Journal of Environmental Psychology 31 (2011) 323–335

Contents lists available at SciVerse ScienceDirect

Journal of Environmental Psychology

journal homepage: www.elsevier.com/locate/jep

The influence of place attachment, and moral and normative concerns on the conservation of native vegetation: A test of two behavioural models

Christopher M. Raymond[a,*], Gregory Brown[b], Guy M. Robinson[c]

[a] Centre for Rural Health and Community Development, University of South Australia and Enviroconnect Pty Ltd, PO Box 190, Stirling, SA 5152, Australia
[b] School of Geography, Planning and Environmental Management, University of Queensland, St. Lucia Campus, Brisbane, QLD 4072, Australia
[c] Centre for Rural Health and Community Development, University of South Australia, 111 Nicolson Avenue, Whyalla Norrie, SA 5608, Australia

ARTICLE INFO

Article history:
Available online 26 August 2011

Keywords:
Place attachment
VBN theory
Human values
Environmental concern
Normative beliefs
Pro-environmental behaviour

ABSTRACT

This study examines the influence of place attachment, values, beliefs and personal norms about environmental action on the conservation of native vegetation in two primary production settings in South Australia. We use regression and multiple mediation analyses to test a base model of pro-environmental behaviour which includes variables from value-belief-norm (VBN) theory and then compare it to an expanded model which includes the same variables and five dimensions of place attachment. The expanded model including place attachment explained up to twice the amount of variance in native vegetation planting than the base model when controlling for all variables preceding behaviour, but the overall explanatory power was low (<22%). Place attachment had a stronger influence on the antecedents of behaviour compared with the behaviour itself, particularly nature bonding which was a significant moderate predictor of both personal norms and awareness of consequences in the two study regions. We assert that place attachment has statistically significant direct and indirect effects on variables included in VBN theory. Future studies may reveal stronger effects in settings where there are fewer resource and monetary costs associated with pro-environmental behaviour.

1. Introduction

Globally, government agencies have invested billions of dollars into schemes which encourage landholders to conserve native vegetation, among other natural resources, in return for a farm payment. Since 1992, the European Common Agricultural Policy (CAP) has required member states to implement agri-environmental programs, which has resulted in policies that lead to biodiversity conservation and farm income support (Buller, Wilson, & Höll, 2000; Wilson & Hart, 2000). In the United States, the Grassland Reserve Program and the Conservation Security Program emphasise the importance of preventing the loss of wildlife and habitat, as well as the preservation of soil resources (Baylis, Peplow, Rausser, & Simon, 2008). Australian farmers have been heavily dependent upon devolved grant schemes and market-based instruments in order to implement specific conservation measures, such as *BushBids* that support improved primary productivity and biodiversity conservation (Lockwood, Davidson, Curtis, Stratford, & Griffith, 2009). However, such schemes have been criticised for not delivering long-term behavioural change. Researchers have found little evidence in Austria (Schmitzberger et al., 2005), Finland (Herzon & Mikk, 2007), the Netherlands (Kleijn, Berendse, Smit, & Gilissen, 2001) and the United Kingdom (Feehan, Gillmor, & Culleton, 2005; MacDonald & Johnson, 2000) that farmers long-term attitudes and behaviours have changed to support conservation efforts despite almost two decades of scheme implementation. Similar concerns have been raised about the effectiveness of government investment in natural resource management (NRM) programs in Australia (Australian National Audit Office, 2008). Thus, one important question is how to encourage enduring on-farm pro-environmental behaviour which is less reliant on government funding. A key objective of this research is to better understand and describe the influence of non-monetary factors on farming decisions, including moral and normative factors.

Value-belief-norm (VBN) theory provides a theoretical basis for understanding how values and moral norms influence pro-environmental behaviour (Stern, Dietz, Abel, Guagnano, & Kalof, 1999). The theory holds that environmental behaviour results from personal norms (PN) about pro-environmental action, and that these are activated in individuals who believe the environmental conditions will have adverse consequences on valued objects (AC)

* Corresponding author. Tel.: +61 423 299 986; fax: +61 8 8303 8590.
E-mail addresses: chris.raymond@enviroconnect.com.au (C.M. Raymond), greg.brown@uq.edu.au (G. Brown), guy.robinson@unisa.edu.au (G.M. Robinson). .

0272-4944/$ – see front matter © 2011 Elsevier Ltd. All rights reserved.
doi:10.1016/j.jenvp.2011.08.006

and that their action will avert the consequence (ascription of responsibility, AR). These behaviour-specific beliefs are in turn influenced by general beliefs on human–environment interactions, as expressed in the New Ecological Paradigm (NEP) scale (Dunlap & Van Liere, 1978; Dunlap, Van Liere, Mertig & Jones, 2000) and by human value orientations (Schwartz, 1994). However, VBN theory does not consider the affective determinants of pro-environmental behaviour. Affect is particularly important in many rural agricultural contexts where farms have been owned by families for multiple generations, contributing towards the development of strong attachments to land and nature (Bieling & Plieninger, 2003; Seabrook, McAlpine, Fensham, 2008; Willock et al., 1999).

Dietz, Fitzgerald, and Shwom (2005) also encourage research on the relationships among values, identity and emotions, and Steg and Vlek (2009) urge a theory-driven understanding of the role of affect on pro-environmental behaviour. One affective construct is place attachment, defined here as the positive bonds which develop between an individual and a geographic locale (Altman & Low, 1992). 'Sense of place' researchers have examined the univariate relationships between place attachment and pro-environmental behaviour in recreation and leisure settings (e.g., Stedman, 2002; Vaske and Kobrin, 2001), but few studies have considered them in primary production settings where there are substantial costs associated with conservation efforts. Further, we are not aware of any studies which have considered the multivariate relationships among multiple dimensions of place attachment and some of the variables theorised to form part of the VBN causal chain, including human values, AC, PN and self-reported pro-environmental behaviour.

In this study, we examine the influence of place attachment on a model of pro-environmental behaviour including variables from VBN theory and a measure of on-farm native vegetation planting by rural landholders in South Australia. To address this aim, we develop and test a base model of pro-environmental behaviour which includes VBN theory variables utilised in data collected from the South Australian Murray-Darling Basin (SAMDB) and Northern and Yorke regions and then compare it with an expanded model which includes these variables and place attachment. We use hierarchical linear regression and mediation analyses to identify the direct and indirect effects of human values, AC and PN on intentions to plant and self-reported planting of native vegetation on private farmland, as well as variables preceding behaviour within the base model causal chain. We then use linear regression and multiple mediation analyses to identify where place attachment is best situated in an expanded model. Finally, we compare the explanatory power of the base and expanded models and discuss the implications of the results for environmental policy and theories of pro-environmental behaviour.

1.1. Applying a behavioural model including variables from VBN theory to the conservation of native vegetation on private farmland

VBN theory links values theory, ecological worldview (NEP) and the norm activation model (NAM) of behaviour. Whilst some studies offer support for the validity and reliability of the causal chain (e.g., Black, Stern, & Elworth, 1985; Steg, Dreijerink, & Abrahamse, 2005; Stern, Dietz, & Guagnano, 1995; Stern, Dietz, Kalof, & Guagnano, 1995), the structure of and relationships between variables within the causal chain has been intensely scrutinised in recent years. We discuss some of the major developments in the theory below and use them to justify our base model of pro-environmental behaviour.

Our base model of pro-environmental behaviour includes VBN theory variables, with some important modifications (Fig. 1). We employ a three-dimensional framework of environmentally

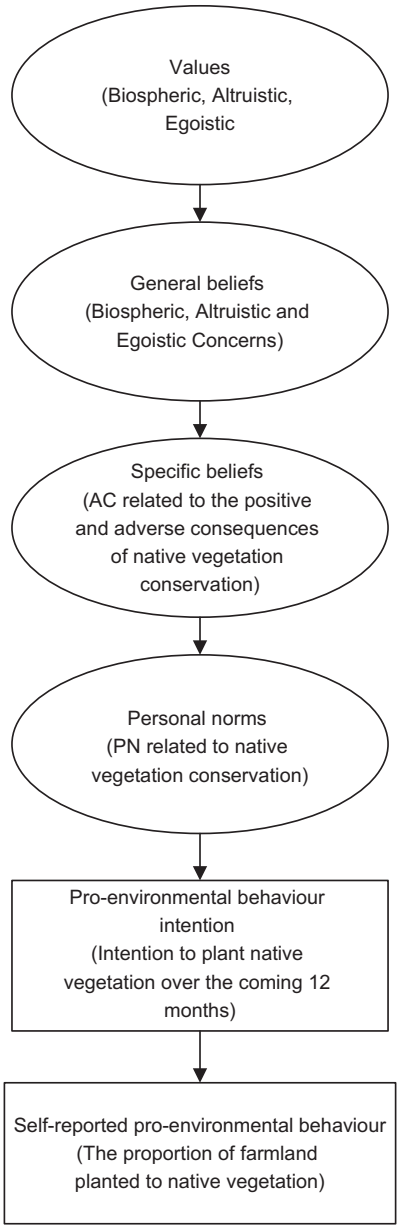

Fig. 1. The base causal model of the role of values, general beliefs, behaviour-specific beliefs and personal norms in determining pro-environmental behaviour.

relevant values (human values) developed by Stern et al. (1999) and refined by de Groot and Steg (2008). A biospheric value orientation represents a set of values for the environment and the biosphere, an altruistic value orientation represent a set of values for the welfare of others and an egoistic value orientation is associated with maximising personal benefit. Most pro-environmental behaviour studies do not show a distinction between biospheric and altruistic value orientations (e.g., Bardi & Schwartz, 2003; Corraliza & Berenguer, 2000; McCarty & Shrum, 1994; Nordlund & Garvill, 2002; Stern & Dietz, 1994); however, de Groot and Steg (2007) found a distinction between these value orientations across five countries, suggesting it is a plausible model.

We test the effect of human values on general biospheric, altruistic and egoistic concerns rather than NEP as a result of the argument raised by Schultz (2000, 2001) that the beliefs about the interrelationships between self and nature have an influence on environmental concern, in addition to humanity and nature as

measured by the NEP scale. Schultz developed a theory of inclusion of self in nature which posits that environmental concern is linked to the degree to which individuals include nature and other people in their cognitive representation of self. Environmental concern among people who view themselves as part of nature will be based on a desire to avoid consequences to the natural environment (*biospheric concern*). Environmental concern among people who view themselves as interconnected with others will be based on a desire to provide benefits for all people or to avoid consequences for other people (*altruistic concern*). Environmental concern for those people who see themselves as separate to nature will be motivated by reward for the self (*egoistic concern*). Empirical research provides support for this theory. In two studies of university students in California, moderate positive relationships were found between connectedness to nature and biospheric concerns, and a negative relationship between connectedness to nature and egoistic concerns (Schultz, Shriver, Tabanico, & Khazian, 2004). Dutcher, Finley, Luloff and Johnson (2007) also found a positive relationship between connectedness to nature and environmental concern. Schultz's research also considered the relationships between values and environmental concern. Values of self-transcendence (e.g., biospheric, altruistic) were positively related to biospheric environmental concerns and negatively related to egoistic environmental concerns. Values of self-enhancement (e.g., egoistic) were negatively related to biospheric concerns and positively related to egoistic concerns (Schultz et al. 2005).

Few studies have considered the relationships between general environmental concerns and AC. Hansla, Gamble, Juliusson and Garling (2008) provide the most compelling evidence of a relationship. Environmental concern for oneself, others and the biosphere were related to AC beliefs for oneself, others and the biosphere, respectively.

Despite different interpretations, the majority of studies offer support for a sequential or mediation relationship between specific beliefs, personal norms and behaviour. Both AC and ascription of responsibility (AR) influence PN, which in turn influence intention and behaviour (see Bamberg & Schmidt, 2003; Harland, Staats, & Wilke, 2007). In three studies examining pro-social intentions in The Netherlands, AC affected AR which in turn affected PN and behavioural intention (Steg & de Groot, 2010). However, AR and PN were strongly correlated ($r = .73$), suggesting the concepts were very similar. We therefore do not examine ascription of responsibility (AR) as part of our model. Stern et al. (1999), among others, also did not include measures of AR beliefs within their testing of the VBN framework.

We also adopt a modified operational definition of AC. Most studies operationalise AC in terms of awareness of adverse consequences to whatever the individual values (see Stern et al. 1999). However, more recent studies suggest that an awareness of the positive and adverse consequences of environmental issues are important elements of the AC concept (see Hansla et al. 2008; Ryan and Spash, 2008). We therefore define AC in terms of both the positive and adverse consequences of native vegetation conservation.

We include measures of native vegetation planting intention and self-reported planting behaviour in this study. Native vegetation planting intention refers to an intention to plant native vegetation on the farm within the next 12 months, whereas native vegetation planting behaviour refers to the proportion of farmland planted to native trees or shrubs since the landowner took over the management of the farm.

The base model does not consider how the interrelationships between individuals and place influence environmental concern and pro-environmental behaviour. Place attachment is one construct for better understanding the multiple cognitive and affective bonds which develop between individuals and place. The following section provides a rationale for including dimensions of place attachment with a behavioural model including variables from VBN theory.

1.2. Rationale for integrating place attachment within a behavioural model including variables from VBN theory

Place attachment has been measured in a variety of ways in the environmental psychology literature. Most researchers have operationalised it using a two-dimensional model of place identity and place dependence (Bricker & Kerstetter, 2000; Kyle, Absher, & Graefe, 2003; Moore & Graefe, 1994; Williams, Patterson, Roggenbuck, & Watson, 1992). Place identity refers to the mixture of feelings about specific physical settings and symbolic connections to place that define who we are (Proshansky, Fabian, & Kaminoff, 1983). Place dependence refers to the functional or goal-directed connections to a setting (Schreyer, Jacob, & White, 1981). Vorkinn and Riese (2001) found that place identity explained 17% of the variance in environmental concerns relating to the development of a hydropower plant in Norway.

Researchers adopting this two-dimensional model have generally found that positive bonds to natural and recreational settings positively affect behavioural intention. American lakeside property owners with higher levels of place identity were more willing to protect the lake setting's quality (Stedman, 2002). Place attachment predicted environmentally responsible behaviour (measured using both intention and self-reported behaviour, $R^2 = .40$), with place identity mediating the relationship between place dependence and environmentally responsible behaviour (Vaske & Kobrin, 2001). Place identity also mediated the effects of place dependence in predicting pro-environmental intentions in a study of visitor behaviour in a Canadian national park (Halpenny, 2010). Walker and Chapman (2003) found a strong positive association between place identity and intention to pick up other people's litter in a park and to work on park projects.

Researchers interested in community attachment have identified multiple connections related to the shared symbolic meanings of places. Community attachment refers to an emotional connection to a community which emerges in the context of residence, belonging and social interaction (see Hummon, 1992; Kasarda & Janowitz, 1974), as well as natural landscape related factors (Brehm, 2007; Matarrita-Cascante, Stedman, & Luloff, 2010). Related constructs include: *place belongingness* where people feel a 'membership' to an environment (Mesch & Manor, 1998; Milligan, 1998), *civic attachment* where groups develop social-symbolic bonds at the city level (Scannell & Gifford, 2010a), and *neighbourhood attachment* which captures one's emotional connection to his or her neighbourhood (Buller et al., 2000; Cohen, 1985; Dominy, 2001; Sampson & Goodrich, 2005). Brehm, Eisenhauer and Krannich (2006) found that community attachment is a statistically significant predictor of environmental concern particularly in relation to issues of community culture and identity or health. However, the direction and strength of the relationships between these constructs and pro-environmental behaviour are less clear. Scannell and Gifford (2010b) found no significant associations between civic attachment and behaviour. Kyle, Theodori, Absher, and Jihnhee (2010) examined the effect of home attachment and community attachment on firewise behaviour. They found that home attachment was the strongest predictor of firewise activities around the home, whereas community attachment was the strongest predictor of community-based fire management activities.

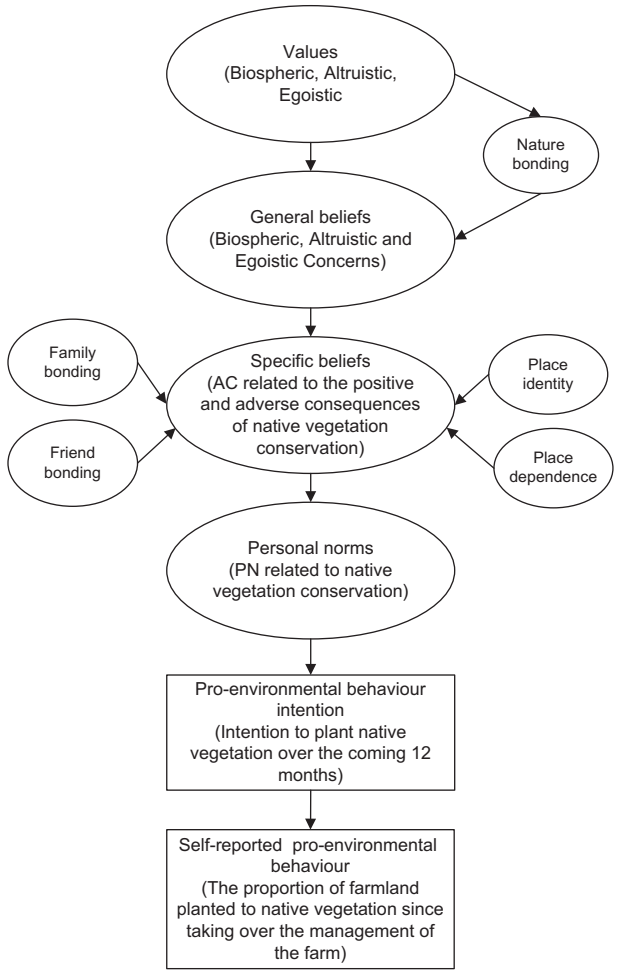

Fig. 2. The expanded causal model including five dimensions of place attachment.

It is possible that community attachment also has an influence on awareness of consequences about conservation activities. Devine-Wright (2009) accounted for geographical differences in the relationships between place attachment and support for sustainable energy developments using a modified conceptualisation of social representations theory (Moscovici, 2000). He and colleagues theorise that individuals adopt the specific beliefs and attitudes of influential groups or institutions who seek to change thinking processes in regional communities (Devine-Wright, 2009; Devine-Wright & Howes, 2010; Walker, Devine-Wright, Hunter, High, & Evans, 2010). They provide examples where individuals adopt attitudes informed by influential groups and institutions who seek to influence ways of thinking within community, sub-regional, and regional place contexts. For example, strong local opposition to wind farms was achieved by groups in Llandudno, United Kingdom, who focused upon local, place relevant attributes (Devine-Wright & Howes, 2010).

Researchers have also found positive relationships between connectedness to nature and pro-environmental behaviour. Kals, Schumaker and Montanda (1999) found that connectedness to nature was a strong predictor of pro-environmental behavioural intentions. In two separate studies, Mayer and Frantz (2004) found moderate correlations between ecological behaviour and connectedness to nature ($r > .44$). Clayton (2003) observed that measures of broad environmental identity have significant positive correlations ($r = .64$) with environmentally responsible behaviour such as turning off lights or donating to environmental organisations. Scannell and Gifford (2010b) identified that natural attachment predicted pro-environmental behaviour when controlling for town, length of residence, gender, education and age. Connectedness to nature was a significant, but modest, predictor of self-reports of native vegetation pro-environmental behaviour in rural Victoria, Australia (Gosling & Williams, 2010).

The preceding review highlights the importance of considering multiple dimensions of place attachment with respect to an examination of environmental concern and pro-environmental behaviour. Despite significant research attention being devoted to an examination of the univariate relationships between dimensions of place attachment and environmental concern or pro-environmental behaviour, comparatively little research has considered multiple dimensions of place attachment with respect to variables included in the VBN theory. In response, we present an expanded model which incorporates five dimensions of place attachment and variables included in the VBN theory of human values, AC, PN, and self-reported planting of native vegetation.

1.3. An expanded model of pro-environmental behaviour

Our expanded model of pro-environmental behaviour includes three human value orientations; a five-dimensional conceptualisation of place attachment; awareness of positive and negative consequences associated with native vegetation conservation (AC); personal norms about the conservation of native vegetation (PN) and a self-report measure of native vegetation planting (Fig. 2). The five dimensions of place attachment were developed and validated by Raymond, Brown and Weber (2010); namely, the traditional two-dimensional conceptualisation of place identity and place dependence, as well as connectedness to nature (termed nature bonding), family bonding and friend bonding. Following the environmental identity literature, nature bonding refers to a connection to some part of the non-human natural environment, based on history, emotional response or cognitive representation. Following the community attachment literature, family bonding refers to feelings of belongingness or membership to family, as well as the emotional connections based on shared history, interests or concerns. Friend bonding refers to feelings of belongingness or membership to friends in place.

Specific hypotheses about the relationships between these latent constructs and behaviour are presented below.

Hypothesis 1. Those landholders who strongly identify with or depend on place will have stronger AC associated with the conservation of native vegetation. Support comes from Vorkinn and Riese (2001) who found that place attachment (expressed as place identity and dependence) predicted 17% of the variance in environmental concern in relation to the development of a hydropower plant.

Hypothesis 2. Family bonding and friend bonding will have negative effects on rural landholder AC of native vegetation conservation. Following Devine-Wright's (2009) conceptualisation of social representations theory, the nature and direction of the effect will depend upon the dominant influencers within the family or friendship circle. Given the majority of commercial farmers come from families with at least 2–3 generations of involvement in primary production, it is expected that that the dominant influencers within the family or friendship circle will have a primary production rather than conservation ethic. Therefore they are more likely to dismiss the positive and negative consequences associated with the conservation of native vegetation on their farmland.

Hypothesis 3. Nature bonding mediates the effect of biospheric values on biospheric concerns. Support comes from Schultz's

(2000, 2001) inclusion theory, which suggests that environmental concern is linked to the degree to which individuals include nature and other people in their cognitive representation of self. Empirical work has indicated positive associations between connectedness to nature and environmental concern (Schultz et al., 2004) and moderate positive relationships among self-transcendent values (i.e., biospheric, altruistic) and biospheric concern (Schultz et al., 2005).

Hypothesis 4. The expanded model will explain a greater amount of the variance in intention to plant native vegetation and self-reports of planting of native vegetation than the base model because it considers an affective antecedent of pro-environmental behaviour; namely place attachment.

2. Methods

A postal survey was administered to 1300 landholders who own greater than 2 ha of land in the South Australian Murray-Darling Basin (SAMDB) region between February and March 2010. Research areas addressed in the survey included rural landholders' place attachments, native vegetation pro-environmental behaviour, environmental concerns, environmentally relevant values (human values), beliefs about native vegetation conservation, and attitudes towards government assistance programs for the management of natural resources. The following sections present the study area, participants, survey procedure, and measures specific to this study.

2.1. Study areas

The SAMDB region has a population of around 81, 000 people and spans an area of just over 56,000 km^2. The River Murray, a critical source of fresh water for South Australia, flows through the region entering the Ramsar listed lower lakes, Coorong (a 100 km long coastal wetland) and Murray mouth. Land use in the region is dominated by dryland (23,304 km^2) and irrigated (1023 km^2) agricultural production (South Australian Murray-Darling Basin NRM Board, 2009). The region has been subject to land clearance and agricultural development for more than 80 years. In the agricultural part of the region, only 28% (1,191,000 ha) of native vegetation remains, of which 42% (499,000 ha) is formally protected (DEH, 2009). The Northern and Yorke region covers an area of 34,500 km^2 and includes the townships of Hawker to the north, the Yorke Peninsula, the Northern Mount Lofty Ranges, and the Southern Flinders Ranges. The region supports a population of 89,000, with the major urban centres being the cities of Port Pirie, Port Augusta, Clare, and 'The Copper Triangle' towns of Kadina, Moonta and Wallaroo. Dryland farming (crops and livestock) is the dominant land-use of the region (Northern and Yorke NRM Board, 2009).

2.2. Participants

Over half of the Northern and Yorke and SAMDB rural landholders completed a survey (51.7% and 53.7% survey responses) providing samples of 659 and 664 respondents, respectively. The majority of respondents in both Northern and Yorke and SAMDB regions were male (85.9% and 86.9%). The average male age was 55.00 and 55.43 years (SD = 11.90, 11.65) and average female age was 56.07 and 53.46, respectively (SD = 12.91, 12.74). Respondents were older and had completed a higher level of education (17.4% Northern and Yorke and 23.8% SAMDB with tertiary or post-graduate degree) than would be expected based on comparable regional statistics collected by the Australian Bureau of Statistics (ABS, 2006). Further, the response rate from females was lower than expected given ABS (2006) data indicate that females represent 18.2% of all farm owners or managers in the Northern and Yorke region and 25.9% in the South Australian Murray-Darling Basin region.

2.3. Survey procedure

Surveys were administered using a modified Tailored Design Method (Dillman, 2007), which entailed sending out a hand-signed introductory letter (at time t), a first survey packet comprising the survey and reply-paid envelope (t + one week), reminder postcard (t + three weeks), and second survey packet to non-respondents to the first round of mailing (t + five weeks).

2.4. Measures

The survey included scale items for self-reporting of human values, place attachment, AC, PN and survey items for measuring the planting of native vegetation. Table 1 provides the mean scores and reliabilities for each construct in the SAMDB and Northern and Yorke regions. Each construct is then described below.

2.4.1. Human values

Human values were measured using a scale of environmentally relevant values (human values) conceived by Stern et al. (1999) and further refined along the self-transcendence vs. self-enhancement dimension by de Groot and Steg (2008). The results of de Groot and Steg (2007, 2008) indicate the scale measures biospheric, altruistic, and egoistic value orientations with high internal and cross-cultural validity.

2.4.2. Environmental concern

Following Schultz (2001), general attitudes of environmental concern were assessed using twelve items. The items were preceded by the statement of "people around the world are

Table 1
Descriptive scale statistics for the measures in the SAMDB and Northern and Yorke regions.

Measure	# items	SAMDB region				Northern and Yorke region			
		α	Mean r	M	SD	α	Mean r	M	SD
Human values									
Biospheric	4	.91	.72	4.72	1.48	.88	.65	4.54	1.44
Altruistic	4	.74	.42	4.76	1.33	.78	.47	4.61	1.38
Egoistic	4	.70	.36	2.10	1.30	.73	.40	2.10	1.33
General Environmental Concern									
Biospheric	4	.94	.78	5.34	1.22	.94	.81	5.20	1.22
Altruistic	4	.90	.70	5.57	1.15	.91	.72	5.53	1.14
Egoistic	4	.92	.73	4.84	1.45	.90	.70	4.87	1.31
Place attachment									
Place identity	6	.91	.63	3.69	.69	.91	.62	3.80	.64
Place dependence	5	.84	.52	3.25	.71	.85	.54	3.31	.69
Nature bonding	4	.83	.50	3.53	.68	.86	.56	3.55	.67
Family bonding	2	.78	.64	3.30	.83	.70	.54	3.39	.73
Friend bonding	2	.65	.45	3.31	.83	.65	.48	3.63	.80
AC	7	.68	.26	3.81	.59	.54	.17	3.69	.52
PN	2	.68	.53	3.78	.76	.64	.50	3.55	.78
NV planting intention	1	–	–	3.51	1.16			3.48	1.18
NV planting	1	–	–	.10	.19	–	–	.11	.53

Note: place attachment, AC, PN and NV planting scale items were presented on a scale from "1 = Strongly Disagree" to "5 = Strongly Agree".
Environmental concern scale items were presented on a scale from "1 = Not Important" through to "7 = Of Supreme Importance".
Human value scale items were presented on a scale from "−1 = Opposed to my Values" through to "7 = Of Supreme Importance".

generally concerned about environmental problems because of the consequences that result from harming nature. However, people differ in the consequences that concern them the most. Please rate each of the following items from 1 (not important) to 7 (supreme importance) in response to the question: I am concerned about environmental problems because of the consequences for…" Four items measured each of the biospheric concerns (plants, marine life, birds, animals), altruistic concerns (humanity, children, people in the community, future generations) and egoistic concerns (me, my future, my health, my prosperity). Each item loaded on the theorised dimension of environmental concern with high reliabilities (Cronbach $\alpha > .90$) and mean scores greater than 4.84 (Table 1).

2.4.3. Place attachment

Place attachment was measured using a 20-item scale developed and validated by Raymond et al. (2010). Place attachment was divided into five dimensions of place identity, place dependence, nature bonding, family bonding, and friend bonding. The scale showed good internal consistency across three NRM regions in South Australia. Exploratory and confirmatory factor analyses revealed that the five-dimensional model explained a greater amount of variance in overall place attachment than the traditional two-dimensional model of place identity and place dependence in two NRM regions; however, the two-dimensional scale was more parsimonious. Six items previously found to be related to place identity loaded on a place identity dimension ($M > 3.69$, Cronbach $\alpha = .91$) and a further four items found to be related to place dependence loaded on a place dependence dimension ($M > 3.25$, Cronbach $\alpha > .84$). Four items loaded on the nature bonding dimension ($M > 3.53$, Cronbach $\alpha > .83$). Two items loaded on each of the family bonding ($M > 3.30$) and friend bonding constructs ($M > 3.31$) with moderate reliabilities (Cronbach $\alpha > .65$).

2.4.4. Awareness of consequences and personal norms

Respondents indicated to what extent they agreed with seven items reflecting awareness of consequences (AC) associated with native vegetation conservation and two items reflecting personal norms (PN) about the conservation of native vegetation in the SAMDB region on a scale ranging from "1 = Strongly Disagree" through to "5 = Strongly Agree" (see Table 2). A multiple group method (MGM), a type of confirmatory factor analysis widely applied in the psychology literature (Guttman, 1952; Nunnally, 1978; Ten Berge, 1986) was used to verify whether the data supported the two dimensions of AC and PN. In the MGM, the scale items were first defined on theoretical grounds by calculating the mean scores of the items supposedly related to the two components. Correlations were then computed between each AC and PN item and the respective component. AC and PN scale items were corrected for 'self-correlation' (items automatically correlating highly with components in which they take part). Finally, it was verified whether the AC and PN items correlated highest with the component to which they are assigned on theoretical grounds. The AC and PN structure is supported when the items correlate highest with the component they are assigned to on theoretical grounds (Nunnally, 1978). Both the AC and PN constructs have moderate reliabilities (Cronbach $\alpha > .54$ and $>.64$, respectively). Other studies have also faced difficulties in reaching acceptable AC scale reliability levels (Gärling, Fujii, Gärling, & Jakobsson, 2003; Snelgar, 2006; Stern, Dietz, & Kalof, 1993).

2.4.5. The planting of native vegetation

Measures of both intention to plant native vegetation and self-reported planting of native vegetation were included in the survey. We measured intention by asking survey participants to rate their level of intention to plant native vegetation on their farm over the coming 12 months on a "1 = Strongly Disagree" to "5 = Strongly Agree" scale. The survey item for measuring self-reported planting of native vegetation was adapted from research conducted by Curtis et al. into the drivers of preferred NRM practices on Australian farms (Curtis, McDonald, Mendham, & Sample, 2008). They were able to measure the level of planting behaviour, among other NRM practices, with high validity and reliability. Following their approach, participants were asked to identify the area (in acres or hectares) of land which they had planted to native trees or shrubs since taking over the management of the farm. To increase responses to the behavioural variable, Raymond and Brown (2011) conducted a follow-up telephone survey to non-respondents to planting of native vegetation question. They telephoned all landholders with publicly listed telephone numbers who did not respond to the planting question and asked whether they had or had not planted any native trees and shrubs since

Table 2
Corrected correlations between AC and PN scale items and AC and PN components (multiple group method).

	SAMDB region		Northern and Yorke region	
	PN	AC	PN	AC
I feel a personal obligation to do whatever I can to conserve native vegetation in the SA Murray-Darling basin region (PN1)	**.84**	.38	**.82**	.38
The government should exert pressure nationally to conserve native vegetation the SA Murray-Darling Basin region (PN2)	**.91**	.44	**.91**	.46
I conserve native vegetation because it prevents soil erosion (AC1)	.18	**.64**	.24	**.49**
I conserve native vegetation because it prevents soil salinity (AC2)	.19	**.58**	.29	**.58**
I conserve native vegetation because it provides habitat for native plants and animals (AC3)	.34	**.67**	.40	**.64**
I conserve native vegetation because it covers unproductive land (AC4)	.13	**.50**	.10	**.49**
I conserve native vegetation only because government regulations prevent me from clearing native vegetation (AC5)	.33	**.61**	.27	**.44**
A significant portion of the native vegetation on public lands in the SAMDB needs to be cleared to protect the region's farm assets from bushfire (AC6)	.20	**.53**	.12	**.51**
Native vegetation clearance is a very serious problem for me and my family (AC7)	.42	**.65**	.30	**.57**

Bolded figures represent the strongest correlation between AC and PN items and their respective components.

taking over the management of their farm. Their responses were then added to the respective data set.

2.5. Analyses

We first used bivariate correlations to examine the relationships between place attachment dimensions and variables which form part of the base model, such as AC, PN, and human values. Hierarchical regression analyses were then used to confirm the causal relationship between base model variables and to identify where place attachment was situated in the expanded model. This procedure enables testing of whether the place attachment dimensions also affect variables further along the causal chain when intermediate variables are controlled for. A similar procedure was used by Steg et al. (2005) when they tested the causal chain of VBN theory. In model 1, the variable directly preceding the dependent variable was added to the regression analysis. In model 2, it was examined whether the additional independent variables in the model explained additional variance in the dependent variable. To reduce the likelihood of finding significant difference by chance, a Bonferroni correction of .006 was used (.05 divided by 8 steps).

The mediation effects were then tested. A multiple mediation model (Preacher & Hayes, 2008) was used for testing the effect of: 1) human values on AC through five dimensions of place attachment, and; 2) AC on PN through five dimensions of place attachment. In multiple mediation models, the researcher is concerned not only with the *total indirect effect* of *X* on *Y*, but also with *specific indirect effects*. The *total indirect effect* of *X* on *Y* through M_1 is quantified as a_1b_1. The *specific indirect effect* of *X* on *Y* through mediator *M* is defined as the product of the two unstandardised paths linking *X* to *Y* via that mediator. Unlike simple mediation, multiple mediation enables the identification of which specific place attachment dimensions (*M* variables) mediate the relationship between human values and environmental concern or PN, conditional on the presence of other place attachment dimensions in the model. It also enables identification of the relative magnitude of the indirect effects between *X* and *Y* (Preacher & Hayes, 2008).

Multivariate normality is one assumption of multiple mediation analyses. The paths that constitute the indirect effects must follow a multivariate normal distribution, and the sampling distributions of the total and specific indirect effects must be normal. The specific and total indirect effects of the sample distribution were bootstrapped 2000 times to address this problem. This yields 2000 estimates of the total and specific indirect effects of *X* on *Y*. Bootstrap confidence interval (CI) for the population-specific indirect effect through M_i is derived by sorting the 2000 values of a_ib_i from low to high. The lowest and highest values then form the confidence interval for the population indirect effect at $\alpha = .05$.

3. Results

3.1. Correlations between place attachment and variables included in the VBN theory

We first examined the correlations between place attachment and values, beliefs and norms across both study regions (Table 3). In both regions, high correlations were found between place identity and place dependence ($r > .72$), place identity and nature bonding ($r > .69$), and place dependence and nature bonding ($r > .67$). Moderate to high correlations exist between biospheric values and biospheric concerns ($r > .69$), altruistic values and altruistic concerns ($r > .55$), egoistic values and egoistic concerns ($r > .38$), nature bonding and biospheric values ($r > .36$) and nature bonding and biospheric concerns ($r > .32$). Further, moderate correlations exist between biospheric values and AC ($r > .50$), and biospheric concerns and AC ($r > .44$).

Contrary to hypothesis one, no significant relationships exist between AC and the place attachment dimensions of place identity and place dependence. In support of hypothesis two, significant negative relationships exist between family bonding and AC, but these relations were only weak ($r > -.12$). The strongest relationships exist between nature bonding and AC ($r = .30$).

In both regions, only weak positive relationships were found between PN and the planting of native vegetation ($r < .19$) and AC and the planting of native vegetation ($r < .25$). Further, no significant correlations were found between intention to plant native vegetation and the self-reported planting of native vegetation ($p > .05$).

3.2. Explaining the ordering of variables in the base model

Hierarchical linear regression of variables in the base model (Table 4) revealed that planting intention was not a significant predictor of native vegetation planting ($\beta < .14$, $p > .05$). In both regions, intention only explained 2% of the variance in planting behaviour. PN were a significant predictor of behaviour, but the results are modest. In model 1, PN explained 6% of the variance in planting intention in the SAMDB region and 12% of planting intention in the Northern and Yorke region. However, PN was not a significant predictor of both native vegetation planting intention and self-reported behaviour when controlling for variables preceding PN in the causal chain. In separate analyses, PN also

Table 3
Correlations between place attachment, variables included in the VBN theory, age and length of residence.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Biospheric values		.68**	.13**	.69**	.47**	.23**	.28**	.23**	.39**	−.04	.05	.56**	.55**	.25**	.19**
2	Altruistic values	.63**		.24**	.51**	.55**	.32**	.24**	.14**	.23**	.08	.13**	.27**	.27**	.12*	.08
3	Egoistic values	.19**	.22**		.13**	.20**	.39**	.13**	.05	−.03	.10*	.11**	−.02	.06	−.01	−.04
4	Biospheric concerns	.71**	.51**	.14**		.64**	.40**	.24**	.18**	.32**	.03	.06	.51**	.45**	.16**	.12*
5	Altruistic concerns	.52**	.60**	.22**	.70**		.62**	.25**	.18**	.22**	.16**	.12**	.17**	.22**	−.01	.07
6	Egoistic concerns	.30**	.35**	.38**	.47**	.66**		.13**	.13**	.12**	.25**	.15**	.04	.08*	−.04	−.01
7	Place identity	.21**	.24**	.02	.22**	.23**	.18**		.72**	.73**	.33**	.51**	.07	.25**	.07	.02
8	Place dependence	.11*	.15**	.01	.15**	.20**	.19**	.69**		.67**	.29**	.42**	.10	.20**	.07	.11*
9	Nature bonding	.36**	.25**	−.01	.33**	.24**	.13**	.70**	.64**		.23**	.37**	.30**	.39**	.22**	.15**
10	Family bonding	−.10*	−.01	.18**	−.07	.08	.18**	.23**	.19**	.12**		.44**	−.14*	.01	−.07	−.13**
11	Friend bonding	−.00	.17**	.18**	.02	.18**	.21**	.41**	.32**	.26**	.35**		−.10	.06	.01	−.11*
12	AC	.50**	.23**	−.01	.44**	.28**	.10	.14*	.11	.30**	−.12*	−.06		.48**	.34**	.13*
13	PN	.55**	.32**	.07	.45**	.30**	.13**	.22**	.19**	.41**	−.05	.01	.49**		.30**	.19**
14	NV planting intention	.32**	.19**	−.02	.29**	.18**	.07	.05	.11*	.30**	−.10*	−.02	.37**	.40**		.15**
15	NV planting	.13*	.04	−.11	.11	.06	−.04	−.02	−.04	.04	−.05	−.08	.25**	.08	.07	

SAMDB region above the diagonal; Northern and Yorke region below the diagonal; $^{**}p < .01$, $^{*}p < .05$.

Table 4
Multiple regression analyses to test a model including variables from VBN theory (base model).

	SAMDB region				Northern and Yorke region			
	β	p	Sr^2	R^2	β	p	Sr^2	R^2
DV:NV Planting								
Model 1				.02				.02
NV Planting Intention	.13	.070	.02		.14	.061	.02	
Model 2				.11				.08
NV Planting Intention	.05	.535	.00		.06	.496	.00	
PN	.17	.051	.02		.02	.803	.00	
AC	−.05	.600	.00		.10	.297	.01	
Bio Concern	−.03	.765	.00		.11	.297	.01	
Alt Concern	−.05	.550	.00		−.09	.287	.01	
Ego Concern	.12	.143	.01		−.08	.365	.00	
Bio Value	.15	.149	.01		.03	.781	.00	
Alt Value	.08	.377	.00		.00	.975	.00	
Ego Value	−.16	.046	.02		−.01	.922	.00	
DV:NV Planting Intention								
Model 1				.07	.35	.000		.12
PN	.27	.000	.07				.12	
Model 2				.14				.19
PN	.13	.090	.01		.18	.012	.02	
AC	.24	.004	.04		.28	.000	.05	
Bio Concern	−.11	.201	.01		−.02	.781	.00	
Alt Concern	−.09	.215	.01		−.04	.581	.00	
Ego Concern	−.06	.427	.00		.00	.994	.00	
Bio Value	.14	.136	.01		.06	.488	.00	
Alt Value	.12	.134	.01		.00	.957	.00	
Ego Value	−.03	.629	.00		−.08	.196	.01	
DV: PN								
Model 1				.21				.25
AC	.46	.000	.21		.50	.000	.25	
Model 2				.34		.000		.36
AC	.23	.000	.04		.30	.000	.06	
Bio Concern	.12	.085	.01		.05	.447	.00	
Alt Concern	−.10	.090	.01		.01	.898	.00	
Ego Concern	−.04	.502	.00		−.02	.722	.00	
Bio Value	.23	.001	.03		.33	.000	.05	
Alt Value	.27	.000	.05		.11	.050	.01	
Ego Value	−.08	.168	.00		.04	.478	.00	
DV: AC								
Model 1				.30				.21
Bio Concern	.54	.000	.29		.43	.000	.18	
Alt Concern	.07	.208	.00		.17	.001	.03	
Ego Concern	−.07	.204	.00		−.05	.333	.00	
Model 2				.35		.000		.30
Bio Concern	.35	.000	.07		.17	.007	.02	
Alt Concern	−.03	.557	.00		.07	.186	.00	
Ego Concern	−.07	.215	.00		−.08	.138	.01	
Bio Value	.27	.000	.04		.41	.000	.09	
Alt Value	.14	.014	.02		.05	.361	.00	
Ego Value	−.10	.091	.01		−.03	.542	.00	
DV: Env Concern								
Model 1				.39				.44
Bio Value	.52	.000	.27		.46	.000	.21	
Alt Value	.30	.000	.09		.46	.000	.21	
Ego Value	.17	.000	.03		.20	.000	.04	

explained 6% of native vegetation planting behaviour in each region.

AC was a significant predictor of native vegetation planting intention and PN ($\beta > .23$, $p < .004$). It explained 4% of the variance in intention in the SAMDB and 5% in the Northern and Yorke region when controlling for PN and all variables preceding AC in the causal chain. It also explained 21% of the variance in PN in the SAMDB region and 25% of the variance in the Northern and Yorke region; however, the variance explained reduced to 4% and 5% respectively when controlling for the variables preceding PN in the causal chain.

Biospheric, altruistic and egoistic concerns were not significant predictors of NV planting, intention or PN in both the SAMDB and Northern and Yorke regions. Biospheric concerns were a significant predictor of AC in both model 1 ($\beta > .43$, $p < .001$) and model 2 ($\beta > .17$, $p < .007$).

Human value orientations were not significant predictors of planting intention or self-reported planting when controlling for all variables preceding them in the base model, but biospheric values were significant predictors of PN and AC in the SAMDB region and Northern and Yorke region ($\beta > .23$, $p < .001$). In the Northern and Yorke region, biospheric value accounted for 9% of the variance in AC when controlling for variables preceding AC. Altruistic values were only a significant predictor of PN in the SAMDB region ($\beta = .27$, $p < .001$), accounting for 5% of the variance in PN. Biospheric, altruistic and egoistic values were all significant predictors of overall environmental concern (grand mean of biospheric, altruistic and egoistic concerns), accounting for up to 27% of the variance in environmental concern in the SAMDB region and up to 21% in the Northern and Yorke region.

3.3. Explaining the ordering of variables in the expanded model

Table 5 shows the results of the hierarchical regression analyses aimed at testing where place attachment fits within the expanded model of pro-environmental behaviour. Family bonding was a significant negative predictor of native vegetation planting in the SAMDB region when controlling for all variables preceding the behavioural variable ($\beta = -.25$, $p = .001$), accounting for 6% of the variance in native vegetation planting. However, no other dimensions of place attachment were significant predictors of either the planting of native vegetation planting or intention to plant in both study regions when controlling for the variables preceding self-reported planting and intention to plant in the causal chain ($\beta < .14$, $p > .05$).

In both study regions, nature bonding was a significant predictor of PN when controlling for all variables preceding PN in the causal chain ($\beta > .29$, $p < .001$), accounting for greater than 4% of the variance in PN. Further, nature bonding was a significant predictor of AC ($\beta > .37$, $p < .001$) in model 1, accounting for greater than 10% of the variance in AC. No other dimensions of place attachment were significant predictors of PN.

Relationships exist between place attachment and AC and general environmental concern. In accordance with hypothesis two, family bonding was a significant negative predictor of AC in the Northern and Yorke region when allowing for a Bonferroni correction ($\beta = -.15$, $p = .006$) and friend bonding was a significant, but modest, predictor of overall environmental concern in the Northern and Yorke region ($\beta = .14$, $p = .001$). Further analysis revealed that friend bonding was a significant positive predictor of altruistic and egoistic environmental concerns ($\beta > .12$, $p < .007$), but not biospheric environmental concerns.

3.4. Mediation analyses

The multiple mediation model of the effect of biospheric values was tested on biospheric concerns through five dimensions of place attachment. In support of hypothesis three, nature bonding was a significant mediator of the relationship between biospheric values and biospheric concerns in both the SAMDB region ($Z = 4.73$, $p < .001$) and Northern and Yorke regions ($Z = 3.73$, $p < .001$). The indirect effect of biospheric values on biospheric concerns was bootstrapped using 2000 samples with replacement. Because zero was not contained in the interval, it can be confirmed that nature bonding is a significant mediator. In the Northern and Yorke region, the specific indirect effect of nature bonding was .067 and in the SAMDB region the specific indirect effect was .082.

Table 5
Multiple regression analyses to test where place attachment fits within a model including variables from VBN theory (expanded model).

	SAMDB region				Northern and Yorke region			
	β	p	Sr^2	R^2	β	p	Sr^2	R^2
DV:NV Planting								
Model 1				.02				.02
NV Planting Intention	.14	.063	.02		.13	.093	.02	
Model 2				.22				.11
NV Planting Intention	.03	.679	.00		.02	.803	.00	
PN	.15	.110	.01		−.01	.911	.00	
AC	−.14	.129	.01		.10	.333	.01	
PI	−.05	.517	.00		.03	.713	.00	
PD	.14	.061	.02		−.05	.521	.00	
NB	.09	.344	.00		.16	.086	.02	
FB	−.25	.001	.06		.01	.897	.00	
FRB	−.14	.059	.02		−.13	.124	.01	
Bio Concern	−.03	.732	.00		.09	.403	.00	
Alt Concern	−.02	.838	.00		−.11	.221	.01	
Ego Concern	.19	.027	.02		−.04	.650	.00	
Bio Value	.16	.129	.01		.01	.925	.00	
Alt Value	.06	.489	.00		.04	.666	.00	
Ego Value	−.13	.098	.01		.02	.870	.00	
DV:NV Planting Intention								
Model 1				.08				.12
PN	.28	.000	.08		.35	.000	.12	
Model 2				.19				.27
PN	.13	.106	.01		.12	.109	.01	
AC	.19	.025	.02		.28	.000	.05	
PI	−.12	.082	.01		−.17	.005	.03	
PD	−.01	.922	.00		−.02	.790	.00	
NB	.08	.334	.00		.20	.004	.03	
FB	−.08	.266	.01		.03	.593	.00	
FRB	.16	.020	.02		−.04	.519	.00	
Bio Concern	−.11	.207	.01		−.04	.599	.00	
Alt Concern	−.10	.167	.01		−.01	.826	.00	
Ego Concern	−.08	.297	.00		.03	.634	.00	
Bio Value	.13	.168	.01		.03	.770	.00	
Alt Value	.11	.170	.01		.03	.602	.00	
Ego Value	−.03	.736	.00		−.09	.136	.01	
DV: PN								
Model 1				.21	.50	.000		.25
AC	.46	.000	.21				.25	
Model 2				.39				.44
AC	.22	.001	.03		.25	.000	.04	
PI	−.12	.183	.00		.07	.135	.00	
PD	−.03	.646	.00		.06	.177	.00	
NB	.34	.000	.04		.28	.000	.06	
FB	.06	.299	.00		.00	.966	.00	
FRB	.00	.999	.00		.01	.780	.00	
Bio Concern	.05	.462	.00		.02	.762	.00	
Alt Concern	−.12	.043	.01		.04	.492	.00	
Ego Concern	−.06	.341	.00		−.04	.487	.00	
Bio Value	.17	.016	.01		.27	.000	.04	
Alt Value	.27	.000	.05		.05	.315	.00	
Ego Value	−.04	.530	.00		.08	.119	.00	
DV: AC								
Model 1				.16				.17
PI	−.19	.051	.01		.06	.235	.00	
PD	−.03	.765	.00		.02	.721	.00	
NB	.51	.000	.10		.37	.000	.14	
FB	−.03	.606	.00		−.15	.006	.02	
FRB	−.16	.025	.02		.01	.828	.00	
Model 2				.38				.31
PI	−.17	.051	.01		.02	.641	.00	
PD	.00	.999	.00		.00	.997	.00	
NB	.19	.036	.01		.17	.003	.02	
FB	.01	.876	.00		−.08	.137	.01	
FRB	−.12	.069	.01		.02	.648	.00	
Bio Concern	.28	.000	.04		.16	.019	.01	
Alt Concern	.15	.009	.02		.09	.114	.01	
Ego Concern	−.05	.382	.00		−.07	.220	.00	
Bio Value	.31	.000	.05		.31	.000	.05	
Alt Value	−.03	.546	.00		.01	.874	.00	
Ego Value	−.05	.369	.00		.01	.912	.00	
DV: Env Concern								
Model 1				.10				.10
PI	.05	.523	.00		.13	.004	.02	
PD	.01	.820	.00		.07	.115	.00	
NB	.21	.002	.02		.24	.000	.06	
FB	.13	.008	.01		.01	.812	.00	
FRB	−.01	.883	.00		.14	.001	.02	
Model 2				.41				.46
PI	−.07	.251	.00		.05	.127	.00	
PD	.07	.200	.00		.07	.030	.01	
NB	.07	.233	.00		.00	.940	.00	
FB	.15	.000	.02		.07	.048	.00	
FRB	−.02	.692	.00		.08	.027	.01	
Bio Value	.48	.000	.20		.46	.000	.17	
Alt Value	.30	.000	.09		.44	.000	.18	
Ego Value	.16	.000	.02		.19	.000	.03	

Note: PI = Place identity, PD = Place dependence, NB = Nature bonding, FB = Family bonding and FrB = Friend bonding.

We used multiple mediation analysis to test the effect of altruistic values on altruistic concerns through five dimensions of place attachment. No dimensions of place attachment were significant mediators of this relationship in the Northern and Yorke and SAMDB regions ($Z < 1.70$, $p > .05$).

We then examined the effect of egoistic values on egoistic concerns through five dimensions of place attachment. Both family bonding and friend bonding were significant mediators of this relationship in the Northern and Yorke region ($Z > 2.01$, $p < .05$; zero was not contained in the confidence interval), but these dimensions of place attachment were not significant mediators of the relationship between egoistic values and egoistic concerns in the SAMDB region ($Z < 1.90$, $p > .05$).

3.5. Comparing the explanatory power of base and expanded behaviour models

In support of hypothesis four, the expanded model explained a larger amount of the variance in self-reports of native vegetation planting than the base model in the SAMDB region ($R^2 = .22$ vs. .11) and Northern and Yorke region ($R^2 = .11$ vs. .08) when controlling for all variables preceding behaviour in the causal chains.

In both regions, the explanatory power of the behavioural models increased when the independent variables were regressed on planting intention rather than self-reports of self-reported planting behaviour. In the SAMDB region, variance in the base model increased from 11% to 14%. In the Northern and Yorke region, the base model increased from 8% to 19% and the expanded model increased from 11% to 27%.

4. Discussion

The aim of this study was to examine the influence of place attachment on a model of pro-environmental behaviour which included variables from VBN theory. To address this aim, we developed and tested a base model of pro-environmental behaviour which included variables from VBN theory and then compared it with an expanded model which included these variables and place attachment. This section discusses the outcomes of the tests of four hypotheses and then presents theory and policy implications for encouraging conservation practices on private farmland.

We did not find support for hypothesis one that place identity and place dependence will be significant predictors of AC. It is possible that length of residence, farm economic factors and primary production attitudes may be confounding relationships between identification with and dependence on the NRM region and AC of native vegetation conservation.

We found partial support for hypothesis two that family bonding and friend bonding will be significant predictors of AC. Family bonding was a significant negative predictor of AC in the Northern and Yorke region, but not in the SAMDB region. Friend bonding was not a significant predictor of AC in either region after we applied a Bonferroni correction. These results suggest that strong bonds with family may be influencing AC of native vegetation conservation. The dominant influencers within family may be more aware of consequences of actions on the primary production enterprise rather than the natural resource base, and these priorities may be instilled in family members from an early age. These results provide a small signal about the linkage between place attachment and social representations as theorised by Devine-Wright et al. (Devine-Wright, 2009; Devine-Wright & Howes, 2010; Walker et al., 2010). The signal may have been confounded by the social norms of farming families, particularly injunctive norms about the need to use the land for primary production purposes rather than conservation purposes. Future studies could consider the influence of both place attachment and norm focus theories on the conservation of native vegetation.

Nature bonding was the strongest and most consistent predictor of the antecedents of behaviour. In support of hypothesis three, it was a significant mediator of the relationship between biospheric values and biospheric concerns. It was also a significant predictor of both PN and AC in both study regions. These findings offer further support for Schultz's (2001) inclusion theory which suggests that those individuals who are strongly connected to nature are more likely to express concerns about the consequences to all living things. We also found that the more a landholder is connected to nature, the more likely he/she will be aware of the positive and negative consequences associated with the conservation of native vegetation and will be more likely to hold PN in support of the conservation of native vegetation. This finding provides a logical extension to both inclusion and VBN models. Norms are not only activated by AC, but also the extent to which an individual is connected to the natural environment.

Despite the low explanatory power of both models, the expanded model is a stronger predictor of the planting of native vegetation than the base model, providing support for hypothesis four. The expanded model explained twice the amount of variance in native vegetation planting in the SAMDB region than the base model when controlling for all variables preceding behaviour in each causal chain (22% vs. 11%) and 1.5 times the amount of variance in the Northern and Yorke region (11% vs. 8%). Further, the expanded model explained a greater amount of variance in intention to plant native vegetation in both regions than the base model. Our results also reveal that place attachment has a stronger influence on the antecedents of behaviour compared with the behaviour itself. We therefore encourage more studies to focus on the direct and indirect relationships of place attachment on the antecedents of behaviour, including VBN variables, within different natural resource and cultural contexts.

Both base and expanded models tested in this study explained a smaller amount of the variance in pro-environmental behaviour (<22%) than VBN theory models tested in previous studies. Steg et al., (2005) found that VBN theory explained 29% of acceptability judgements of environmental policies regarding energy, whereas Kaiser Hubner, and Bogner (2005) found that VBN theory explained 48% of the variance in a composite measure of general ecological behaviour, including items such as recycling and composting, energy and water conservation, and political activism. The types of behaviours being measured may explain these differences. The planting of native vegetation on private farmland, as measured in this study, is an example of a high-cost behaviour because assigning land to conservation results in a reduction in the amount of land available for commercial production. For example, each hectare of land converted to conservation leads to a reduction of approximately AUD $264 of market return from wheat per season in the Northern and Yorke region of South Australia (based on figures derived from Hooper, Levantis, & Formosa, 2011), without consideration of foregone opportunity costs associated with land reallocation or the costs associated with planting and maintenance of native seedlings. In contrast, acceptability judgements of environmental policy, recycling, composting, energy and water conservation are all low-cost behaviours because they only have a low economic impact on the enterprise or individual. Future studies could empirically compare the effect of VBN theory on multiple forms of low-cost and high-cost pro-environmental behaviour within the one study to provide added support for the hypothesis that VBN is a stronger explainer of low-cost than high-cost behaviour.

In both the base and expanded models, intention to plant native vegetation was not a significant predictor of self-reported planting. This finding conflicts with other expanded models of pro-environmental behaviour which suggest that behavioural intention directly effects behaviour (e.g., Halpenny, 2010; Milfont, Duckitt, & Wagner, 2010). Further, PN were a significant predictor of intention but not self-reported behaviour in both study areas. We therefore express reservations about empirical studies which solely focus on the direct and indirect effects of values, beliefs and norms on intention to act. If the goal is to effect long-term behavioural change, more studies need to consider the influence of moral and normative concerns on self-reported measures of behaviour. Steg and Vlek (2009) also encourage the collection of valid and reliable measures of self-reported behaviour and a systematic examination of this behaviour within multiple applied settings.

No dimension of place attachment was a significant predictor of intention to plant native vegetation or self-reported planting when controlling for all variables in the expanded model causal chain, with the exception of family bonding which was a significant negative predictor of self-reported planting behaviour in the SAMDB region. These results conflict with previous studies which found modest positive relationships between place identity and behavioural intention, and place dependence and behavioural intention (e.g., Stedman, 2002; Vaske & Kobrin, 2001). The geographical and economic contexts of the study may partially explain the small effect of place attachment on pro-environmental behaviour. Previous studies of place attachment and behaviour have largely focussed on leisure, wilderness or rural settings where individuals are responding to a 'threat' to place compared with behaviour that is responding to future 'improvement' of place. The planting of native vegetation is about improving place, not reducing threat to place. Further, previous studies have largely focussed on place attachment and behaviour dynamics in settings whereby there is no evident resource or monetary cost associated with the pro-environmental behaviour, but economic and resource constraints are a reality in primary production settings. Future research could examine the influence of economic and moral and normative factors on the planting of native vegetation on private farmland. We suggest that the Theory of Planned Behaviour (TPB) may be a more suitable model for the consideration of economic factors because it posits that individuals adopt behaviours based on a rational evaluation of behavioural consequences, including their economics costs and benefits (see Bamberg & Moser, 2007). We

encourage researchers to compare the explanatory power of a model of pro-environmental behaviour including variables from VBN theory and a model including variables from TPB theory to systematically understand the relative contribution of moral and normative concerns and economic factors to the planting of native vegetation on private farmland.

4.1. Policy implications

This study has shown that place attachment has an important role in understanding pro-environmental behaviour on private land. The nature bonding dimension of place attachment was consistently the strongest predictor of biospheric concerns, awareness of consequences (AC) and personal norms (PN) related to native vegetation conservation. Time spent in nature was also strongly positively associated with these nature bonds. Hence, environmental policies and programs which increase the amount of time spent in the natural environment, including nature-based experiences coupled with environmental interpretation, are likely to strengthen nature bonds, as well as biospheric concerns, AC and PN among landholders. We suggest that these policies will be most effective for hobby farmers (rural landholders who do not rely on the farm as a primary source of income) considering the costs associated with native vegetation conservation are lower for this sub-group. To effect long-term behaviour change among hobby farmers, it is recommended that environmental policy makers promote the recreational and restorative benefits of both spending time in natural areas and conserving native vegetation when developing agri-environmental schemes. Policies targeting the recreational and restorative benefits of native vegetation conservation could complement existing policies targeted at farm income support and sustainable agriculture.

Conversely, this study revealed a negative relationship between family bonds and the planting of native vegetation in the SAMDB region. The stronger these bonds, the less planting of native vegetation by rural landholders. One possible reason is that family members hold strong personal norms related to the need to use the land for primary production over native vegetation conservation. To effect long-term behaviour change among rural landholders, it is recommended that policy makers develop and apply instruments which activate personal norms. We suggest that these policies will be most effective for commercial farmers (rural landholders who rely on the farm as a primary source of income) considering the strong negative relationships between family bonding and behaviour for this sub-group. Raymond and Brown (2011) indicated that mentoring schemes need to be targeted at commercial farmers moderately engaged in the planting of native vegetation considering the potential for increasing the planting of native vegetation on their properties. Such schemes need to recognise the achievements of commercial farmers highly engaged in the planting of native vegetation and provide opportunities for them to communicate the production, habitat and restoration benefits of native vegetation conservation to other classes of landholders.

4.2. Limitations

This study has some limitations. Both models presented in this study do not consider all the variables included in the VBN causal chain. We therefore cannot make inferences about the explanatory power of the VBN model compared with the models presented here. Both studies were undertaken in rural and natural settings and therefore results are not generalisable to other land-use contexts, including urban and recreational contexts. Future studies could apply the two models presented here in multiple cultural and land-use settings. We also acknowledge that we are measuring regional attachments to place, rather than farm-scale attachments. It is possible that the scale of measurement of place attachment may influence the results, with attachments at the farm scale being stronger than the regional scale. Future studies could examine the strength of the relationships between place attachment and behaviour at different scales of measurement. The results presented here may not be generalisable to other settings. Place attachment is an inherently contextual variable. Previous studies show positive relationships between place attachment and behaviour, but we have found no significant effects, which may relate to the primary production focus.

5. Conclusion

The direct and indirect effects of place attachment on pro-environmental behaviour and variables from VBN theory were not large in two rural farming contexts, but they were statistically significant and warrant further examination because the potential environmental benefits are globally significant. Moral and normative concerns, as expressed in the base model, were also not powerful explainers of on-farm planting of native vegetation, suggesting other factors may be contributing to planting decisions by rural landholders on South Australian farms. We encourage researchers to combine place attachment, moral and normative concerns as well as economic and farm characteristics within future models of pro-environmental behaviour within primary production settings.

Acknowledgements

Christopher Raymond acknowledges the generous financial support provided by Jean Pearce.

Funding for this project was provided by the Centre for Rural Health and Community Development, University of South Australia, South Australian Murray-Darling Basin Natural Resources Management Board and the Northern and Yorke Natural Resources Management Board.

References

Altman, L. A., & Low, S. M. (1992). *Place attachment*. New York: Plenum.

Australian Bureau of Statistics. (2006). *ABS census population and housing*. Canberra: Author. Retrieved 14th May, 2010.

Australian National Audit Office. (2008). *Regional delivery model for the natural heritage trust and the national action plan for salinity and water quality*. Canberra: ANAO. Audit Report No.21 2007–08.

Bamberg, S., & Moser, G. (2007). Twenty years after Hines, Hungerford, and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behaviour. *Journal of Environmental Psychology, 27*(1), 14–25.

Bamberg, S., & Schmidt, P. (2003). Incentives, morality or habit? Predicting students' car use for university routes with the models of Ajzen, Schwartz and Triandis. *Environment and Behavior, 35*(2), 264–285.

Bardi, A., & Schwartz, S. H. (2003). Values and behaviour: Strength and structure of relations. *Personality and Social Psychology Bulletin, 29*(10), 1207–1220.

Baylis, K., Peplow, S., Rausser, G., & Simon, L. (2008). Agri-environmental policies in the EU and United States: A comparison. *Ecological Economics, 65*(4), 753–764.

Bieling, C., & Plieninger, T. (2003). 'Stinking, disease-spreading brutes' or 'four-legged landscape managers'? Livestock, pastoralism and society in Germany and the USA. *Outlook on Agriculture, 32*(1), 7–12.

Black, J. S., Stern, P. C., & Elworth, J. T. (1985). Personal and contextual influences on household energy adaptations. *Journal of Applied Psychology, 70*(1), 3–21.

Brehm, J. M. (2007). Community attachment: The complexity and consequence of the natural environment facet. *Human Ecology, 35*(4), 477–488. doi:10.1007/s10745-006-9104-3.

Brehm, J. M., Eisenhauer, B. W., & Krannich, R. S. (2006). Community attachments as predictors of local environmental concern: The case for multiple dimensions of attachment. *American Behavioural Scientist, 50*(2), 142–165.

Bricker, K. S., & Kerstetter, D. L. (2000). Level of specialization and place attachment: An exploratory study of whitewater recreationists. *Leisure Sciences, 22*, 233–257.

Buller, H., Wilson, G. A., & Höll, A. (2000). *Agri-environmental policy in the European Union*. Aldershot: Ashgate.

Clayton, S. (2003). Environmental identity: A conceptual and an operational definition. In S.Clayton., & S. Opotow. (Eds.), *Identity and the natural environment* (pp. 45–66). Massachusetts: Massachusetts Institute of Technology.
Cohen, A. P. (1985). The symbolic construction of community. In P. Hamilton (Ed.), *Key ideas series (Open University)*. Milton Keynes: Routledge.
Corraliza, J. A., & Berenguer, J. (2000). Environmental values, beliefs, and actions – A situational approach. *Environment and Behavior, 32*(6), 832–848.
Curtis, A., McDonald, S., Mendham, E., & Sample, R. (2008). *Understanding the social drivers for natural resource management in the Wimmera region*. Report No. 46. Albury: Institute for Land Water and Society, Charles Sturt University.
Department for Environment and Heritage, DEH. (2009). *Plans for biodiversity conservation - Regional biodiversity plans. Biodiversity plan for the South Australian Murray-Darling Basin*. Retrieved 7 November 2009.
Devine-Wright, P. (2009). Rethinking NIMBYism: The role of place attachment and place identity in explaining place-protective action. *Journal of Community & Applied Social Psychology, 19*(6), 426–441.
Devine-Wright, P., & Howes, Y. (2010). Disruption to place attachment and the protection of restorative environments: A wind energy case study. *Journal of Environmental Psychology, 30*(3), 271–280.
Dietz, T., Fitzgerald, A., & Shwom, R. (2005). Environmental values. *Annual Review of Environment and Resources, 30*, 335–372.
Dillman, D. (2007). *Mail and internet surveys: The tailored design method* (2nd ed.). New Jersey: John Wiley and Sons.
Dominy, M. (2001). *Calling the station home: Place and identity in New Zealand's high country*. Lanham: Rowman and Littlefield Publishers.
Dunlap, R. E., & Van Liere, K. D. (1978). The New Environmental Paradigm: A proposed measuring instrument and preliminary results. *Journal of Environmental Education, 9*(4), 10–19.
Dunlap, R. E., Van Liere, K. D., Mertig, A. G., & Jones, R. E. (2000). Measuring endorsement of the New Ecological Paradigm: A revised NEP scale. *Journal of Social Issues, 56*(3), 425–442.
Dutcher, D. D., Finley, J. C., Luloff, A. E., & Johnson, J. B. (2007). Connectivity with nature as a measure of environmental values. *Environment and Behavior, 39*(4), 474–493.
Feehan, J., Gillmor, D. A., & Culleton, N. (2005). Effects of an agri-environment scheme on farmland biodiversity in Ireland. *Agriculture, Ecosystems & Environment, 107*(2–3), 275–286.
Gärling, T., Fujii, S., Gärling, A., & Jakobsson, C. (2003). Moderating effects of social value orientation on determinants of pro-environmental behavior intentions. *Journal of Environmental Psychology, 23*(1), 1–9.
Gosling, E., & Williams, K. J. H. (2010). Connectedness to nature, place attachment and pro-environmental behaviour: Testing connectedness theory among farmers. *Journal of Environmental Psychology*, 1–7.
de Groot, J. I. M., & Steg, L. (2007). Value orientations and environmental beliefs in five countries: Validity of an instrument to measure egoistic, altruistic and biospheric value orientations. *Journal of Cross-Cultural Psychology, 38*, 318–332.
de Groot, J. I. M., & Steg, L. (2008). Value orientations to explain beliefs related to environmental significant behaviour: How to measure egoistic, altruistic and biospheric value orientations. *Environment and Behaviour, 40*(3), 330–354.
Guttman, L. (1952). Multiple group methods for common-factor analysis: Their basis, computation and interpretation. *Psychometrika, 17*, 209–222.
Halpenny, E. A. (2010). Pro-environmental behaviours and park visitors: The effect of place attachment. *Journal of Environmental Psychology, 30*(4), 409–421.
Hansla, A., Gamble, A., Juliusson, A., & Garling, T. (2008). The relationships between awareness of consequences, environmental concern, and value orientations. *Journal of Environmental Psychology, 28*(1), 1–9. doi:10.1016/j.jenvp.2007.08.004.
Harland, P., Staats, H., & Wilke, H. A. M. (2007). Situational and personality factors as direct or personal norm mediated predictors of pro-environmental behavior: Questions derived from norm-activation theory. *Basic and Applied Social Psychology, 29*(4), 323–334.
Herzon, I., & Mikk, M. (2007). Farmers' perceptions of biodiversity and their willingness to enhance it through agri-environment schemes: A comparative study from Estonia and Finland. *Journal for Nature Conservation, 15*(1), 10–25.
Hooper, S., Levantis, C., & Formosa, T. (2011). *Physical and financial performance benchmarks for grain producing farms, South Australia mid-north – Lower Yorke and Eyre agroecological zone*. Canberra: ABARES Report Prepared for the Grains Research and Development Corporation.
Hummon, D. M. (1992). Community attachment: Local sentiment and sense of place. *Human Behavior & Environment: Advances in Theory & Research, 12*, 253–278.
Kaiser, F. G., Hubner, G., & Bogner, F. X. (2005). Contrasting the theory of planned behavior with the value-belief-norm model in explaining conservation behavior. *Journal of Applied Social Psychology, 35*(10), 2150–2170.
Kals, E., Schumacher, D., & Montada, L. (1999). Emotional affinity toward nature as a motivational basis to protect nature. *Environment and Behaviour, 31*, 178–202.
Kasarda, J., & Janowitz, M. (1974). Community attachment in mass society. *American Sociological Review, 39*, 328–339.
Kleijn, D., Berendse, F., Smit, R., & Gilissen, N. (2001). Agri-environment schemes do not effectively protect biodiversity in Dutch agricultural landscapes. *Nature, 413*(6857), 723–725, [10.1038/35099540].
Kyle, G. T., Absher, J. D., & Graefe, A. R. (2003). The moderating role of place attachment on the relationship between attitudes toward fees and spending preferences. *Leisure Sciences, 25*(1), 33–50.
Kyle, G. T., Theodori, G. L., Absher, J. D., & Jun, J. (2010). The influence of home and community attachment on firewise behavior. *Society & Natural Resources, 23*(11), 1075–1092. doi:10.1080/08941920902724974.
Lockwood, M., Davidson, J., Curtis, A., Stratford, E., & Griffith, R. (2009). Multi-level environmental Governance: Lessons from Australian natural resource management. *Australian Geographer, 40*(2), 169–186.
MacDonald, D. W., & Johnson, P. J. (2000). Farmers and the custody of the countryside: Trends in loss and conservation of non-productive habitats 1981–1998. *Biological Conservation, 94*(2), 221–234.
McCarty, J. A., & Shrum, L. J. (1994). The recycling of solid wastes: Personal values, value orientations, and attitudes about recycling as antecedents of recycling behavior. *Journal of Business Research, 30*(1), 53–62.
Matarrita-Cascante, D., Stedman, R., & Luloff, A. E. (2010). Permanent and seasonal residents' community attachment in natural amenity-rich areas: Exploring the contribution of community and landscape-based factors. *Environment and Behavior, 42*(2), 197–220.
Mayer, F. S., & Frantz, C. M. (2004). The connectedness to nature scale: A measure of individuals' feeling in community with nature. *Journal of Environmental Psychology, 24*(4), 503–515. doi:10.1016/j.jenvp.2004.10.001.
Mesch, G. S., & Manor, G. (1998). Social ties, environmental perception, and local attachment. *Environment and Behaviour, 30*(4), 504–519.
Milfont, T. L., Duckitt, J., & Wagner, C. (2010). A cross-cultural test of value-attitude-behaviour hierarchy. *Journal of Applied Social Psychology, 40*(11), 2791–2813.
Milligan, M. J. (1998). Interactional past and potential: The social construction of place attachment. *Symbolic Interactionism, 21*, 1–33.
Moore, R. L., & Graefe, A. R. (1994). Attachments to recreation settings: The case of rail-trail users. *Leisure Sciences, 16*(1), 17–31.
Moscovici, S. (2000). *Social representations: Explorations in social psychology*. London: Polity Press.
Nordlund, A. M., & Garvill, J. (2002). Value structures behind proenvironmental behavior. *Environment and Behavior, 34*(6), 740–756.
Northern and Yorke Natural Resources Management Board. (2009). Northern and Yorke natural resources management plan. In. *State of the region report, Vol. A*. Adelaide: Northern and Yorke Natural Resources Management Board.
Nunnally, J. C. (1978). In *Psychometric theory* (2nd ed.). New York: McGraw-Hill.
Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behaviour Research Methods, 40*(3), 879–891.
Proshansky, H. M., Fabian, A. K., & Kaminoff, R. (1983). Place-identity: Physical world socialization of the self. *Journal of Environmental Psychology, 3*(1), 57–83.
Raymond, C. M., & Brown, G. (2011). Assessing conservation opportunity on private land: Socio-economic, behavioural, and spatial dimensions. *Journal of Environmental Management, 92*(10), 2513–2523.
Raymond, C. M., Brown, G., & Weber, D. (2010). The measurement of place attachment: Personal, community, and environmental connections. *Journal of Environmental Psychology, 30*, 422–434.
Ryan, A., & Spash, C. L. (2008). *Measuring awareness of environmental consequences: Two scales and two interpretations. Socio-economics and environment in discussion (SEED) working papers*. Canberra, Australia: Commonwealth Scientific and Industrial Research Organisation (CSIRO).
Sampson, K., & Goodrich, C. (2005). 'We're coasters, why should we move? Community identity, place attachment and forestry closure in rural New Zealand. *Sites: A Journal of Social Anthropology and Cultural Studies, New Series, 2*(1), 124–149.
Scannell, L., & Gifford, R. (2010a). Defining place attachment: A tripartite organizing framework. *Journal of Environmental Psychology, 30*(1), 1–10.
Scannell, L., & Gifford, R. (2010b). The relations between natural and civic place attachment and pro-environmental behaviour. *Journal of Environmental Psychology, 30*(3), 289–297.
Schmitzberger, I., Wrbka, T., Steurer, B., Aschenbrenner, G., Peterseil, J., & Zechmeister, H. G. (2005). How farming styles influence biodiversity maintenance in Austrian agricultural landscapes. *Agriculture, Ecosystems and Environment, 108*(3), 274–290.
Schreyer, R., Jacob, G., & White, R. (1981). Environmental meaning as a determinant of spatial behaviour in recreation. In *Paper presented at the Proceedings of Applied Geography Conference*.
Schultz, P. W. (2000). Empathizing with nature: The effects of perspective taking on concern for environmental issues. *Journal of Social Issues, 56*(3), 391–406.
Schultz, P. W. (2001). The structure of environmental concern: Concern for self, other people, and the biosphere. *Journal of Environmental Psychology, 21*(4), 327–339.
Schultz, P. W., Gouveia, V., Cameron, L., Tankha, G., Schmuck, P., & Franek, M. (2005). Values and their relationship to environmental concern and pro-environmental behaviour. *Journal of Cross-Cultural Psychology, 36*, 457–475.
Schultz, P. W., Shriver, C., Tabanico, J. J., & Khazian, A. M. (2004). Implicit connections with nature. *Journal of Environmental Psychology, 24*(1), 31–42.
Schwartz, S. H. (1994). Are there universal aspects in the structure and contents of human values? *Journal of Social Issues, 50*(4), 19–45.
Seabrook, L., McAlpine, C., & Fensham, R. (2008). What influences farmers to keep trees? A case study from the Brigalow Belt, Queensland, Australia. *Landscape and Urban Planning, 84*, 266–281.
Snelgar, R. S. (2006). Egoistic, altruistic, and biospheric environmental concerns: Measurement and structure. *Journal of Environmental Psychology, 26*(2), 87–99.
South Australian Murray-Darling Basin NRM Board. (2009). *State of the region report, Vol. B*. Adelaide: SAMDB NRM Board.
Stedman, R. C. (2002). Toward a psychology of place: Predicting behaviour from place-based cognitions, attitude, and identity. *Environment and Behaviour, 34*(5), 561–581.
Steg, L., Dreijerink, L., & Abrahamse, W. (2005). Factors influencing the acceptability of energy policies: A test of VBN theory. *Journal of Environmental Psychology, 25*(4), 415–425.

Steg, L., & de Groot, J. (2010). Explaining prosocial intentions: Testing causal relationships in the norm activation model. *British Journal of Social Psychology, 49*(4), 725–743. doi:10.1348/014466609x477745.

Steg, L., & Vlek, C. (2009). Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of Environmental Psychology, 29*(3), 309–317.

Stern, P. C., & Dietz, T. (1994). The value basis of environmental concern. *Journal of Social Issues, 50*(3), 65–84.

Stern, P. C., Dietz, T., Abel, T., Guagnano, G., & Kalof, L. (1999). A value-belief-norm theory of support for social movements: The case of environmental concern. *Human Ecology Review, 6*(2), 81–97.

Stern, P. C., Dietz, T., & Guagnano, G. A. (1995). The new ecological paradigm in social-psychological context. *Environment and Behaviour, 27*(6), 723–743.

Stern, P. C., Dietz, T., & Kalof, L. (1993). Value orientation, gender, and environmental concern. *Environment and Behavior, 25*(3), 322–348.

Stern, P. C., Dietz, T., Kalof, L., & Guagnano, G. A. (1995). Values, beliefs, and pro-environmental action: Attitude formation toward emergent attitude objects. *Journal of Applied Social Psychology, 25*(18), 1611–1636.

Ten Berge, J. M. F. (1986). Rotation to perfect congruence and the cross-validation of components weights across populations. *Multivariate Behavioural Research, 21*, 41–64.

Vaske, J. J., & Kobrin, K. C. (2001). Place attachment and environmentally responsible behaviour. *Journal of Environmental Education, 32*(4), 16.

Vorkinn, M., & Riese, H. (2001). Environmental concern in a local context: The significance of place attachment. *Environment and Behaviour, 33*(2), 249–263.

Walker, G. J., & Chapman, R. (2003). Thinking like a park: The effects of sense of place, perspective-taking, and empathy on pro-environmental intentions. *Journal of Park and Recreation Administration, 21*(4), 71–86.

Walker, G., Devine-Wright, P., Hunter, S., High, H., & Evans, B. (2010). Trust and community: Exploring the meanings, contexts and dynamics of community renewable energy. *Energy Policy, 38*(6), 2655–2663.

Willock, J., Deary, I. J., Edwards-Jones, G., Gibson, G. J., McGregor, M. J., Sutherland, A., et al. (1999). The role of attitudes and objectives in farmer decision making: Business and environmentally-oriented behaviour in Scotland. *Journal of Agricultural Economics, 50*(2), 286–303.

Wilson, G. A., & Hart, K. (2000). Financial imperative or conservation concern? EU farmers' motivations for participation in voluntary agri-environmental schemes. *Environment and Planning A, 32*(12), 2161–2185.

Williams, D. R., Patterson, M. E., Roggenbuck, J. W., & Watson, A. E. (1992). Beyond the commodity metaphor: Examining emotional and symbolic attachment to place. *Leisure Sciences, 14*, 29–46.