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Understanding the role of assigned values in natural resource management

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Abstract

Understanding community values can improve communication and ownership of decisions about the management of natural resources. However, the extent that values predict environmental behaviour is less certain. Most research has focussed on held values (values towards the environment in general). Assigned values are expressed in relation to specific natural places and our hypothesis is that they may be a better predictor of behaviour. Drawing on existing theory and findings from a case study, we develop a conceptual model of factors influencing assigned values and the role of assigned values in shaping environmental behaviour. This model builds on the widely accepted value-belief-norm theory with additional components addressing asset characteristics, socialisation processes and externally-imposed factors. An understanding of community assigned values is likely to assist decision making by regional natural resource management bodies as they move towards a more targeted approach to the investment of public funds which focuses on the most highly valued environmental assets.

Key words: assigned values, held values, environmental values, environmental behaviour, natural resource management.

Introduction

The study of human values spans fields such as psychology, social science, ecology and economics. From a socio-psychological perspective, research over the past five decades has identified and classified human values (Rokeach 1973; Schwartz 1992), examined whether similar value-types apply cross-culturally (Schwartz 1994), investigated the interaction of values with other attitudinal constructs (Nordlund &

Garvill 2002; Stern & Dietz 1994) and explored how human values change over time (Bengston 1994). Indeed, the study of values has been described as being in many ways a history of psychology itself (Reser & Bentrupperbäumer 2005). There are many general definitions of 'value', the common elements being that values are specific modes of conduct or guiding principles (Rokeach 1973; Schwartz 1994) which influence our choices and actions (Brown 1984; Braithwaite & Scott 1991) and which are relatively enduring (Brown 1984).

More recently, the study of human values from a social science perspective has been applied to the field of natural resource management (NRM) as we strive to understand place attachment (Gustafson 2001; Bricker & Kerstetter 2000), how the community values specific natural features and natural resources (Kellert 1996; Winter 2005; Curtis & Robertson 2003) and how the values of landholders might motivate their environmental behaviour (Curtis and others 2008; Winter 2005; Dietz and others 2005). In NRM, some researchers also approach 'value' from an ecological perspective via the use of rapid assessment and evaluation to assess current condition of specific natural places to guide NRM planning (Oliver and others 2005; Parkes and others 2003). Economic valuation offers another set of useful approaches to inform natural resource management. Non-market valuation techniques have developed rapidly over the past four decades and enable the exploration of how people 'trade-off' their environmental values in decision-making (Freeman 1993).

As NRM continues to bring together economics, ecology and social science in an attempt to elicit the 'value' or environmental attributes of specific natural places, the various interpretations of the term 'value' continues to cause confusion. There have been useful critiques concerning how 'value' approaches have been used in an NRM domain and some of the challenges in doing so (Reser & Bentrupperbäumer 2005; Rohan 2000; Knetsch 1994). According to Bentrupperbäumer and others (2006, p. 726), 'value' is a term that is '...genuinely struggling at this crossroads of cultures, disciplines, concerned communities, management challenges, and statutory requirements.' Further complicating the study of values in NRM is the distinction between 'value' as a social science construct and the assigning of value to specific natural sites, places or attributes (Reser & Bentrupperbäumer 2005).

The study of assigned values, the values that individuals attach to physical places, goods and services (Lockwood 1999), has been a focus of economic research over a

number of years with the non-market valuation literature rich with examples (Boxall and others 1996; Mallawaarachchi and others 2001; Blamey and others 2000; Adamowicz, 2004). While the study of values from a social science perspective has mainly focused on held values (values towards the environment in general), assigned values research is also becoming an established field as natural resource managers seek to better understand community values for specific natural places including forests (Bengston and others 1999; McIntyre and others 2008; Brown and others 2002), wildlife (Miller 2003) and rivers (Curtis and others 2001; Curtis and Robertson 2003). Assigned values are said to be more useful for examining values in relation to specific sites than are held values (McIntyre and others 2008). From a social science perspective, very few studies have examined the relationship between assigned values and behaviour, with Curtis and Robertson (2003), Curtis and others (2008) and Winter (2005) among the rare exceptions.

In attempting to explore assigned values and behaviour for specific natural places, one can draw on several widely-applied theoretical frameworks, such as Value-Belief-Norm theory (Stern et al. 1993), Cognitive Hierarchy Theory (Fulton et al. 1996; Vaske & Donnelly 1999) and the Theory of Planned Behaviour (Ajzen 1985). These theories are typically applied to environmental values and behaviour in a general sense and do not deal with the valuation of specific natural places. These theories, particularly VBN, do offer a useful way to explore the links between held values, beliefs, personal norms and behaviour. We suggest that, while these theories offer a useful basis to study assigned values for specific places, they could also include a greater number of potential influences on behaviour (such as assigned values and a range of socio-demographic factors).

An understanding of assigned values for natural places has a number of potential benefits for NRM at the regional or watershed scale. In Australia, governments have devolved considerable NRM responsibilities and actions to the regional scale, based on partnership approaches between government agencies and local communities (Robins & Dovers 2007). As governments seek better outcomes from their NRM investments throughout regions, increased attention is being given to the targeting of resources to highest priority natural assets (Auditor General 2008). Deciding which assets have 'high-value' requires the consideration of 'value' from a number of stakeholder perspectives, including the biophysical sciences, economics and social

science (Seymour et al. 2008). At present neither governments nor regional NRM bodies have robust, reliable processes for articulating and evaluating the range of community values for the environment. Improved understanding of assigned values and their influence on decision making should also improve the ability of NRM bodies to engage rural landholders and other stakeholders.

Coming from multi-disciplinary backgrounds ourselves (i.e. social science, economics and biophysical science), we bring together various perspectives to develop a model to be used as a basis for exploring the formation and expression of assigned values for specific natural places and their relationship with behaviour. We do not suggest that this model should replace existing behavioural theories. Rather, we provide a framework to further study assigned values. In doing this we:

1. Explore literature reflecting the values-behaviour relationship and the potential of assigned values to enhance understanding of that relationship, particularly for regional NRM; and
2. Draw on findings from a qualitative case study (of community values assigned to three natural assets on the Moolort Plains, Victoria) explore the factors influencing assigned values and environmental behaviour.

Held and assigned environmental values

From an NRM perspective, two distinct types of values are of interest: ‘held’ and ‘assigned’ values. Held values are said to be ideas or principles that people hold as important to them (Lockwood 1999) which are generally highly abstract, generic and conceptual, but guide action (McIntyre et al. 2008). Value orientations are clusters of held values (Stern 2000) and have been described as the position a person takes where a particular set of held values are more important to them than other held values (Axelrod 1994), although individuals can hold more than one value orientation simultaneously (Lockwood 1999). There is a large body of research regarding held values which has focussed on the deeply held principles which underlie people’s environmental beliefs, attitudes and decisions. Psychologists have described value orientations in various ways including ‘anthropocentric’ and ‘ecocentric’ (Gagnon Thompson & Barton 1994); ‘egoistic’, ‘social-altruistic’ and ‘biospheric’ (Schwartz 1992; Stern & Dietz 1994). It is said that people evaluate environmental dilemmas by expressing their value orientations or held values (Kaltenborn & Bjerke 2002); and

that much of the conflict over the environment can be attributed to basic differences in value orientations between stakeholders (Layden et al. 2003). An important distinction to make is that held values are expressed in relation to environmental concern in a general sense and are ‘not focused on specific objects or situations with which an individual has contact or experiences’ (Fulton et al. 1996, p.27).

While held values are useful for understanding people’s motivation to undertake certain environmental behaviours, in NRM we are also interested in how people perceive and assign values to specific natural places. Most definitions of assigned values draw on the paper by Brown (1984, p. 233) who suggests that when someone assigns value to an object they are ‘...*in some way expressing the importance or worth of the object relative to one or more other objects*’. In other words, assigned values deal with the valuation of natural places, attributes or phenomena, are more specific than held values in that they are ‘...uniquely appropriate to site-level evaluations’ (McIntyre et al. 2008, p. 660). Assigned values are also based on comparative judgements regarding the worth of an ‘object’ in a given context (McIntyre et al. 2008) relative to other objects. Assigned values can be expressed in either monetary or non-monetary terms, and are relevant to economic and psychology approaches.

In a social science context, assigned values have been studied using a variety of techniques, including survey approaches (Kellert 1996; Kyle et al. 2004; Curtis & Robertson 2003; Brown & Reed 2000); interviews (Bohnet & Kinjun 2009; Campbell & Smith 2006; O’Brien 2006); spatial approaches (Brown et al. 2002; Brown 2005; Brown & Raymond 2007; McIntyre et al. 2008); content analysis (Bengston et al. 1999; Bengston & Fan 1999; Webb et al. 2008); and focus groups (Jackson et al. 2008; O’Brien 2006; Racevskis & Lupi 2006). Values assigned to natural areas have been described in such ways as economic and recreation values (Curtis & Robertson 2003), ‘quality of life’ values (Bengston et al. 1999), aesthetic value (Tarrant & Cordell 2002) and therapeutic or spiritual values (Brown & Raymond 2007; Campbell & Smith 2006). The community may also value natural assets for the ecological benefits provided (Curtis & Robertson 2003) and for ‘heritage’ and ‘learning’ values (Brown and Raymond 2007). Wildlife studies report additional values relating to the experience of interacting with wildlife and feeling emotional attachment (Campbell &

Smith 2006, Miller 2003). Natural areas may also be valued for intrinsic reasons, such as valuing the environment for its own sake (Kumar & Kumar 2008).

It is hypothesised that held values (through our value orientations) have an influence on assigned value (Brown 1984; Lockwood 1999). Importantly, assigned values are considered to be less stable than held values because they are relative, not absolute and are influenced by the context in which the valuation occurred and the perceptions, preferences and held values of the individual (Brown 1984). At the same time, several studies suggest that assigned values may be better predictors of landholder environmental behaviour than are held values (Curtis & Robertson 2003; Tarrant & Cordell 2002). Researchers have also demonstrated that members of different communities can share common held values but perceive specific natural places in different ways (Stein et al. 1999).

In summary, the study of assigned values seems to offer potential to increase our understanding of community perceptions of their local landscape and to provide guidance to regional NRM managers in the relative importance of different environmental assets, and how to engage more effectively with different community types (i.e. farmers, urban, rural residents, interest groups).

Existing approaches used to explore environmental behaviour

A number of theoretical approaches have been developed and applied to explain the relationship between values and behaviour. Cognitive hierarchy theory (CHT) is based on the view that an individual's stance regarding the environment can be organised as a hierarchy of value orientations, attitudes, normative beliefs and behaviour (Vaske et al. 2001; Fulton et al. 1996). This relationship can be illustrated as an inverted pyramid where elements build upon each other and determine environmental behaviour. Value orientations, or groups of related values, have been explored in the context of forestry as a continuum of values with anthropocentric values at one extreme and biocentric values for forests at the other (Vaske et al. 2001; Steel et al. 1994; Vaske & Donnelly 1999). Value orientations are said to influence attitudes (Vaske & Donnelly 1999) and normative beliefs. The final component in CHT is behaviour, which is often measured as behavioural intention rather than actual behaviour.

The Theory of Planned Behaviour (TPB) has been one of the major models used to explore human decision-making for around 30 years (Ajzen 1985; Armitage & Christian 2003). TPB hypothesises that an individual's actual behaviour can be predicted by their intention to engage in those behaviours. Intention, in turn, is influenced by attitudes, subjective norms and beliefs about perceived behavioural control (Fielding et al. 2005). TPB requires the identification of three different types of beliefs: behavioural beliefs, perceived social pressure (normative beliefs or subjective norms) and control beliefs (how hard or easy it is to carry out the behaviour) (Beedell & Rehman 1999). According to Fielding et al. (2005), if individuals feel they have support for certain behaviour, have a positive attitude about it and think that they can easily perform the behaviour, this will lead to a strong intention to actually perform the behaviour. The TPB has been applied in a number of environmental contexts such as riparian management by landholders (Fielding et al. 2005), household recycling (Oom Do Valle et al. 2005); and water conservation (Trumbo & O'Keefe 2001). The TPB is perhaps the major approach used by social scientists to explain pro-environmental behaviour, but it does not specifically include a values component. Also, the model does not deal with the influence of socio-demographic attributes (Oom Do Valle et al. 2005).

Value-belief-norm (VBN) theory is another framework used to explain individual's motivation for environmental behaviour. VBN theory proposes a chain of elements, with one component influencing the next. These elements are values, beliefs (awareness of consequences, ascribed responsibility beliefs and general environmental concern), personal norms and behaviour. VBN theory states that an individual's value orientation biases them to select and believe in information that aligns with their values, and that they deny information that is not (Hansla et al. 2007). Early development and testing of VBN focussed on values and beliefs about environmental consequences based on three broad value orientations: biospheric (concerns about the biosphere), altruistic (concern for others) and egoistic (concern for self) and the hypothesis that pro-environmental behaviour was more likely if the individual felt there may be adverse consequences for something that they value highly (Stern et al. 1993). All three value orientations are said to contribute to pro-environmental concern under various conditions, with measures for behavioural intention able to explain this (Stern et al. 1993). VBN theory has been used to explore support for environmental

social movements (Stern et al. 1999), the influence of gender on environmental concern (Stern et al. 1993) and willingness to reduce personal car use (Nordlund & Garvill 2002). VBN, while a powerful model for exploring environmental behaviour, has been limited mainly to studies regarding specific environmental behaviours. VBN has rarely been used to explore community values for specific natural places.

All three models have useful elements for exploring environmental behaviour. However, none specifically considers assigned values, or takes into account the complexity of factors driving an individual's decisions regarding their use of specific natural resources or support for such places to be actively managed. VBN theory, however, seems to offer a comprehensive model for exploring the links between values, beliefs and norms, which we propose are a crucial influence on the formation of assigned values, and ultimately behaviour, regarding specific assets. VBN offers a simple and useful way to categorise held values and beliefs into egoistic, altruistic and biospheric clusters. Further strengths of VBN include that the methodological issues in applying it are well-covered in the literature.

While the existing behavioural models could be adapted to include assigned values, we have taken elements from these models (particularly VBN theory) and added other factors expected to influence the formation of assigned values, and ultimately, environmental behaviour regarding specific natural assets. Drawing on the existing literature and our findings from a case study, we propose a model that offers a basis for exploring the formation of assigned values and the relative influence of assigned values in predicting environmental behaviour in a subsequent quantitative study. In the next sections we introduce a case study to inform the development of such a model, and explore the proposed components of this model.

The Moolort Plains case study

Background

A qualitative scoping study was undertaken to identify the range of values assigned to three natural assets across a range of community types. The scoping study also aimed to identify the factors potentially influencing assigned value expression, thus informing the development of both an assigned values model and a survey instrument to comprehensively test such a model. The scoping study was conducted in the Moolort Plains area of North Central Victoria (Loddon Catchment). The study area is

a very diverse landscape in that within a 30 km radius there is commercial cropping and grazing land, small rural ‘lifestyle’ blocks, large areas of public land (box-ironbark forests), a series of wetlands, the Loddon River, two large urban towns and a number of small rural centres [see Figure 1]. The district has been extensively cleared for agriculture and extensive gold mining occurred in large portions of the study area during the Gold Rush of the 1850s.

Figure 1 here

The close proximity of three natural assets (the Moolort wetlands, the mid-upper Loddon River and box-ironbark forests) made the Moolort Plains a standout study area. The Moolort wetlands are a chain of red gum wetlands and freshwater meadows located across a basalt plain between the townships of Castlemaine and Maryborough. These wetlands occur on largely private land with some being used for grazing areas, while others are fenced and protected from stock access. The mid-upper Loddon River extends between the small towns of Vaughan Springs and Baringhup and supports a number of threatened flora and fauna. It is under threat from weeds, stock access and water extraction (Matthew et al. 2008). The Loddon River frontage occurs on private and public land. Buloke Grassy Woodlands are an endangered ecological community consisting of Buloke (*Allocasuarina luehmannii*), Slender Cypress Pine and Grey Box. This asset was once widespread but is now largely cleared and is only present as scattered remnants on roadsides and private property.

Data collection

Semi-structured interviews were held with 17 community members. Interviewees were purposively selected (Sarantakos 2005), aiming for adequate coverage across the three assets and across the three types of NRM communities identified by Harrington et al. (2008) including ‘communities of locality’ (urban and rural centres), ‘communities of practice’ (in this case NRM professionals and farmers); and a ‘community of interest’ (Field Naturalist group members). The interview sample included nine males and eight females. Most interviewees (12) had lived in the area for longer than ten years. Seven of the 17 participants were farmers, three of whom owned small properties and were part-time farmers. Property size varied from 10 ha to 1,400 ha. These seventeen interviews were considered sufficient to provide the

information needed for the development of a model that, in turn, would be used as the conceptual framework to guide the subsequent quantitative study.

Semi-structured interviews were a useful method for exploring interviewee perceptions of 'value' regarding the three assets. The semi-structured format involved the interviewee responding to a series of broad questions and allowed for probing of further information (Bryman 2004). Each interviewee was asked about one of the three natural assets. The questions were similar for each asset to enable the value descriptions of interviewees to be fully explored through their own narratives and stories (O'Brien 2006). For example the questions about the river were:

- 1) Are you interested in the local environment and, if yes, what developed this interest?
- 2) Is the Loddon River important to you?
- 3) What is it about the river that has value for you?

Demographic information was also collected (gender, occupation, residency status, membership of Landcare (an environmentally oriented community group)) given previous findings that there can be significant differences in the values and attitudes of rural landholders depending on these variables (Curtis & De Lacy 1998; Curtis & Robertson 2003).

Interviews were tape-recorded and later transcribed. Following the guidelines of Poland (2002) interviews were carefully transcribed to reduce potential sources of error. Open coding was used as a starting point to search for concepts in the data (Sarantakos 2005). Common and outlying themes were developed using a 'mind-mapping' process. Assigned value descriptions were revealed through the informants' use of words. A number of clear thematic categories emerged based on broad categories of assigned values. Finally, inductive thematic analysis was used to explore the factors or variables that influence assigned value formation. These emerging themes included socialisation processes, economic factors, occupation, interaction with government departments and location of respondents in relation to the assets.

Findings

The case study provided some useful insights into the wide range of values assigned to the three natural assets in the study area. The categories generated from

interviewees' comments are similar to those identified in other studies (Satterfield 2001; Brown & Raymond 2007). Table 1 provides a summary of the values assigned to the three assets by the interview participants.

Table 1 here

The widest range of values was assigned to the Loddon River, with specific values spanning economic, social and environmental values [Table 1]. The Loddon River had the additional values of 'therapeutic' (i.e. the river is peaceful or provides a spiritual benefit), 'community value' (the river provides a place for the community to gather) and 'value to future generations'. The value of Buloke Grassy Woodlands regarding ecological functions was a widely held value across participants. Farmers also valued Buloke Grassy Woodlands for economic reasons (e.g. used for grazing and stock shelter). The Moolort wetlands were valued by most interviewees for their ecological, recreation (nature study) and life-sustaining values. Few participants (only a few individuals) discussed intrinsic or existence value in relation to any of the three assets in the study. Differences between the different community-types will be explored in more detail in the follow-up quantitative study.

The in-depth interviews also enabled exploration of why, and in what circumstances, these values were assigned, thus informing the development of the assigned values model. These influencing factors are described below.

Socialisation processes

The literature suggests a range of social and demographic factors which have been found to influence values assigned to natural assets, including gender and age (Brown & Reed 2000; Tarrant & Cordell 2002; Bohnet & Kinjun 2009); place and length of residence (Tarrant & Cordell 2002; Brown & Raymond 2007); and environmental group membership (Miller 2003).

The Moolort study also provided some indications that various socialisation processes in an individual's life can influence how they perceive or value nature. Family upbringing and childhood experiences seemed to be factors in shaping values assigned to the assets, as evidenced in these quotes from a Field Naturalist and a farmer:

We lived on the edge of the bush and my aunt would take me for walks and show me all different things. So my interest just grew and grew and all I wanted to do was protect things [Field Naturalist 1]; and

We had a teacher who would take us on excursions into the forest and show us all the ecology and stuff [Farmer 2].

The assigned values of those who discussed family as influencing their environmental interest were largely based around life-sustaining value, biological diversity and aesthetic value.

Membership of environmental groups, such as Landcare, may also influence assigned values and environmental behaviour (Curtis & de Lacy 1998). In the Moolort study, Landcare membership had an influence on knowledge and assigned values. For example:

New land owners come to the group [Landcare] for guidance and because they want to plant trees, but through doing that they get an appreciation for the importance of what they've already got [on their property] [Farmer 4].

As shown by Curtis et al. (2008), occupation may also influence assigned values. The Moolort study found that farmers assigned a wider range of values to wetlands than non-farmers. For example, although both occupational groupings gave a high rating to the biological diversity and learning values of wetlands, farmers also valued them for their economic, aesthetic and existence values. Residency may also be important, with the interviews providing some indication that shorter-term residents of the district (residents for less than 10 years) may place greater emphasis on the environmental values of the three assets rather than economic values.

Held values, beliefs, norms

The relationship between held values, beliefs, norms and behaviour has been a major focus of research using VBN theory (Stern et al. 1993, Stern & Dietz 1994). Because values are abstract concepts that transcend situations, they are less likely to have a direct influence on behaviour (Nordlund & Garvill 2002). It is thought that the relationship between values and behaviour is mediated by various types of beliefs and personal norms. Beliefs about the consequences of environmental conditions, in combination with held values, have been found to explain much of the variation in environmental attitudes in a study conducted by Stern et al. (1995). Nordlund and Garvill (2002) suggest (based on Schwartz's norm-activation theory, Schwartz 1977) that personal norms become activated when the individual perceives environmental conditions threatening something that they value.

It is thought that held values are likely to influence assigned values (Lockwood 1999). Utilising the held value categories from VBN theory (egoistic, altruistic and biospheric values), we explored the held values of Moolort case-study interviewees. A key finding was that the individuals who shared the same held values often assigned very different values to a specific asset. For example, four interviewees who all had similar biospheric held values assigned quite different values for Buloke Grassy Woodlands. While all four interviewees valued the vegetation for ‘biological diversity’, one interviewee also valued it for recreation and learning, another interviewee for economic and aesthetic values. Three people who were interviewed about the Moolort wetlands seemed to have strong social-altruistic values and all three assigned importance to the learning value of wetlands. However, each respondent also expressed assigned values across a number of categories. For example, one wetland interviewee highlighted the importance of historical value, another interviewee discussed economic value while a third interviewee emphasised the social value of attractiveness. These data suggest that held values may not be a good predictor of assigned values.

Norms (Godin et al. 2005) are also likely to play an important role in the formation of assigned values and behaviour. The following quote from a farmer in the Moolort study reveal how a personal norm can influence environmental behaviour:

I just thought it was the best thing to do [preserving the grassland] ... I thought it was best to keep what had naturally been there for thousands of years [Farmer 1].

Asset characteristics

As highlighted in the choice modelling literature, the characteristics of the asset itself is likely to have a major bearing on assigned values. One such characteristic is the location of the asset and its proximity in relation to the valuer. For example, in the Moolort case study, landholders who had the natural asset on their land assigned a much wider range of values (including additional economic values) to that asset than those living further away. According to Brown et al. (2002, p. 54) ‘physical distance can influence the intensity of value judgements’.

The case-study data also suggest that land tenure may be another factor influencing assigned values, as demonstrated in this quote from a Field Naturalist:

We don't really know much about the Moolort Plains [vegetation] apart from the roadsides because the rest of it [grassy woodland] is largely on private property. We don't go on private property unless we are invited [Field Naturalist 2].

It could be hypothesised that natural assets on public land (such as the Loddon River) are easier for the community to access, thus increasing their familiarity with the asset and resulting in people assigning a much wider range of values to that asset. In the Moolort interviews, people were more likely to place more abstract and biospheric values on natural assets on private land with no public access (such as the Moolort wetlands), perhaps because they had no direct contact with the asset. For example, three residents of small rural towns valued the Moolort wetlands for biological functions, life sustaining value and existence value.

Knowledge and perceptions

According to Pannell et al. (2006, p. 1409), an individual's 'knowledge' can take a number of forms including 'scientific information, personal experience, and cultural influences'. Knowledge is continually modified as new information comes to hand. Information regarding the benefits of sustainable management of an asset is perhaps the most influential type of knowledge on behaviour (Munro & Moore 2005; Pannell et al. 2006).

Knowledge, information and perceptions all have a likely role in influencing assigned value formation and behaviour regarding an asset, provided that the person can relate directly to that knowledge or has sought the information for their own utilitarian purposes (Trumbo & O'Keefe 2001). While the 'values, beliefs and norms' component was based on 'how things should be', knowledge and perceptions are based on how individuals perceive things as they *actually* are. For example, a number of farmers on the Moolort Plains have attempted to establish new plantings of Bulokes on their properties in response to some research findings that alarmed them:

We found out that 50% of the 1996 population of Bulokes was gone. So that was fairly sobering for me and a lot of other landholders [Farmer 1].

The community having involvement in basic awareness-raising activities can also change their perception and values assigned to certain places, as evidenced in this quote:

The environment around here is a subtle landscape to interpret. Unless you've been introduced to them [the Moolort wetlands] through some awareness activity, most people wouldn't know that they are quite important swamps [Rural Centre Resident 2].

External factors

Economic conditions are one external factor influencing assigned values and behaviour. According to Axelrod (1994) economic factors are likely to 'influence many, if not all, issue-oriented social behavioural decisions'. Curtis & Robertson (2003) found that lower adoption of sustainable practices for managing river frontages was linked to lower on-property income and to the higher economic importance assigned to river frontages by landholders. Case-study data suggested that the need to make a living from the land whilst also wanting to preserve it created a tension among the farmer participants. For example:

The price for cropping land was such that some [farmers] were removing Bulokes... we have to make a living [Farmer 4].

The availability of off-farm income influenced the behaviour of a number of the case-study participants. One participant had been able to carry out works on the Loddon River frontage because she was able to 'still earn an income from the city'.

The case study revealed that while farmers valued wetlands for aesthetic, biological diversity and intrinsic reasons, the on-going drought (another external factor) meant that some farmers were unable to protect these areas and felt they had to utilise them for grazing. For example:

We locked up the swamps but as the 'big dry' came along all of a sudden we had to put them back into agriculture on a short-term basis. I know a few farmers who have had to put their sheep back onto the swamps [Farmer 4].

In order to integrate the findings from this case study with existing behavioural models (described earlier), and other literature, we have developed a preliminary model to explain the formation of assigned values and their influence on environmental behaviour regarding specific natural assets [Figure 2].

Figure 2 here

Assigned values towards specific natural assets are at the centre of the model proposed in Figure 2. This model draws heavily upon the established literature (particularly VBN theory) and has been refined as a result of findings from the Moolort study. The model suggests that assigned values are influenced by a complex series of interactions between held values, beliefs about the consequences of environmental conditions and personal norms. This hypothesis aligns closely with the findings of Stern et al. (1995) who suggested that held values and beliefs about environmental consequences can account for much of the variation in environmental attitudes (Stern et al. 1995). In Figure 2, the dashed arrow connecting held values and beliefs represents the expected correlations between these two components of the model. Personal norms, as suggested by Nordlund and Garvill (2002), are likely to have a mediating effect between values and behaviour. Figure 2 also represents the influence of socialisation processes on the formation of held values and beliefs. Such socialisation processes include childhood experiences and involvement in environmental groups. The characteristics of the asset itself, including the proximity of the valuer to the asset in question, are also likely to influence assigned values, as are knowledge and, to a lesser extent, externally-imposed factors such as economic conditions, drought and the availability of financial incentives. The right hand side of Figure 2 illustrates the influence of assigned values on environmental behaviour regarding the specific asset in question. The model reflects our hypothesis that assigned values are likely to be a better predictor of environmental behaviour than are held values, as demonstrated in the Moolort interviews. The components relating to knowledge and external factors are likely to influence both assigned value formation and behaviour.

Conclusion

An understanding of the values that landholders and the wider rural community assign to natural assets can help regional NRM bodies decide which assets should receive highest priority for investment in conservation works, how best to engage landholders and which policy tools to use to improve asset management on private land. In Australia, regional NRM bodies are starting to collect social data to inform investment decision-making and prioritisation of resources (Seymour and others 2008). It would seem useful to provide some theoretical guidance to underpin such approaches.

The Moolort study has provided a useful insight (from a social science perspective) into the range of values assigned to natural assets and the factors which may potentially influence assigned-value expression. Interview participants expressed a wide range of values (spanning across environmental, economic and social themes) regarding the three natural assets in the study. The vegetation asset, Buloke Grassy Woodland, was valued mostly for its ecological functions with economic value also important from a farmer perspective. Ecological and life sustaining values were considered to be important features of the Moolort wetlands. The widest range of values was reported for the Loddon River, which may be the asset with which most of the interviewees interact, and included the additional 'therapeutic' and 'community' values which weren't mentioned for the other assets. Further to this, interviewees with similar held values regarding the environment in general often expressed very different assigned values suggesting that held values may not necessarily predict assigned values.

The study has also provided indications that assigned values are influenced by various socialisation factors including family upbringing, membership of environmental groups, number of years of residency in the district and occupation. Additionally, the proximity of the interviewee to the asset and external factors such as economic conditions and drought are likely to influence assigned value expression. Many of these factors are not considered by existing models of environmental behaviour. It seems that a complex interaction between values, beliefs and norms (as set out in VBN theory) is also likely to influence assigned values and, in turn, environmental behaviour. Such relationships in the assigned values model are being tested in a larger quantitative study to be reported in future papers.

To conclude, building on existing theory (VBN theory), the literature and findings from a qualitative study, we have proposed a model to examine the factors that potentially influence assigned value formation and behaviour. While there has been a research focus on understanding community assigned values for natural places in an NRM context, less is known about the factors which might influence assigned value expression and the predictive power of such values for understanding environmental behaviour. The assigned values model will provide a basis for examining these relationships and for providing insights regarding the usefulness of assigned value studies in an NRM decision-making context.

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Figure 1 Location of study area

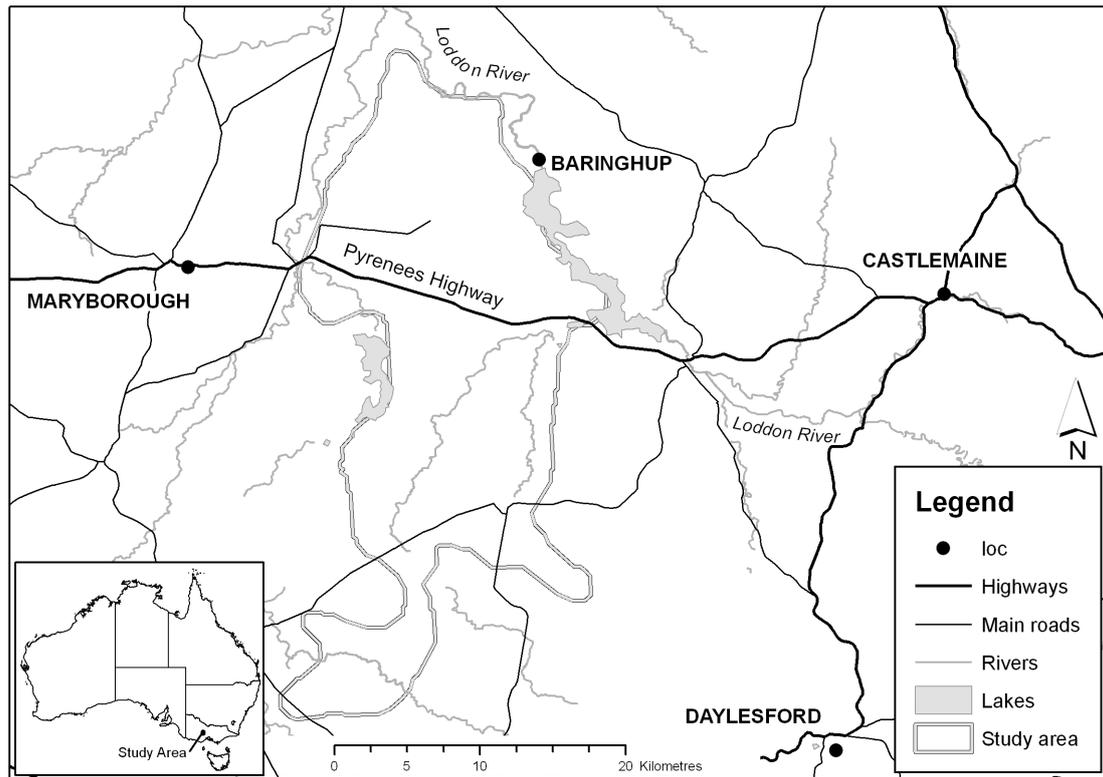


Figure 2 Assigned values model

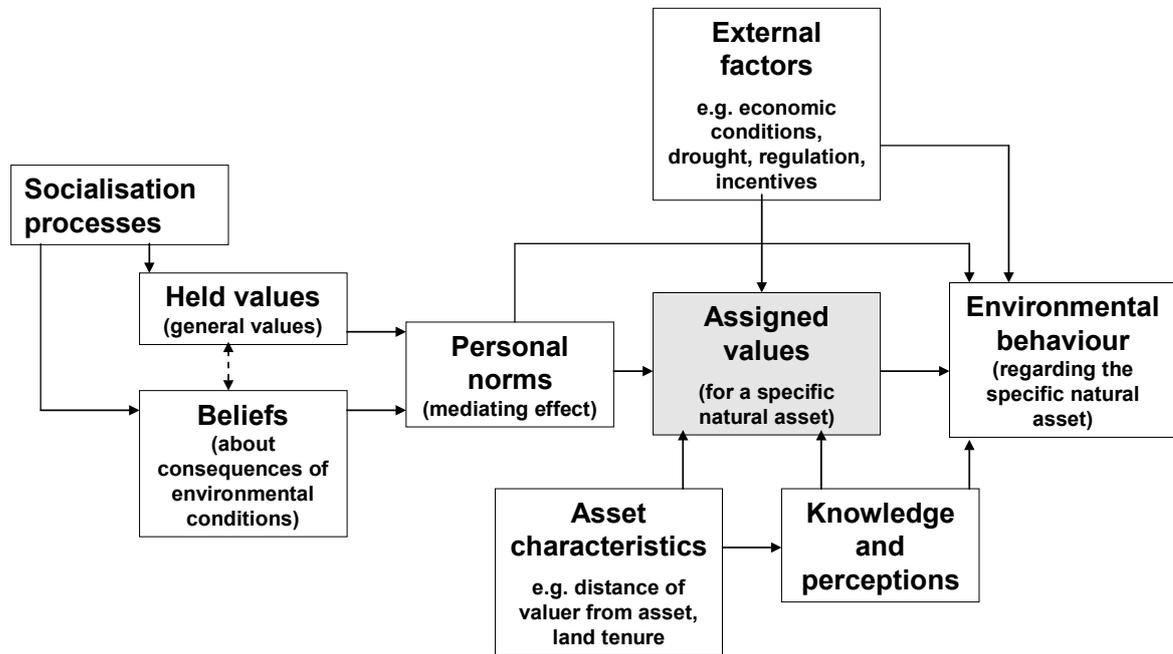


Table 1 Values assigned to three natural assets on the Moolort Plains, Victoria

Moolort wetlands	Buloke Grassy Woodland	Loddon River
Biological diversity	Biological diversity	Biological diversity
Life sustaining value	Life sustaining value	Life sustaining value
Learning value	Learning value	-
Recreation value	Recreation value	Recreation value
Economic value	Economic value	Economic value
Aesthetic value	Aesthetic value	Aesthetic value
Historical value	Historical value	Historical value
Existence value	Existence value	Existence value
-	-	Therapeutic value
-	-	Community value
-	-	Value to future generations