contesting positions is required to understand the constitution of issues and framing of solutions in order to maintain resilience in these iconic rural, agricultural Australian landscapes.

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Appendix

Appendix One: Pilot Study

People in the landscape:
a demonstration study showing the relationships between sense of place, social capital and discourses of the environment.

Angela Wardell-Johnson. School of Humanities, Griffith University.

Introduction

Commitment to place is associated with specific values (Malpas 1999). To assess the relationships people have with places investigations need to include associations with social capital and discourses of the environment (Cantrill and Senecah 2001, Brown 2001, Eisenhauer 2000, Rice 2001). This report asks about the strengths of relationships with different places, the presence and strengths of social capital, and the sorts of environmental philosophies adhered to. This study shows the outcomes of a survey of people on Nathan Campus conducted as a demonstration of the quantitative methodology to be used in the explorative first phase of this PhD thesis. Appendix 1 shows the survey and Appendix 2 shows the database that was generated.

This explorative study aims to develop hypotheses that may be tested to assess the associations between the three associated concepts in this research.

Methodology

A survey was conducted to reflect four components in accordance with the recommendations of the wider literature under study:

1. Extrinsic variables: Demographic variables
   1.1. Basic information about each person surveyed (each case)
2. Concept One: Sense of place
   2.1. to provide an assessment of relationships with a variety of places on campus

3. Concept Two: Social capital
   3.1. to provide an assessment of social capital associated with group memberships on campus
4. Concept Three: Discourses of the environment
   4.1. to provide an assessment of discourses of the environment for each person.

Twenty surveys were distributed equally between people in the Humanities and in Environmental Studies. Once the data had been cleaned, reduced and summarised it was entered onto an Excel spreadsheet. The structure of the summarised matrix was then examined using WinPATN (Belbin *et al.* 2002). The following analyses were used:

1. Cluster analysis to derive groups from the cases and variables.
2. Multidimensional scaling ordination to examine the trends in the relationship between cases. Principal Axis Correlation (PCC) was used to determine correlates of variables with the ordination. Montecarlo permutation tests (MCAO) were used to determine the significance of these variables.
3. Network analysis was used to determine the nearest neighbours for each of the cases.

(Appendix 3 provides the 'history' of analysis, along with the algorithms used).

Results

The outcomes indicate that the eighteen people who participated in the survey may be divided into six groups of people (the cases) who show similar responses (through the variables shown in Figure 1). One survey was not returned and one was not completed sufficient to include in the analysis. The remainder represented nine from each school. The results of each of the analytical techniques are represented in figures 1 to 6.

Figure 1 shows the dendrogram that depicts the associations between individuals in the study to form six groups.

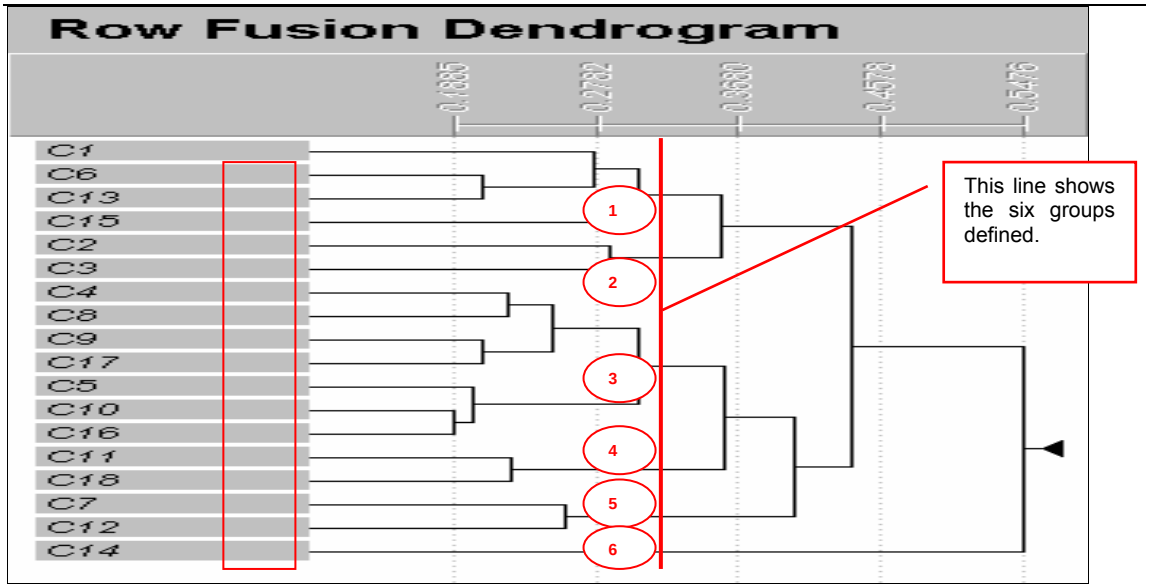

Figure 1. Dendrogram (Unweighted Pair Group Mean Analysis (UPGMA), Gower Metric, B = -0.1) showing the clusters of cases.

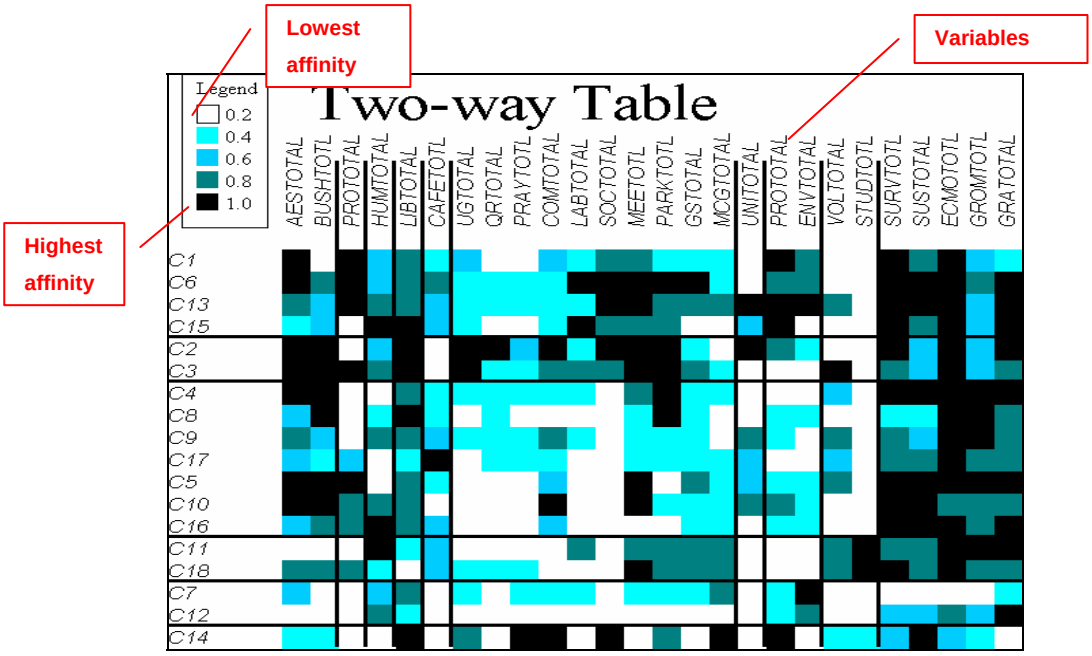

Figure 2 shows the two-way table overlaying the groups of cases with the groups of variables

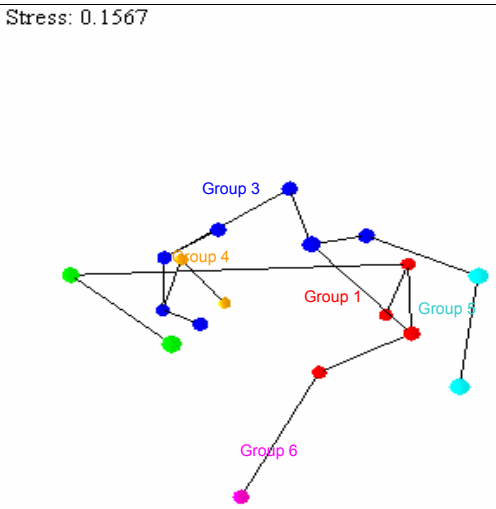

Figure 3. Three dimensional multi-dimensional spanning (SemiStrong Hybrid Multi dimensional spanning (SSH MDS)) ordination and minimum spanning tree (MST) linking all cases.

Appendix 4 shows the significance ratings of all the variables used in Principal Axis Correlation (PCC). Those variables with less than 5% are significant using the Monte Carlo Permutation test (MCAO). Thirteen of thirty-three of the variables tested (39%) are significantly associated with the ordination indicate a highly interpretable pattern.

Discussion.

Each of these groups shows distinct and explicit defining variable associations. Network analysis, cluster analysis and ordination are congruent in defining six groups of cases. These groups can be defined as:

Group One used the ecological discourses alongside the Promethean discourses as a basic environmental philosophy. They have a minimal interest and association in either voluntary or compulsory study groups and their social capital appears to be generated through professional associations. Places to which they allocate value are the AES common room, the library, school meeting rooms, the park and G's.

Group Two has association with the ecological discourses but no association with the Promethean discourses. Though they also show a minimal interest and involvement in the study groups, their place associations are with campus bushland, and their social capital is generated and sustained through links with the AES common room.

Group Three is the largest group made up of seven individuals and shows strong association with ecological discourses and little evidence of Promethean environmental philosophy. They have no association with social or activity groups and appear to have no association with any of the other means tested for identifying or generating social capital. Their associations with a sense of place are through the AES common room, bushland on campus and to a lesser extent the park and school meeting rooms.

Group Four shows a distinct antipathy to the Promethean discourses and a strong ecological discourse association. Social capital appears to be derived from both voluntary and compulsory study groups with only limited links with professional associations and not from university representative groups or social and activity groups. There doesn't appear to be a strong association with any particular place on campus.

Group Five shows an absence of social capital framed in this survey. Their strongest environmental association is with Promethean discourse and no value is attached to bushland, café's and those types of places but instead an emphasis is on values derived from the library and humanities social spaces.

Group Six consists of one individual who accords value to the library, computer labs, the Muslim Prayer Room and McGriffiths Food Supply. Both the Promethean and sustainable development discourses of the environment define environmental philosophy. Social capital is derived through social activity groups and study groups.

There was no significant association between the extrinsic variables, gender, age or distance between home and campus and the three dimensional ordination derived from the cases. There is some indication that the binary of ecological and technological environmental discourses (Hay 2002) may be a strong indictor of environmental philosophy, rather than the continuum of positions postulated by (Dryzek 1997). As the subjects under study had chosen particular fields of study or career that may have correlated with sympathy with ecological or technological positions, this may have influenced the associations with place, and thus kinds of related social capital. If this is the case, this study confirms an assumption that these three concepts must be linked in assessing relationships with the environment.

Conclusion

The variables that define these groups of people will provide the insights into the hypotheses that can be used to further examine the relationships that different groups of people have with the environment. Groups that have a strong Promethean philosophy can be asked to define this further in relation to the reasons they may have for making decisions about consumption of environmental resources. In knowing how different groups of people associate their philosophy of the environment with place and capital, it is possible to frame qualitative questions and further research to clarify these positions. In knowing the underlying structure of groups, without a dependence on *a priori* assumptions and judgements about the structure of social groups, it becomes possible to allow the subjects of this study to portray and illuminate their own positions in a follow up to this study.

Acknowledgements

I would like to acknowledge the twenty people who so generously completed the survey for me. In addition, I would like to acknowledge my supervisors, Sally Rickson, John Fien and Jenny Cameron for their input and encouragement.

My husband, Grant, has given me coaching and support in the analysis of this data. Griffith University has provided the place and space for this exploration and the groundwork for my real research in the sub-catchments of the Upper Condamine River in Queensland and the Fitzgerald River in Western Australia.

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Appendix Two: Survey Questionnaire

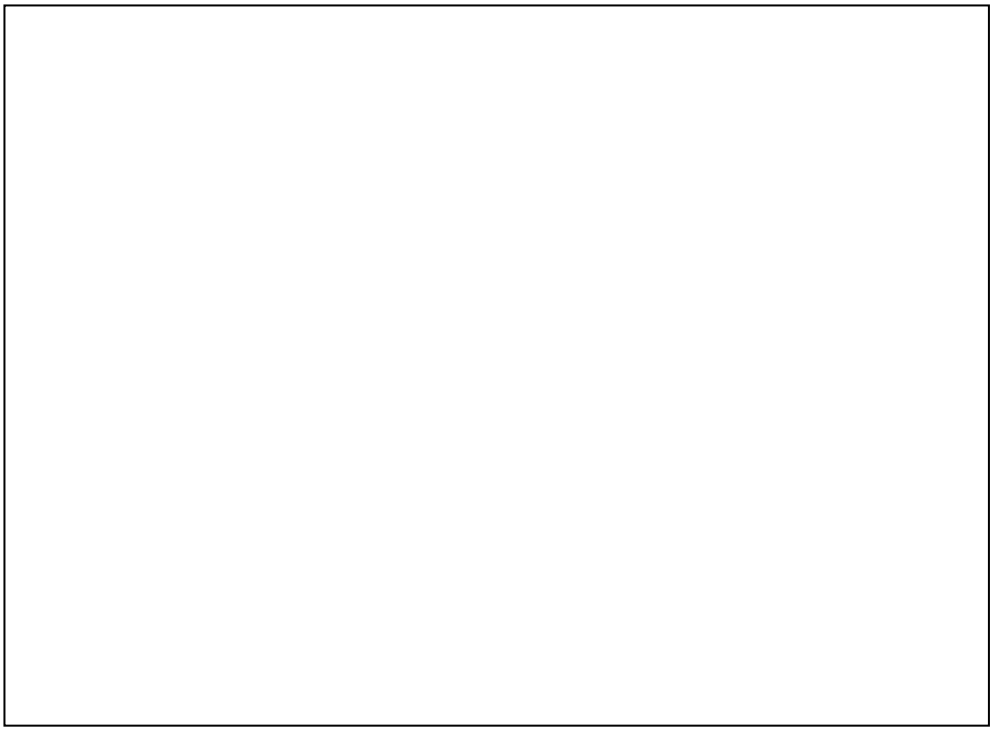
Places in the Landscape:

A survey exploring how people feel about the places in which they live.

Angela Wardell-Johnson

Doctoral Student.

Griffith University, Nathan Campus, Brisbane.



Angela is doing her doctoral thesis on a study of how people relate to the environment in which they live.

The purpose of this study is to find out how best to formulate and implement plans for the management of catchments and landscapes.

Information from this study will be converted into data that is not connected to any names and will only be used by Angela for her doctoral research.

Results will be available through a short newsletter.

People participating in this study are associated with two sub-catchments:

*The **Blackwood Basin** sub-catchment around Katanning*

and

*The Headwaters of the **Condamine** in the Murray Darling Basin.*

Acknowledgements:

Griffith University, through four supervisors, supports Angela's doctoral research.

Supervision is provided by:

Dr Sally Rickson, and **Dr Malcolm Alexander**, School of Humanities;

Professor John Fien, Australian Environmental Studies; and

Dr Jenny Cameron, School of Environmental Planning.

Funding for this research has been made available through:

The Queensland Government's Growing the Smart State PhD Scholarship program

Queensland Government

The Blackwood Basin Group Student Scholarship program

BLACKWOOD BASIN GROUP

The Cooperative Research Centre for Plant-based Dryland Salinity

CRC FOR PLANT~BASED MANAGEMENT OF DRYLAND SALINITY

Section One: Participant Details

We would like to be able to contact you again in the future.

This section is voluntary and will remain confidential.

If you would like to receive a brief newsletter providing summarised information on the results of this survey please provide contact details.
No further contact will be made.

NAME		Phone No.		Fax No.	
POSTAL ADDRESS					
		Post Code			
PHYSICAL ADDRESS					
EMAIL ADDRESS					

Please circle where you live on the attached catchment map.

Are you are interested . . .
in helping Angela with some follow up face-to-face **interviews** *to give a more complete story about how you feel about this catchment?*

Yes **No**

in receiving a follow up newsletter to give a more complete story about how your community feels about this catchment?

Yes **No**

Section Two: Details of respondents

1. **How long have you lived in the catchment? (continuous years)**
   Tick one box:

Six months to one year		
One year to two years		
Two years to three years		
Three years to five years		
Five years to ten years		
Ten years to twenty years		
Twenty years to forty years		
More than forty years		

2. **How many members of your extended family (apart from those you share a home with) live in the Catchment?**

1 - 4	
5 - 9	
10 - 15	
16 - 20	
More than 20	

3. **Which statement best describes how you feel about where you live?**
   Tick up to 3 boxes.
   This catchment …

…is where I live.	
…is where I grew up.	
…is where my family lives.	
…is where I visit when I can get away.	
…is the community I feel most committed to.	
…is the community I best relate to.	
…is where I earn an income from the land.	
…is where I earn an income through business interests.	
…is where I am employed.	
…is where I earn an income through working in a government agency.	
…is where I contribute to solving environmental issues.	
…is where I contribute to community well being.	
…is where I am interested in issues of land management.	
…is where I earn an income through working with land/water management issues.	
Other: please specify	

4. **Tick the boxes that best show which members of your extended family help out:**

THE RELATIONSHIP	CIRCLE THE NUMBER THAT APPLIES: 1 = NEVER, 2 = ONCE A YEAR 3 = SOMETIMES (twice a year) 4 = ONCE A MONTH 5 = OFTEN (at least weekly)					
PARENTS						
My parents live close by in the catchment and help out….	NOT APPLICABLE	NEVER 1	2	SOMETIMES 3	4	OFTEN 5
My parents live outside the catchment help out….		1	2	3	4	5
My parents *in law* live close by in the catchment and help out….		1	2	3	4	5
My parents *in law* live outside the catchment and help out….		1	2	3	4	5
SIBLINGS						
My brothers/sisters live close by in the catchment and help out….	NOT APPLICABLE	NEVER 1	2	SOMETIMES 3	4	OFTEN 5
My brothers/sisters live outside the catchment and help out….		1	2	3	4	5
My sisters/brothers *in law* live close in the catchment by and help out…		1	2	3	4	5
My sisters/brothers *in law* live outside the catchment and help out…		1	2	3	4	5
GRANDPARENTS						
My grandparents live close by in the catchment and help out…	NOT APPLICABLE	NEVER 1	2	SOMETIMES 3	4	OFTEN 5
My grandparents live outside the catchment and help out…		1	2	3	4	5
My partner's grandparents live close by in the catchment and help out…		1	2	3	4	5
My partner's grandparents live outside the catchment and help out…		1	2	3	4	5
OTHER RELATIVES						
My cousins and/or cousins *in law* who live close in the catchment help out…	NOT APPLICABLE	NEVER 1	2	SOMETIMES 3	4	OFTEN 5
My cousins and/or cousins *in law* who live outside the catchment help out…		1	2	3	4	5
Aunts and Uncles live close by in the catchment and help out…		1	2	3	4	5
Aunts and Uncles live outside the catchment and help out…		1	2	3	4	5
OTHER family members living nearby in the catchment help out….name the family relationship		1	2	3	4	5
OTHER family members living outside the catchment help out….name the family relationship		1	2	3	4	5

Section Three:

How you use and value PLACES in the catchment.

How do you value different places in the catchment?

- Are some places special for **production** purposes?
- Are other places special for **rest and rejuvenation**?
- Angela has defined a number of ways people have come to relate to the landscapes in which they live. Some of the categories might reflect your relationship with the different parts of the landscape.

Use the map in the front to help Angela record how you value different parts of your landscape.

There are 2 PARTS **to this section and**

a number of CATEGORIES **in each part**.

- *Please choose **at least one category from each part** or complete all categories if you choose.*
- ***Mark each category** on the map using A, B, C etc and number each if you want to mention more than one kind of place for each category.*
- Rate the **frequency** of visits and how you **value** each place.

Part 1:

PLACE: Mark each category of place on the map either: A, B, C or D. And, if there is more than one place: A:1; A:2 etc	1. How many times do you visit these places during a six month period? 0 - never 1 - occasionally 2 – reasonably often 3 - regularly 4 - frequently 5 - everyday						2. Rate each of these places in general, in their value to your *work*. 0 = least 5 = most						3. Rate each of these places in general, in their value to your *social life.* 0 = least 5 = most						4. Rate each of these places in general, in their value to your *spiritual/ aesthetic life.* 0 = least 5 = most						5. Rate your *commitment* (for each place) to maintaining values of each place. 0 = least 5 = most					
A: Recreation	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5
B: Historic	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5
C: Cultural	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5
D: Learning	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5

Part 2

PLACE Mark each category of place on the map either E, F, G or D. If there is more than one mark: E:1; E:2 etc	1. How many times do you visit these places during a six month period? 0 - never 1 - occasionally 2 – reasonably often 3 - regularly 4 - frequently 5 - everyday						2. Rate each of these places in general, in their value to your *work.* 0 = least 5 = most						3. Rate each of these places in general, in their value to your *social life.* 0 = least 5 = most						4. Rate each of these places in general, in their value to your *spiritual/ aesthetic life.* 0 = least 5 = most						5. Rate your *commitment* (for each place) to maintaining values of each place. 0 = least 5 = most					
E: Life sustaining	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5
F: Subsistence	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5
G: Biological diversity	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5
H: Intrinsic	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5
I: Aesthetic	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5
J: Spiritual	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5
K: Therapeutic	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5
H: Intrinsic	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5
I: Aesthetic	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5
J: Spiritual	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5
K: Therapeutic	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5
L: Future	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5
M: Economic value	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5

Section Four: Membership of groups in the Catchment

Types of Groups:

This section is about the sorts of groups you belong to and how important they are to your life.

Examples of groups include:

- Social/Activity such as tennis clubs and amateur theatre;
- Service Clubs such as Rotary, CWA and Lions;
- Environmental service such as catchment and revegetation;
- Lobbying groups
- Professional associations
- Political organisations
  - ⇨ Local government
  - ⇨ State government
  - ⇨ Federal government
- Community groups
- Church/ religious groups

Part 1

List the groups/ asso-ciations you are a member of:	Length of membership *Circle the category:* Less than one year: 1; 1 – 2yrs: 2; 2 – 5yrs: 3; 5 – 10yrs: 4; 10yrs +: 5	Approx number of members in each of these groups: 1 – 5 = 1; 6 – 10 = 2; 11 – 20 = 3; 21 – 50 = 4; 50 plus = 5	Number of meetings held per year: 1 – 5 = 1; 6 – 10 = 2; 11 – 20 = 3; 21 – 50 = 4; 50 plus = 5	Approx number of members attending average meeting: 1 – 5 = 1; 6 – 10 = 2; 11 – 20 = 3; 21 – 50 = 4; 50 plus = 5	Rate level of trust between group members Least =0 Most = 5	Rate the value of the groups most important to you: Least =0 Most = 5
Social/ Activity groups/associations: How many groups are you a member of? Please write the number in this box						
NAME OF GROUP	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
NAME OF GROUP	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
NAME OF GROUP	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
Service Groups/associations: How many groups are you a member of? Please write the number in this box						
NAME OF GROUP	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
NAME OF GROUP	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
NAME OF GROUP	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
Church/ religious groups/associations: How many groups are you a member of? Write the number in this box						
NAME OF GROUP	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
NAME OF GROUP	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
NAME OF GROUP	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
Environmental Service groups/associations: How many groups are you a member of? Write the number in this box						
NAME OF GROUP	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
NAME OF GROUP	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
NAME OF GROUP	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
Lobbying groups/associations: How many groups are you a member of? Please write the number in this box						
NAME OF GROUP	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
NAME OF GROUP	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
NAME OF GROUP	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5

Part 2

List the groups / associations you are a member of:	**Length of membership** ***Circle the category:*** Less than one year: 1; 1 – 2yrs: 2; 2 – 5yrs: 3; 5 – 10yrs: 4; 10yrs +: 5	**Approx number of members in each of these groups:** 1 – 5 = 1; 6 – 10 = 2; 11 – 20 = 3; 21 – 50 = 4; 50 plus = 5	**Number of meetings held per year:** 1 – 5 = 1; 6 – 10 = 2; 11 – 20 = 3; 21 – 50 = 4; 50 plus = 5	**Approx number of members attending average meeting:** 1 – 5 = 1; 6 – 10 = 2; 11 – 20 = 3; 21 – 50 = 4; 50 plus = 5	**Rate level of trust between group members** Least =0; Most = 5	**Rate the value of the groups most important to you:** Least =0; Most = 5
Political associations: How many groups/associations are you a member of? Please write the number in this box						
NAME OF GROUP	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
NAME OF GROUP	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
NAME OF GROUP	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
Professional associations: How many groups/associations are you a member of? Write the number in this box						
NAME OF GROUP	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
NAME OF GROUP	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
NAME OF GROUP	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
Community groups/associations: How many groups are you a member of? Please write the number in this box						
NAME OF GROUP	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
NAME OF GROUP	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
NAME OF GROUP	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
Other groups or associations: How many groups are you a member of? Please write the number in this box						
NAME OF GROUP	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
NAME OF GROUP	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
NAME OF GROUP	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5

Part 3

This part explores the state of the groups you are a member of.

Choose the ***three groups*** that are most important to you, write the name in the box and answer the following questions:

NAME OF GROUP	STATEMENT THAT BEST REFLECTS THE STATE OF THE GROUP	Circle one number for each: 0 = don't agree 5 = agree strongly					
Name of Group 1:	*…growing in influence and membership in a stable situation*	0	1	2	3	4	5
	…experiencing new and innovative influences and attracting diverse membership	0	1	2	3	4	5
	…starting to influence the broader community with stable & directed leadership	0	1	2	3	4	5
Have you held an office bearing position for this group at any time over the past ten years? Circle your answer. **Committee member:** **Yes No** **Executive position:** **Yes No**	*…experiencing some unsettling change in response to outside influence*	0	1	2	3	4	5
	…many new ideas are being implemented that integrate a range of approaches	0	1	2	3	4	5
	…new ideas have recently been tested & are now being implemented on a broad scale	0	1	2	3	4	5

NAME OF GROUP	STATEMENT THAT BEST REFLECTS THE STATE OF THE GROUP	Circle one number for each: 0 = don't agree 5 = agree strongly					
Name of Group 2:	*…growing in influence and membership in a stable situation*	0	1	2	3	4	5
	…experiencing new and innovative influences and attracting diverse membership	0	1	2	3	4	5
	…starting to influence the broader community with stable & directed leadership	0	1	2	3	4	5
Have you held an office bearing position for this group at any time over the past ten years? Circle your answer. **Committee member:** **Yes No** **Executive position:** **Yes No**	*…experiencing some unsettling change in response to outside influence*	0	1	2	3	4	5
	…many new ideas are being implemented that integrate a range of approaches	0	1	2	3	4	5
	…new ideas have recently been tested & are now being implemented on a broad scale	0	1	2	3	4	5

NAME OF GROUP	STATEMENT THAT BEST REFLECTS THE STATE OF THE GROUP	Circle one number for each: 0 = don't agree 5 = agree strongly					
Name of Group 3:	*…growing in influence and membership in a stable situation*	0	1	2	3	4	5
	…experiencing new and innovative influences and attracting diverse membership	0	1	2	3	4	5
	…starting to influence the broader community with stable & directed leadership	0	1	2	3	4	5
Have you held an office bearing position for this group at any time over the past ten years? Circle your answer. **Committee member:** **Yes No** **Executive position:** **Yes No**	*…experiencing some unsettling change in response to outside influence*	0	1	2	3	4	5
	…many new ideas are being implemented that integrate a range of approaches	0	1	2	3	4	5
	…new ideas have recently been tested & are now being implemented on a broad scale	0	1	2	3	4	5

Section Five: Framing your relationship with Nature

1. What is your basic attitude as to how nature should be used or treated?

For each of the following statements please indicate the strength of your agreement: **0, don't agree at all ⇨ to 5, fully agree.**

STATEMENT THAT BEST REFLECTS HOW YOU THINK NATURE SHOULD BE USED OR TREATED:	**0 = don't agree 5 = agree strongly**					
The benefits of economic growth are outweighed by the negative consequences for the environment.	0	1	2	3	4	5
Human ingenuity will solve all problems that arise in the environment.	0	1	2	3	4	5
If 'Spaceship Earth' is not looked after properly we will exhaust our global resources soon.	0	1	2	3	4	5
We need to manage the earth's resources to ensure they continue to provide for us.	0	1	2	3	4	5
We need to develop partnerships that re-align human use of resources along environmentally sound lines	0	1	2	3	4	5
Science has failed to provide answers, people must accept that they are a part of nature without trying to control it.	0	1	2	3	4	5

2. What sort of relationship do people have with nature?

For each of the following statements please indicate the strength of your agreement:
0, don't agree at all ⇨ to 5, fully agree.

People are in control of the planet and should be able to use it for whatever purposes they see fit.	0	1	2	3	4	5
The planet's resources provide for people but must be managed according to the best science available.	0	1	2	3	4	5
There is a delicate balance between nature and people that must ensure that the planet's resources are not over-exploited.	0	1	2	3	4	5
People must manage nature to ensure that there is enough to provide for future generations.	0	1	2	3	4	5
People must expect that business should be managed to acknowledge the limitations of the natural resource.	0	1	2	3	4	5
Nature and people exist within the limits of ecological principles as an integral part of nature.	0	1	2	3	4	5

3. Who manages nature and the environment?

For each of the following statements please indicate the strength of your agreement: **0, don't agree at all ⇨ to 5, fully agree.**

People are in control of the planet and everyone can manage as they see fit.	0	1	2	3	4	5
Scientists and experts provide the best management within our democratic system of government.	0	1	2	3	4	5
Scientists and experts should manage the planet to ensure that disasters do not happen.	0	1	2	3	4	5
People must manage nature in partnerships to ensure sustainable development and use.	0	1	2	3	4	5
Business people should ensure that business operates within ecological principles.	0	1	2	3	4	5
People must develop inclusive social structures that ensure ecological principles are followed.	0	1	2	3	4	5

4. Which of these statements do you agree with?

For each of the following statements please indicate the strength of your agreement:

0 = don't agree at all ⇨ 5 = fully agree.

The earth is resilient and bountiful and people will not exhaust the environmental supply.	0	1	2	3	4	5
The market and science will help responsible government prevent people over using the earth's resources.	0	1	2	3	4	5
People are reaching the limits of what the earth will provide and environmental disasters are inevitable.	0	1	2	3	4	5
Cautious and planned use of the earth's resources will ensure environmental sustainability for the long term.	0	1	2	3	4	5
Restructuring the market economy will ensure ecological sustainability.	0	1	2	3	4	5
By thinking global and acting local we can achieve considered and rational approaches to a harmonious relationship with the land.	0	1	2	3	4	5

5. What sorts of environmental solutions are needed in this catchment?

For each of the following statements please indicate the strength of your agreement:

0 = don't agree at all ⇨ 5 = fully agree.

All Australian people have a right to deciding how environmental management should be conducted in this catchment.	0	1	2	3	4	5
Scientists and experts working with government should come up with management options for the catchment.	0	1	2	3	4	5
Information from scientists and experts should provide solutions to catchment issues.	0	1	2	3	4	5
Partnerships of local people and agency staff should manage the catchment sustainably.	0	1	2	3	4	5
Business and private enterprise in the catchment must acknowledge impact at the local level.	0	1	2	3	4	5
Local people must develop relationships with the environment that integrate traditional, local and regional approaches.	0	1	2	3	4	5

What are the three most significant environmental issues in your region/ catchment?

1.

2.

3.

Any other comments:

What are the best approaches to solving environmental issues in this catchment?

1.

2.

3.

Any other comments:

Section Six:

Some details to help us find out about our participants.

1. *Female* ☐ *Male* ☐

2. How old are you? Tick one box:

Under 15	
15 – 24	
25 – 39	
40 – 64	
65 – 79	
80 +	

3. Please give some indication of your cultural/ethnic origins. Tick the boxes that best describe you:

Born in Australia	
Born overseas	
Aboriginal or Torres Strait Islander	
Speak English only	
Speak English and another language	
Australian citizen	

4. Occupation and field of work: Please tick one box most relevant to yourself.

OCCUPATION CLASSIFICATION	TICK BOX	OCCUPATION CLASSIFICATION	TICK BOX	OCCUPATION CLASSIFICATION	TICK BOX
MANAGERS AND ADMINISTRATORS					
Generalist Managers		Specialist Managers		Farmers and Farm Managers	
PROFESSIONALS					
Science, Building & Engineering		Business and Information		Health	
Education		Social, Arts		Miscellaneous	
ASSOCIATE PROFESSIONALS					
Science, Engineering & related		Business and Administration		Managing Supervisors (Sales & Service)	
Health and Welfare		Other			
TRADESPERSONS AND RELATED WORKERS					
Mechanical Engineering		Automotive		Electrical and Electronics	
Fabrication Engineering		Skilled Agricultural		Skilled horticultural	
Construction		Food		Other trades & related workers	
ADVANCED CLERICAL AND SERVICE WORKERS					
Secretaries & personal assistants				Other advanced clerical and service workers	
INTERMEDIATE PRODUCTION AND TRANSPORT WORKERS					
Intermediate Plant Operators		Intermediate Machine Operators		Road & Rail Transport Drivers	
Other Intermediate Production and Transport workers					
ELEMENTARY CLERICAL, SALES AND SERVICE WORKERS					
Elementary Clerks		Elementary Sales Workers		Elementary Service Workers	
LABOURERS AND RELATED WORKERS					
Cleaners		Factory Labourers		Other Labourers & Related Workers	

5. Which industry do you work in most? Choose a category on this page or the following, then tick the sector.

CATEGORY OF INDUSTRY	TICK BOX	CATEGORY OF INDUSTRY	TICK BOX	CATEGORY OF INDUSTRY	TICK BOX
AGRICULTURE, FORESTRY AND FISHING					
Horticulture and Fruit Growing		Other crop Growing		Forestry and Logging	
Grain, Sheep and Beef Cattle farming		Other Livestock Farming		Hunting and Trapping	
Dairy Cattle Farming		Aquaculture		Services to Agriculture	
Poultry farming		Marine Fishing			
MINING					
Coal Mining		Mining n.e.c.		Construction Material Mining	
Metal Ore Mining		Oil and Gas extraction		Exploration & other mining services	
MANUFACTURING					
Food, Beverage and Tobacco Manufacturing		Petroleum, Coal, Chemical & Associated Products		Textile, Clothing, Footwear & Leather	
Wood and Paper Products		Metal Products		Printing, Publishing & Recorded Media	
Other manufacturing		Machinery & Equipment			
ELECTRICITY, GAS AND WATER SUPPLY					
Electricity and Gas Supply		Water supply, Sewerage & Drainage Services			
CONSTRUCTION					
General construction		Construction Trade Services			
WHOLESALE TRADE					
Farm produce wholesaling		Mineral, Metal & Chemical wholesaling		Household Goods	
Builders supplies		Machinery and Equipment		Textile, Clothing and footwear	
Motor Vehicle		Food, Drink & Tobacco		Other Wholesaling	
RETAIL TRADE					
Supermarket and Grocery		Specialised Food		Household Equipment repair services	
Department stores		Clothing & Soft Goods		Motor Vehicle Retailing	
Furniture, Houseware & Appliances		Recreational Goods		Motor Vehicle Services	
Other personal and household goods					
ACCOMMODATION, CAFES AND RESTAURANTS					
Accommodation		Pubs, Taverns & Bars		Clubs (Hospitality)	
Cafes and Restaurants					

TRANSPORT AND STORAGE					
Road Transport		Rail Transport		Services to Transport	
Water Transport		Air & Space Transport		Storage	
Other Transport					
COMMUNICATION SERVICES					
Postal and Courier Services		Telecommunications Services			
FINANCE AND INSURANCE					
Central Bank & Deposit Taking Financiers		Financial Asset Investors & Other financiers		Services to Finance and Insurance	
Insurance					
PROPERTY AND BUSINESS SERVICES					
Property operators and developers		Real Estate Agents		Computer Services	
Non-Financial Asset Investors		Machinery & Equipment Hiring & leasing		Marketing and business Management services	
Scientific Research		Technical Services		Legal & Accounting Services	
Other Business Services					
GOVERNMENT ADMINISTRATION AND DEFENCE					
Government Administration		Justice		Defence	
Foreign Government Representation					
EDUCATION					
Preschool		School		Post School	
Other					
HEALTH AND COMMUNITY SERVICES					
Hospitals and Nursing homes		Child Care Services		Medical and Dental Services	
Other Health Services		Community Care Services		Veterinary Services	
CULTURAL AND RECREATIONAL SERVICES					
Motion Picture, Radio & Television Services		Libraries, Museums and Arts		Sport	
Parks and Gardens		Arts services		Recreation (including Gambling)	
CULTURAL AND RECREATIONAL SERVICES					
Personal & Household Goods Hiring		Public Order and Safety Services		Other Personal Services	
Religious Organisations		Private Households Employing Staff		Interests groups	

Thank you for helping with this research.

Are you are interested . . .

in helping Angela with some follow up face-to-face interviews to give a more complete story about how you feel about this catchment?

Circle either of the following: **Yes** **No**

If you would like to help further or receive a brief newsletter providing summarised information on the results of this survey please complete the contact details in the front of this questionnaire. No further contact will be made.

If you need any further help
or

if you would like to make any comments please contact:

- Angela Wardell-Johnson on **0401364817**

or

- Dr Sally Rickson at Griffith University on **07 – 3875 7268**

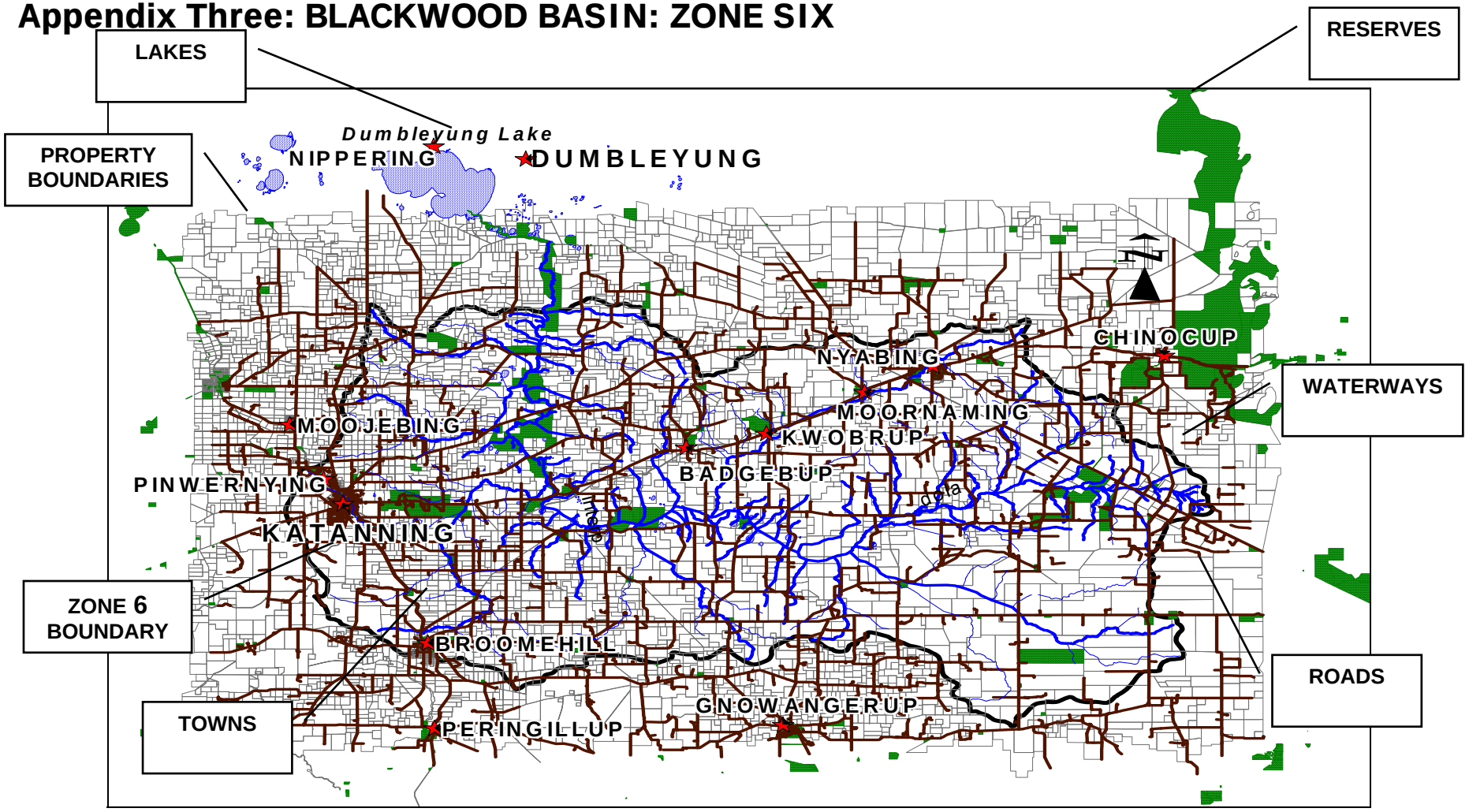
or

- Dr Malcolm Alexander at Griffith University on **07 - 38757169.**

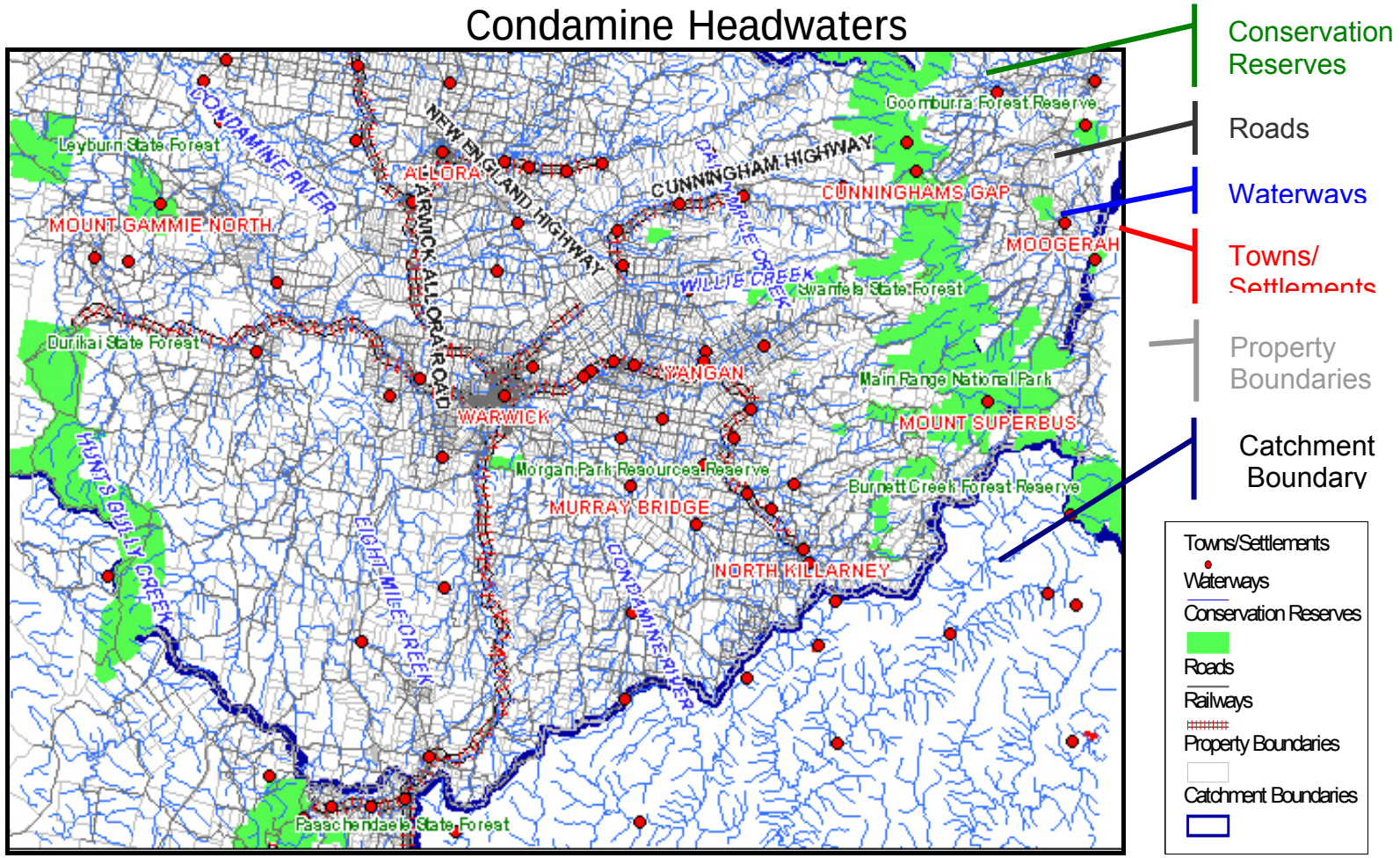
Appendix 2.1: Photograph on Katanning Zone survey front

Appendix 2.2: Photograph on Condamine Survey front

Appendix Three: BLACKWOOD BASIN: ZONE SIX

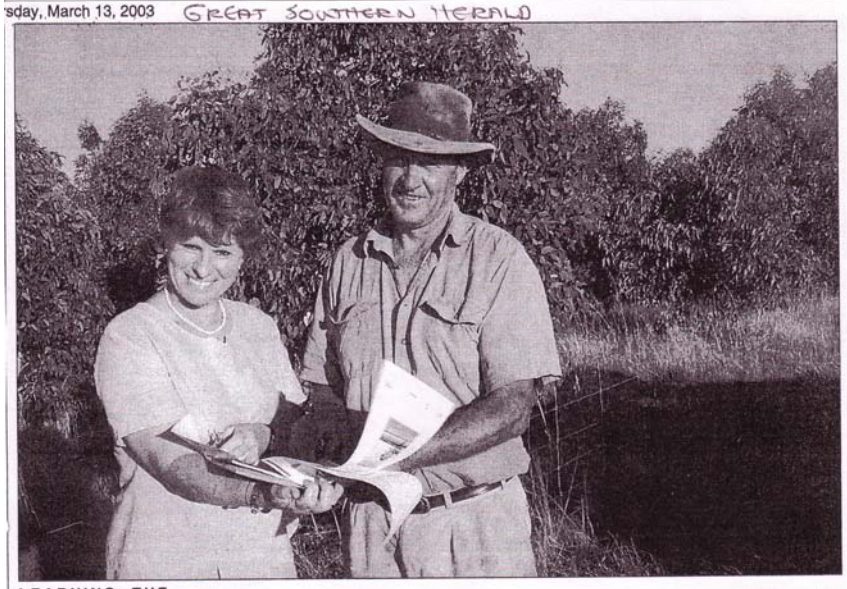


Appendix Four: GIS Map of Condamine Headwaters



Appendix Five: Newsarticles

sday, March 13, 2003 GREAT SOUTHERN HERALD



LEARNING THE LANDSCAPE: Griffith University PhD candidate Angela Wardell-Johnson is shown the land management initiatives John Shaylor has undertaken to deal with salinity on his Katanning property.

Katanning case studied

KATANNING will be a case study for a Queensland PhD thesis on the relationship communities and individuals have with their landscape.

Griffith University PhD student Angela Wardell-Johnson will be in Katanning for two weeks and will be meeting key stakeholders in the community and handing out a survey.

Mrs Wardell-Johnson will be investigating how people's attitude to their landscape will affect natural resource management.

The aim of the research is to provide a theoretical framework for tailoring environmental solutions to a community's particular social characteristics.

"I hope the study will be useful to other areas because it will provide a theoretical perspective on the kinds of social structures one has to be aware of when finding environmental solutions," Mrs Wardell-Johnson said.

"The key to environmental solutions is people."

> "It will provide a theoretical perspective on the kinds of social structures one has to be aware of when finding environmental solutions"

The study will be structured around people's relationship to a particular catchment area.

Mrs Wardell-Johnson has proposed comparing the Zone 6 Blackwood area with the catchment area at the headwaters of Condamine River at the top of the Murray Darling Basin in Queensland

The two catchment area towns of Katanning and Warwick were chosen because of their close similarities.

Both areas farm livestock and grains and the two towns have similar basic demographic profiles such as age, gender and income.

The survey will look at people's ties with the environment asking a number of questions exploring how they value their landscape.

Mrs Wardell-Johnson will return to Katanning to complete the second phase of her research during the State Landcare Conference in October.

She will conduct a number of detailed interviews with key stakeholders in the town and the study should be completed in another two years.

DAILY NEWS, SAT MAY 17 2003 WARWICK

River researcher

By David Sexton

THE Upper Condamine catchment — and what Warwick district residents think of it — is the subject of new research by a Griffith University scholar.

Angela Wardell-Johnson, a PhD student and environmental sociologist, wants to find out how people allocate different values to the landscape in which they live.

Part of her study is comparing the Condamine River Headwaters district with the Katanning area in Western Australia.

"The whole catchment and headwaters of the Murray-Darling is very beautiful and I think there is a distinct attitude because it is so beautiful," Ms Wardell-Johnson said.

"In choosing an area, I was looking for diversity in the community in terms of people and agriculture."

While her research is still in its early days, Ms Wardell-Johnson said she was struck by people's love of the area.

"It is clear people around Warwick really love where they live. It is quite inspiring," she said.

She has already visited Katanning for her West Australian research and said there were similarities with Warwick.

"Katanning is in the West Australian wheat belt.

"It is a smaller community. Its agriculture practices are not the same but close," she said.

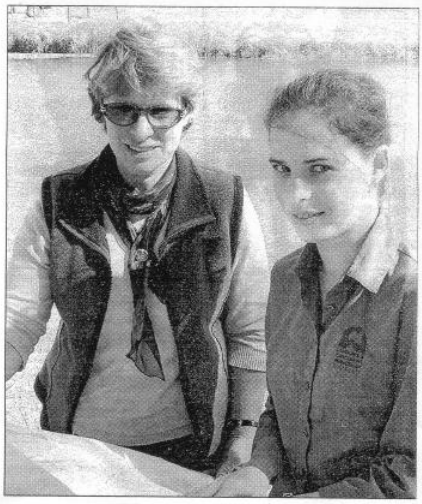
Ms Wardell-Johnson said she took a listening approach to her research.

"I let people tell me what they think," she said.

"It is very easy for people to come here and say things, but I prefer to let people tell me what problems there are or if are any problems," she said.

To collect information, Ms Wardell-Johnson is distributing a series of survey forms.

Anyone interested in contributing to the project should call Landcare co-ordinator June Brundell on 4661 2944.



River people: Researcher Angela Wardell-Johnson talks about the Condamine River with Landcare coordinator June Brundell.

GREAT SOUTHERN HERALD 21/4/04

Griffith University Phd student Angela Wardell-Johnson with Katanning Landcare manager Jill Richardson. Ms Wardell-Johnson is in Katanning conducting the second phase of her study into the town.

Community's strengths revealed

A Phd study comparing into Katanning has found the town has strong social links and support groups which gives it a good basis from which to handle potential problems.

The study by Griffith University Phd student Angela Wardell-Johnson is looking at how decisions are made on landscape management and the social make up of communities where natural resource management decisions are made.

The study compares Katanning with the Queensland town of Warwick at the headwaters of the Murray Darling Basin.

The initial results, arrived at by extensive surveying and interviewing of community members, found Katanning has an impressive amount of social capital.

Katanning was found to have strong social links at local and regional level.

"Strong social capital in a country town is social links between people that mean if you are in a crisis then you can rely on the community to help you out," Ms Wardell-Johnson said.

The study also found a high level of trust from Katanning people towards their social structures and community groups.

Ms Wardell-Johnson is back in Katanning conducting further interviews as a follow up to last year's surveys.

"The intent is to come up with ten easy questions that provide a quick insight into social structures in rural agricultural communities that might ensure a more effective implementation of solutions to environmental issues," she said.

The thesis will be completed by the end of they year and useful conclusions returned to the community through the Landcare Centre and the Blackwood Basin Group by mid 2005.

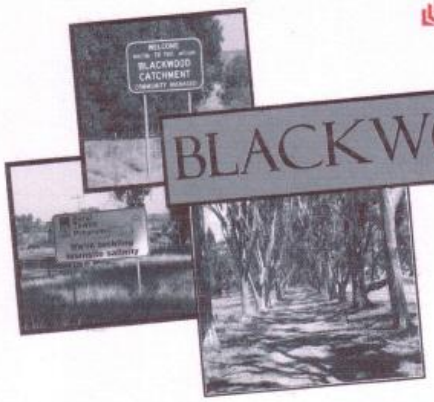
Appendix Six: Newsletters

Blackwood People in the Landscape. August 2003

Blackwood People in the Landscape: September 2004

Condamine Headwaters: People in the Landscape September 2004

ANGELA WARDELL-JOHNSON
Griffith UNIVERSITY



BLACKWOOD PEOPLE: IN THE LANDSCAPE

The First Newsletter
August 2003

LANDSCAPES VALUED DIFFERENTLY

Special thanks to the Katanning Landcare Office and the Blackwood Basin Group for sponsoring and supporting my research. I had a very memorable visit to the Katanning Zone, and learnt a huge amount from all the people I met. I was also very grateful for the very welcoming and friendly attitude from everyone I met. Thanks to all the community for welcoming me.

In the three weeks I was in WA I drove over 3000 kilometres and during the two weeks in Katanning I handed out (mostly) 95 questionnaires. This helped me get to know the catchment, the people and the landscape. I received 60 responses back, which makes a 63% response rate, considered very successful in most social science circles. Thanks to all those who responded, and to all those who helped me get in touch with participants for the study. The first round of analysis is complete and I have written a short story about what I found in this newsletter. More stories will follow as the analysis is completed.

Since I returned to Queensland, I have gone through the same process in the comparative catchment at the top of the Murray Darling Basin around Warwick in SE Queensland. This community has similar but more diverse farming practices, and less salinity, but in general the people are quite like those in the Katanning Zone. Once all the surveys are in, I will analyse them in the same way as I have done for Katanning, then do some comparisons.

An overview of the people who responded indicates a reasonable reflection of those who responded to the last government census. The two exceptions are:

- the ratio of men to women: my sample has more men than the overall average in the Katanning Zone,
- the number of ethnic and Indigenous people: this survey did not receive any responses from this sector of the community. I hope this will be remedied through a different approach when I return to interview people later in the study.

The first two charts show a breakdown of respondents and how they categorised their industry and occupation. About half the people who contributed to the survey have lived in the catchment for up to forty years.

This socio-demographic information ensured that the participants in this study adequately represent the broader community, thus providing the tools for reasonable generalisations to be made. This first step in the analysis was followed by an assessment of how the participants defined themselves as members of the Katanning Zone community.

Figure 1: Participants according to Industry

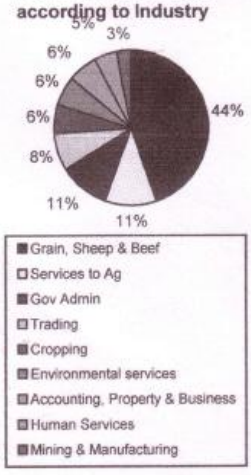
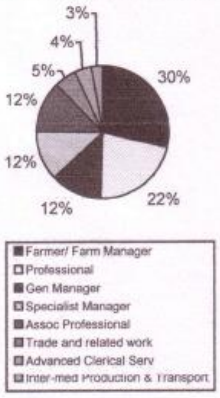


Figure 2: Participants by Occupation



INTERNATIONAL CONFERENCE HEARS ABOUT PEOPLE IN THE BLACKWOOD

Every two years the International Association for Landscape Ecology holds a congress attended by over 500 people from all over the world. In July this year the congress was held in the southern hemisphere for the first time. People from 30 countries with an impressive breadth of approaches to landscape management attended. The Association provided a scholarship that allowed me to present the story of how the people in Katanning Zone value the different elements of their landscape. The people of Katanning Zone provided a story of value contrasts between different community sectors that is recognisable all over the world.

You can read about it on the next page of this newsletter.

-◊-

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Angela Wardell-Johnson is a doctoral research student in the third year of study at Griffith University, Qld. Her research is focused on the way people value different parts of the landscape and how society supports sustained attention to environmental solutions. Questionnaires and interviews are being used to collect information to compare with a sub-catchment in the Headwaters of the Condamine River at the top of the Murray Darling Basin in Queensland. This comparison will be used to define the Katanning Zone's unique relationship with the landscape.

VALUING THE LANDSCAPES IN KATANNING

The survey looked at three different ways in which people connect to where they live:

1. The landscape values show ***Sense of Place***.
2. ***Social Capital*** is a reflection of people's relationships with one another.
3. Frameworks of environmental practice through ***Discourses of the Environment***.

A brief overview of some of the results shows that the Katanning Zone community has strong connections with place that are not based solely on material values. People have strong connections to one another expressed through family relationships and social groups. People have a holistic framing of their frameworks of environmental practice.

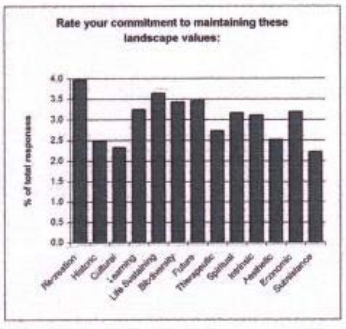
Sense of Place: How did people value different parts of the landscape?

Place provides a grounding of experience that binds people to the landscapes in which they live. This grounding comes about through the development of thought, experience and identity in these places. When value is allocated to a *space* it then becomes *place*. Place provides people with identity.

To capture the essence of values that comprise ***Sense of Place*** thirteen landscape values were used to assess the way different elements of the landscape are valued, and a person's commitment to maintaining these values. The levels of commitment show that recreation and life sustaining values are most important to the Katanning Zone community. These different values in the landscape clustered into four sets of values:

1. Recreational, historic, cultural and learning values
2. Life sustaining, biodiversity and the future
3. Therapeutic values were linked with spiritual, intrinsic and aesthetic values.
4. Economic values were linked with subsistence values.

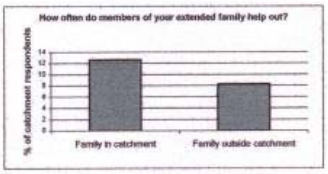
Landscape values are developed and maintained through relationships with other people. These relationships with landscapes, are formed through ***Social Capital***.



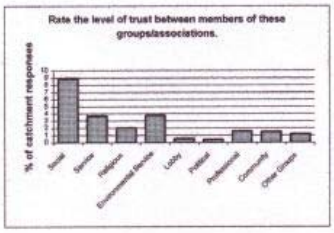
Social Capital: How do relationships between people help in building resources?
Social capital is part of a broader framework of capital that includes economic, human and natural capital. Three basic functions of social capital have been defined as:

- trust and social norms that are developed and maintained by the community;
- resources made available within family support structures;
- a broader form of support available through networks that build resources outside the immediate circle of family and close friends.

Social capital operates through formal (education, religion, government) and informal (social groups, social norms) institutions and organisations. It is recognisable through relations of trust, the activities of exchange, social norms, and connectedness of networks and groups. Strong social capital means that it is easier to get things happening and easier to keep them happening. When people talk to each other and value each other they work together more easily.



Families help each other out. This form distinct social resources. The Katanning community nominated their levels of trust in a range of social groups giving an indication of social capital. Social and Environmental Service groups are highly regarded and provide distinct support systems that form important social capital used for implementing solutions to environmental problems.
The social capital that arises out of a landscape is predictable and stable only if local values support looking after the environment. It is these values that influence, define and embed communities in their landscapes. These cultural values of the landscape are explored by finding out what sorts of assumptions and practices people have in landscape management (the ***Discourses of the Environment***).

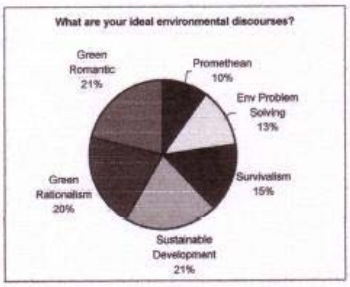


Discourses of the Environment: What do you think is normal in how you use your landscape?

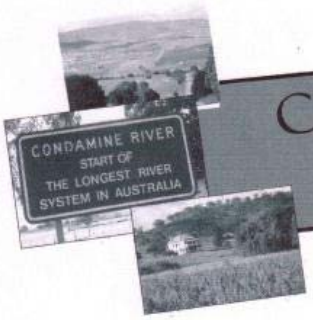
All those who make environmental decisions at the landscape level can be categorised as followers of one or other environmental discourse. Discourses are reflected by the assumptions expressed in talking about people's belief systems, daily environmental practice and ideals in managing land. These discourses include:

- ***Green Romanticism***: puts people's connection to a landscape as most important. Science only plays a limited role.
- ***Green Rationalism***: reflects a strong interconnection of people with landscapes and uses a range of solutions approaches.
- ***Sustainable Development*** recognises the need for a triple bottom line and the needs of future generations as well as other inhabitants of the earth.
- ***Survivalism*** takes the position that when the earth's resources are used up no further options will be forthcoming
- ***Environmental Problem Solving*** includes a range of approaches (participation, using science for solutions, using legislation to ensure change) to convincing people to manage land differently without changing political systems.
- ***Prometheanism*** reflects faith in the environment's capacity to endure endless resource extraction for human use and a faith in people's intelligence and capacity to solve the resulting problems at some point in the future.

The results of the survey show that about two thirds of the community feel connected and committed to the landscape. The Katanning Zone community believe they have a strong connection to the landscape in which they live (Green Romanticism and Green Rationalism). Sustainable Development discourses are also very evident and not many people take a Promethean position that assumes nature is a resource for the sole use of humans.



ANGELA WARDELL-JOHNSON
Griffith UNIVERSITY



CONDAMINE HEADWATERS: PEOPLE IN THE LANDSCAPE

The First Newsletter
August 2004

GETTING TO KNOW THE LANDSCAPES

Special thanks to the people who contributed to my research through the survey and by passing valuable information on. In the first round of field work, conducting the survey, I got to know a lot of wonderful people, and learnt a huge amount about the Headwaters.

This stands me in good stead for the next round of research which involves interviews with representatives from the distinctive groups that have been identified.

I handed out 125 questionnaires and over a six month period (with some reminders) got 65 returns. Travelling around to deliver the questionnaires helped me get to know the catchment, the people and the landscape. When including the Western Australian component, I got a 60% response rate, considered very successful in most social science circles.

Thanks to all those who responded, and to all those who helped me get in touch with participants for the study. The first round of analysis is complete and I have written a short story about what I found in this newsletter. More stories will follow as the analysis is completed.

The catchment community that participated in the Blackwood Basin in Western Australia is similar but with a stronger emphasis on wheat, canola and sheep. They named salinity as their most pressing environmental issue. In general the people are quite like those in the Condamine Headwaters.

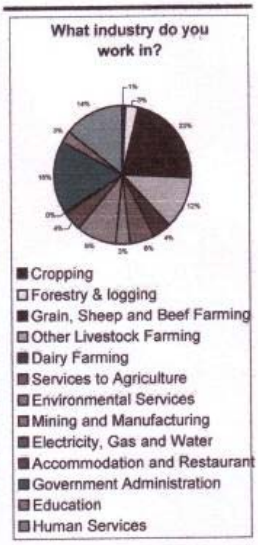
All the surveys have been analysed to provide both detail for each catchment and a comparison.

An overview of the people who responded indicates a reasonable reflection of those who responded to the last government census. The two exceptions are:

- *the ratio of men to women: my sample has more men than the overall average in the Katanning Zone,*
- *the number of ethnic and Indigenous people: this survey did not receive any responses from this sector of the community. I hope this will be remedied through a different approach when I return to interview people later in the study.*

The first two charts show a breakdown of respondents and how they categorised their industry and occupation.

This socio-demographic information ensured that the participants in this study adequately represent the broader community, thus providing the tools for reasonable generalisations to be made. This first step in the analysis was followed by an assessment of how the participants defined themselves as members of the Katanning Zone community.



INTERNATIONAL AUDIENCES HEAR ABOUT PEOPLE IN THE HEADWATERS

The Condamine Headwaters catchment community has been the focus for Angela's involvement in a number of international conferences over the past year. Results from the research currently underway have been reported to audiences ranging from farmer groups, government agencies, applied sciences and research groups. Conferences have included:

- International Association for Landscape Ecology
- Ecological Society of Australia
- The Australian Sociological Association
- The International Soils Conservation Organisation
- The International Rural Sociological Association
- CRC Plant-based Management of Dryland Salinity
- CSIRO Annual Complex Systems Science Workshop and Sustainable Ecosystems Divisional Seminar Series.

The work has been well received and will make a contribution to improved approaches to implementing solutions to Australia's environmental issues. Should members or groups in the Condamine be interested, Angela is happy to present the results of her research.

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VALUING THE LANDSCAPES IN THE HEADWATERS

The extended community associated with the landscapes of the Headwaters of the Condamine contributed to the results of this research. The basis of defining the community that contributes to decision making in this landscape ensured that a range of people that live in and are associated with this landscape participated in the study. These people included those who live and farm in the area, those who contribute to decision making through their occupations and industries, and those who benefit in some way from the resources that this landscape offers. Sixty five people devoted at least 45 minutes to completing the questionnaire, and the information they offered on themselves and how they frame their relationships to the Headwaters was analysed and is reported on here.

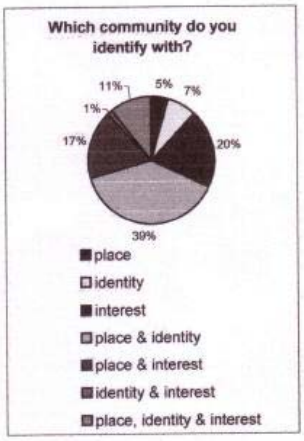


Figure 1. Piechart showing communities who participated.

The first figure shows a pie chart indicating that most people (39%) who contributed to the survey live in the catchment and have social ties that bind them to the catchment (Communities of Place and Identity).

This is followed by 20% of people . who define themselves as people who benefit from the resources of Headwaters (Communities of Interest). The third largest group (17%) comprises those who define themselves as people of place and interest, with a range of other definitions allocated to the remainder of participants.

These definitions were used along with the way in which commitment is allocated to maintaining a range of landscape values. These landscape values are based on a typology developed and tested by researchers in the US, and appears to correlate well with the results of this study. The results indicate a grouping of these values that are portrayed in the dendrogram in Figure 2.

People in the Headwaters group landscape values such as those relating to recreation, culture, historical, and learning together, and economic with biodiversity and the future form another group. Values that reflect more symbolic relationships with place such as therapeutic, intrinsic, and aesthetic elements form an explicit group.

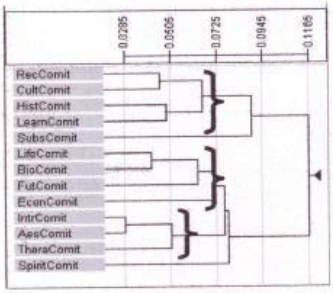


Figure 2. Clustered landscape values.

BLACKWOOD BASIN GROUP

CRC FOR PLANT-BASED MANAGEMENT OF DRYLAND SALINITY

Supporting social research in land management.

Queensland Government

Further results show that there is a contrast in the way in which different industry sectors value landscapes (shown in Figure 3). Dairy farmers have a very different way of valuing landscapes when compared to those in Grain, Sheep & Beef sector. This is related both to commitment to values and to particular values.

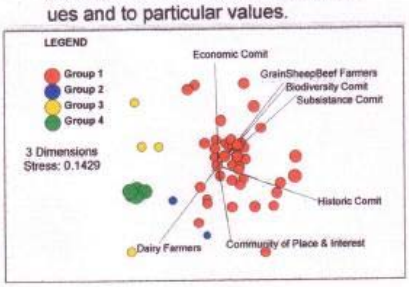


Figure 3. Sectors of the community have contrasting landscape values.

Results indicate that different sectors of the same catchment community value the landscape through different lenses. This may impact on advice given and perspectives offered. Explicit acknowledgement of these contrasts would offer the first step in cooperative approaches in landscape management. This is part of an important story on how policy can benefit from better input at the local and regional level and be more effectively adopted.

ANGELA WARDELL-JOHNSON
Griffith UNIVERSITY

BLACKWOOD PEOPLE: IN THE LANDSCAPE

Newsletter 2
September 2004

THE RESEARCH PROCESS SO FAR...

This study started in 2002 with an extensive review of the research and writing about the topic. This was followed by a period of field work in which a questionnaire based survey was conducted in Katanning Zone in February 2003. The second round of field work conducting in-depth semi-focused interviews with people in Katanning Zone took place in March and April this year, 2004.

As with previous visits, the Katanning Zone welcome was warm and the help was substantial. It felt as though I hadn't been away, and, before I knew it, I was up to date on all the events of the past year. Jill Richardson and the Katanning Landcare Office once again provided great office space and good company. The Blackwood Basin Group sponsored phone calls and other material requirements. The BBG and the Co-operative Research Centre for the Plant-based Management of Dryland Salinity both contributed to my travel costs. I enjoyed the generous hospitality and cheerful company of Angela Stuart-Street and caught up with friends and acquaintances of the previous visit.

The Interviewing

This visit entailed less travelling and more time to talk to people about how they feel about living in Blackwood Basin landscapes. The emphasis was placed on following up some of the results from the survey and hearing a little more detail. Twelve people generously gave up their time to be interviewed. These people represented clusters of people with similar responses that were identified in the first survey analysis.

The tape recorded interviews have been transcribed and, once approved as correct and appropriate by the people I interviewed, will be used in anonymous short quote form to tell the story of how people in Katanning Zone value their landscape.

Some interesting insights from the interviews...

The Triple Bottom Line

A very interesting picture has emerged that provides insights into how people negotiate the different values of the triple bottom line (social, economic and ecological components) in landscape management. In keeping with Katanning's strong social capital and commitment to the landscape, the consensus is that looking after social wellbeing is critical if the economic and ecological are to be accommodated. Keeping the social occasions and opportunities alive seems to be very important if we are to keep the economic elements functioning and maintain and improve the ecological functions.

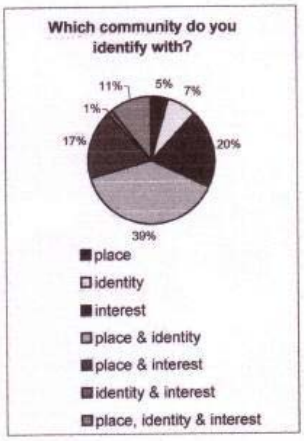
The Three Knowledges

The research shows how people allocate value to local, indigenous and scientific knowledge. As would be expected, the farming community place strong store by local knowledge which is derived through the experiences and learning by family and friends or neighbours. Local knowledge then interacts, and modifies scientific knowledge. The farming community has a strong sense that indigenous knowledge could make a big contribution to decisions in landscape management, but little is known of the extent or sources of indigenous knowledge in the local area.

The community with a greater involvement with scientific knowledge, places greater importance on that knowledge, but integration with local knowledge in land management is still not something that happens automatically.

As for how indigenous knowledge features and is used, this proved difficult to ascertain as people from the Indigenous community were not available for interview while I was in Katanning. Clearly, this is a need for future research as the insight it might provide is highly valued by the Katanning Zone community as a whole.

Once again, this community has impressed me with its commitment and thoughtful approaches to land management. There is clearly a deep commitment to looking after the place and little evidence of dismay at possible problems in the future. The past willingness to co-operate in this community seems to have ensured that people feel secure and confident in being able to keep their community and environment in a happy and productive state in the future.



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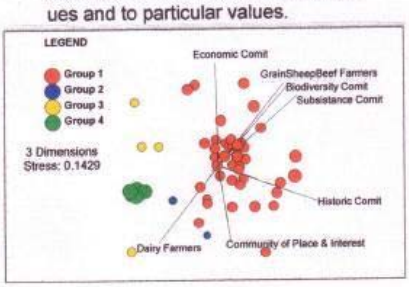
IN THE HEADWATERS

Further results show that there is a contrast in the way in which different industry sectors value landscapes (shown in Figure 3). Dairy farmers have a very different way of valuing landscapes when compared to those in Grain, Sheep & Beef sector. This is related both to commitment to values and to particular values.



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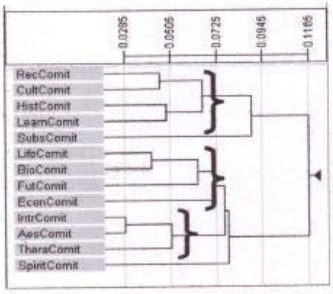

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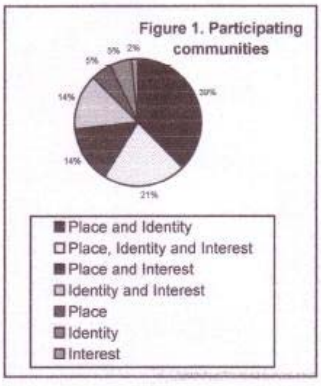
The first figure shows a pie chart indicating that most people (39%) who contributed to the survey live in the catchment and have social ties that bind them to the catchment (Communities of Place and Identity). This is followed by 21% of people who fit the first category but, in addition, define themselves as people who benefit from the resources of



(Communities of Place and Identity).

Katanning Zone (Communities of Place, Identity and Interest). The third largest group (14%) comprises those who define themselves as people of place and interest, with a range of other definitions allocated to the remainder of participants.

These definitions were used along with the way in which commitment is allocated to maintaining a range of landscape values. These values are based on a typology developed and tested by researchers in the US, and appears to correlate well with the results of this study. The results indicate a grouping of these values that are portrayed in the dendrogram in Figure 2. People in Katanning Zone group landscape values such as those relating to historical, cultural and learning together, and economic and subsistence values in another group. A larger group of values is formed by biodiversity, the future, life sustaining, therapeutic, intrinsic, aesthetic and spiritual elements.

Figure 2. Dendrogram of clustered landscape values.

Further results show that there is a contrast in the way in which different

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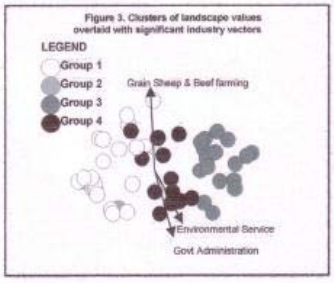
industry sectors value landscapes (shown in Figure 3). People who work in the government and environmental services sector have a very different way of valuing landscapes when compared to those in the farming sector. This is related both to commitment to values and to particular values.



Results indicate that different sectors of the same catchment community value the landscape through different lenses. This may impact on advice given and perspectives offered. Explicit acknowledgement of these contrasts would offer the first step in co-operative approaches in landscape management.

-◊-

Appendix Seven: Typology of landscape values

Katanning Zone examples of typologies:

SECTION THREE:

EXAMPLES of PLACE CATEGORIES:

A: Recreation:
All Ages Playground and Police Pools.

B: Historic:
Cobeelya

C: Cultural:
Katanning Art Gallery

D: Learning:
TAFE, Telecentre and Field Days

E: Life Sustaining:
Badgebup Reserve, Production paddocks.

F: Subsistence:
Fence posts and firewood collection places.

G: Biological Diversity:
Badgebup Reserve.

H: Intrinsic:
Your favourite walk/ride/landscape.

I: Aesthetic:
Your favourite view.

J: Spiritual:
Church, special place, patch of bushland.

K: Therapeutic:
A place that you visit to make you feel better.

L: Future:
A place that you think of as a good future, revegetation sites and other demonstration sites.

M: Economic Value:
Production paddocks, Agroforestry sites.

Condamine Headwaters: examples of typologies.

SECTION THREE:

EXAMPLES of PLACE CATEGORIES:

A: Recreation:
Morgan Park, Golf courses, The River.

B: Historic:
Glengallan, Allora townsite, Talgai.

C: Cultural:
Warwick Art Gallery, The Local Town Hall.

D: Learning:
TAFE, Total Education Centre and Field Days.

E: Life Sustaining:
Bushland, Production paddocks.

F: Subsistence:
Fence posts and firewood collection places.

G: Biological Diversity:
Goomburra Valley, remnant vegetation, Headwater reserves.

H: Intrinsic:
Water, community gathering places, favourite walk/ride/landscape.

I: Aesthetic:
Your favourite view, balanced landscapes.

J: Spiritual:
Church, special place, dams, patch of bushland.

K: Therapeutic:
A place that you visit to make you feel better.

L: Future:
A place that you think of as a good future, revegetation sites and sustainable properties.

M: Economic Value:
Production paddocks, Mediherb, John Dee.

Appendix Eight: Key Qualitative Questions and Interview Schedule

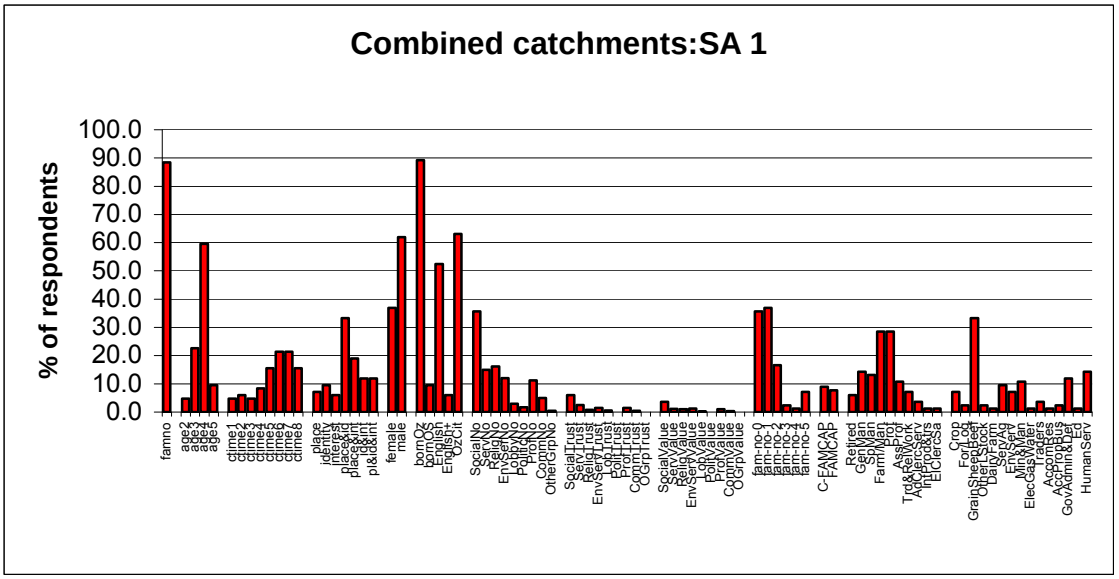
Interview Schedule: April 2004.

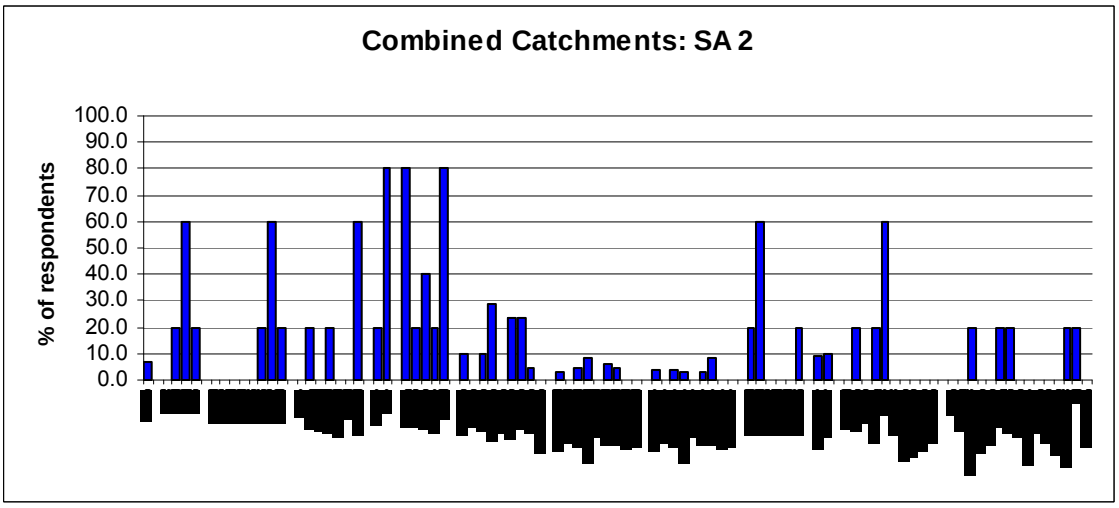
Background: this interview builds on the survey questionnaire completed in 2003.
No names will be used in the reporting of the interviews. Please provide your contact details.

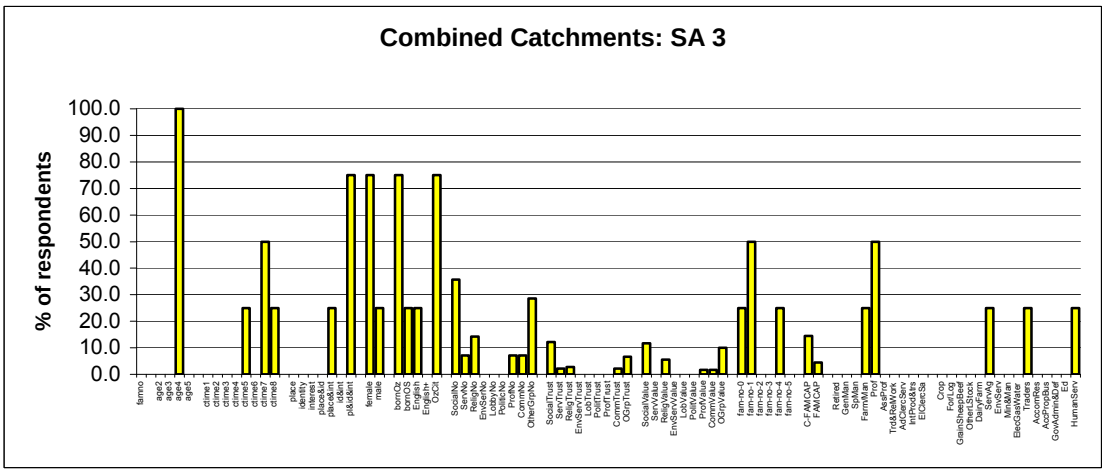
NAME							
Position/ Organisation							
Phone No.		Fax No.					
POSTAL ADDRESS							
	Post Code						
PHYSICAL ADDRESS							
EMAIL ADDRESS							

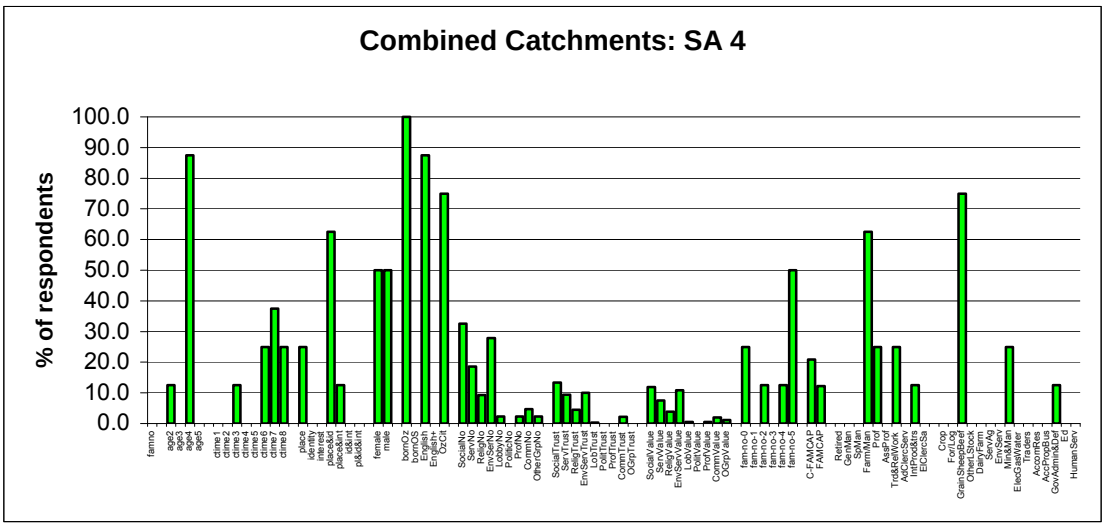
1. Did you grow up in this catchment/area?
2. Do you have members of your extended family living here?
3. What sorts of groups are you involved with?
4. Which of these are most important to you and why?
5. Tell me about a past experience that has influenced the way you make decisions today.
6. What sources of learning do you use in making decisions?
7. What do you feel about this landscape?
8. Is there any part of the landscape that is more important than others, and why?
9. What role does group membership provide in your commitment to looking after this landscape?
10. Does this also apply to other people?
11. Do you think trust between people in this community influences the way in which they think about and solve environmental problems?
12. If you think about agriculture within a triple bottom line system of ecology, economics and society, which is most important to think of first?
13. What kinds of environmental solutions have been put in place in this catchment in the past?
14. How do you think past solutions tried out in this catchment influence the kinds of approaches that might be considered in the future.
15. What do you think is the relationship between the three kinds of knowledges: local, indigenous and scientific?

Appendix Nine: Social Capital Social Assemblage Histograms








Combined Catchments: SA 4
% of respondents
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40.0
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20.0
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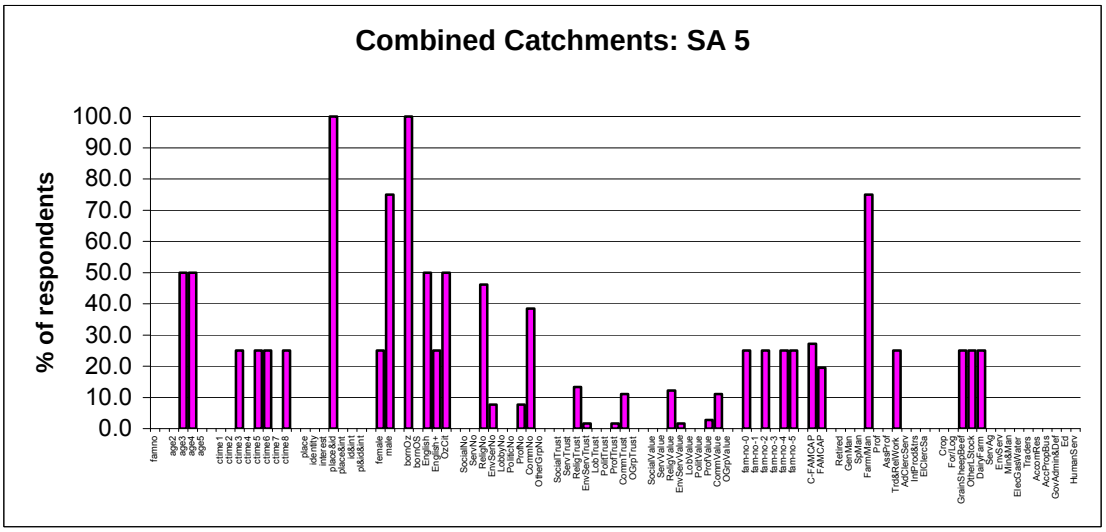
Combined Catchments: SA 5
% of respondents
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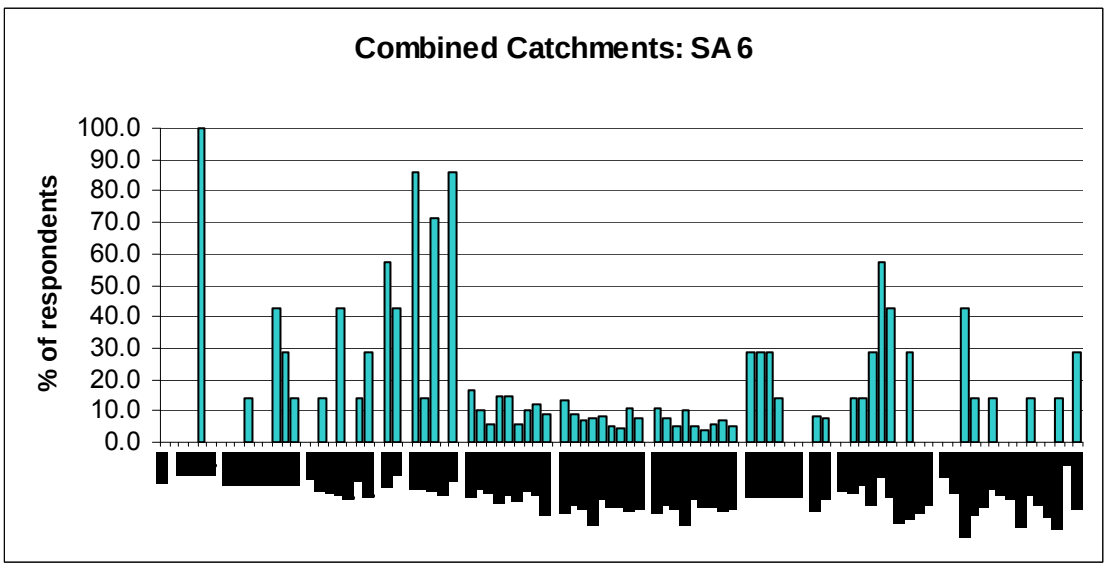
Combined Catchments: SA 6
% of respondents
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Appendix Ten: Discourses of the Environment

Social Assemblage One:

- 14% of total responses
- Katanning Zone contribute most respondents from a range of industries and occupations.
- Condamine Headwaters respondents are all grain, sheep and beef farmers between 40 and 65 years old.
- No discourse framework that sets this assemblage apart

Social Assemblage Two:

- 12%
- Katanning Zone contribute about equal respondents and show no distinctive socio-demographic or discourse characteristics but no representation from Gov Admin.
- Condamine Headwaters respondents represent a range of occupations and industries, but none from the farming sector.
- Katanning zone respondents show more affinity with Environmental Problem Solving Discourses in describing people and their relationship with nature.

Social Assemblage Three:

- 3% of total responses
- In Katanning Zone this assemblage is set apart by low Promethean scores with the exception for responses to how people use nature.

Social Assemblage Four:

- 6%
- Characterised by representing communities of Place and Identity.
- Condamine Headwaters have low scores for Environmental Problem Solving discourses and Katanning zone has no representation in Promethean discourse in relation to solutions to environmental issues.

Social Assemblage Five, **Six**, **Seven** and **Eight**:

- Less than 3% representation in each.

Social Assemblage Nine:

- 22%
- Mostly 40 to 64 years old
- Condamine Headwaters comprise most of the representatives
- Little distinguishes this assemblage from the others in relation to discourse positions.

Social Assemblage Ten:

- 12%
- Katanning zone has higher scores in Promethean discourses than do the respondents in the Condamine Headwaters, with the exception of Solutions discourse. The reverse is true for Green Romantic Discourses where Katanning Zone has a greater representation than does the Condamine.

Social Assemblage Eleven:

- 15%
- Condamine Headwaters has a higher response rate to the Green and Sustainable Development discourses than does Katanning Zone.
- range of industry and occupations in both catchments.

Social Assemblage Twelve:

- 8%
- Condamine Headwaters has lower score than Katanning Zone in Green Romantic and Survivalist discourses.
- Condamine Headwaters respondents include farmers, professionals working in forestry, grain, sheep and beef farming and government administration representing communities of place and interest.
- Katanning Zone has a range of industries and occupations with more respondents claiming to be communities of place and identity.

Social Assemblage Thirteen:

- Less than 2%.

Appendix Eleven:

Complex Systems Row Dendrogram