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The relationship between place attachment and landscape values: Toward mapping place attachment

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Abstract

This paper examines the relationships between place attachment and landscape values using two measures of place attachment—a psychometric, scale-based measure [Williams, D. R., & Vaske, J. J. (2003). The measurement of place attachment: Validity and generalisability of a psychometric approach. *Forest Science*, *49*(6), 830–840] and a map-based measure derived from mapped special places [Brown, G. (2005). Mapping spatial attributes in survey research for natural resource management: Methods and applications. *Society and Natural Resources*, *18*(1), 17–39]. We first examine the external validity of a two-dimensional, psychometric place attachment scale in Australia and its relationship with place-based landscape values. The place attachment scale and landscape value measures were included in a mail survey of residents and visitors to the Otways region (Victoria, Australia). Exploratory factor analysis of resident subgroups and visitors demonstrate the place attachment scale consists of two dimensions with high reliability. We use regression analysis to show that landscape importance values, especially spiritual and wilderness values, are significant predictors of the scale-based measure of place attachment. We then examine the relationship between a map-based measure of place attachment and landscape values. We use spatial cross-correlation and regression analyses to show that aesthetic, recreation, economic, spiritual, and therapeutic values spatially co-locate with special places and thus likely contribute to place attachment. We argue that survey mapping of landscape values and special places provides a reasonable proxy for scale-based measures of place attachment while providing richer, place-based information for land use planning. We conclude by introducing the concept of a map-based place attachment index and suggest that

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survey-based measures of landscape values and special places can be used to assess the risk associated with landscape modification. We provide a map showing one possible place attachment index for the Otways region and discuss its potential application.
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Keywords: Local values; Participatory GIS; Place attachment; Scale development; Sense of place

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Introduction

The emergence of ecosystem management has demanded a new way of valuing natural resources (Manzo, 2003) which accounts for the values people associate with places or landscapes (Brown, 2005; Williams & Patterson, 1996), and the personal bonds people form with them (Williams & Vaske, 2003). Sense of place has been the focus of studies in the geographical sciences (Kaltenborn & Williams, 2002) and refers to the attachment or emotional bond people have with place (Altman & Low, 1992; Williams & Stewart, 1998) or the meaning one attributes to such areas (Fishwick & Vining, 1992; Kaltenborn, 1998; Relph, 1976; Stedman, 2003). According to Williams and Vaske (2003), place attachment is the environmental psychologist's equivalent of the geographer's sense of place. When used broadly, it refers to the positive emotional bonds that develop between individuals and their environment (Altman & Low, 1992; Moore & Graefe, 1994; Williams, Patterson, Roggenbuck, & Watson, 1992).

Williams and Vaske (2003) suggest that place bonds can be systematically identified and measured using a two-dimensional scale of place attachment based on place identity and place dependence. Place identity refers to the mixture of feelings about specific physical settings (Proshansky, Fabian, & Kaminoff, 1983) including how these settings provide meaning and purpose to life (Giuliani & Feldman, 1993; Shamai, 1991; Williams & Roggenbuck, 1989). Place dependence refers to connections based specifically on activities that take place in a setting, reflecting the importance of a place in providing conditions that support an intended use (Schreyer, Jacob, & White, 1981), such as timber harvesting or horse-riding, as well as the ability for the area to adequately provide for that use (Jacob & Schreyer, 1980). Kyle and colleagues (Kyle, Absher, & Graefe, 2003; Kyle, Graefe, Manning, & Bacon, 2004) have applied both place identity and place dependence measures and found that they were suitable predictors of resource conflicts, such as attitudes towards fee programs and overcrowding on public lands.

While these scales are useful in predicting resource conflicts, there is a need to develop analytic tools that can address the geographic dimensions of place more directly (Dixon & Durrheim, 2000; Stedman, 2003). Research from the Lake District of Northern Wisconsin (US) demonstrated that landscape attributes were important to constructed meanings, and that these meanings were not exclusively social (Stedman, 2003). Brown (2005) developed a survey methodology for measuring and linking place bonds with biophysical landscape characteristics by having respondents place coded landscape values on a map of the study region. The methodology was modified in more recent trials to include a map-based measure of place attachment that allows survey participants to identify up to six "special place" locations in the region of study. Building on work by Brown and others, Black and Liljeblad (2006) developed a methodology for integrating qualitative descriptors of place values with spatially referenced "special area" polygons. Passages from transcribed interviews were coded into social setting, activity, social attachment and biophysical setting categories and then spatially joined to the special area polygons identified by interviewees.

One unexamined aspect of Brown's spatial mapping approach is the identification of landscape values that are the most effective predictors of place identity and place dependence. Can mapped landscape values and special places be used to proxy for scale-based measures of place attachment, and if so, are there advantages to using landscape values to measure place attachment?

There are five specific research objectives for this study: (1) to determine if place identity and place dependence emerge as distinct constructs in Australia; (2) to examine the relationships between independent (respondent) variables and place attachment; (3) to determine which landscape values are most predictive of scale-based measures of place identity and place dependence; (4) to explore the relationship between map-based place attachment (special places) and landscape values; and (5) introduce the concept of a map-based place attachment index that can be generated from landscape value and special place data to aid in the assessment of the risks associated with landscape modification.

The concept of place

In geography, the concept of place serves as a unit of analysis for integrating natural and social science concepts of the environment (Patterson & Williams, 2005; Sack, 1997). Early qualitative studies argued that sense of place was dependent on the depth of experience with settings (Tuan, 1980) and social relationships with settings (Relph, 1976). Relph developed an 'insideness' scale which reflected knowledge of the physical details of place, sense of connection with a community, and a personal connection with place. One limitation with these studies is that they have a tendency to emphasize the individualistic dimensions of place (Dixon & Durrheim, 2000), obscuring the collective nature of relations between people, identities, and their environments.

Studies have progressed to place related meanings and the ways in which these meanings can be applied to ecosystem management (Kaltenborn, 1998; Williams & Patterson, 1996; Williams & Stewart, 1998). Environmental problems affect environmental meanings including inherent (aesthetic) meanings, instrumental (goal-directed) meanings, cultural (symbolic) meanings, and individual (expressive) meanings (Williams & Patterson, 1996). These meanings influence how people perceive environmental conditions and how they react to environmental effects (Kaltenborn, 1998).

Although sense of place research recognizes a relationship between environmental problems and meanings or values assigned to places, there are no adequate means by which natural area planners can undertake a comprehensive and integrated assessment of an individual's value for natural areas (Winter & Lockwood, 2004). There have been numerous attempts to develop scales that enable an integrated assessment, including various place attachment scales (Bricker & Kerstetter, 2000; Moore & Graefe, 1994; Williams & Roggenbuck, 1989); the New Ecological Paradigm (Dunlap, Van Liere, Mertig, & Jones, 2000); and the Natural Area Value Scale (Winter & Lockwood, 2004). The New Ecological Paradigm scale is a measure of environmental or "ecological" worldview, encompassing environmental attitudes, beliefs, and values, whereas the Natural Area Value Scale measures, distinguishes between, and determines the relative strength of use, non-use, and intrinsic values for nature to guide decision-making in natural areas.

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Williams and Vaske's (2003) place attachment scale is one of the first validated scales to systematically identify and measure meanings (termed place bonds) over a variety of land use settings. It is based on the place attachment constructs of place identity and place dependence. Kyle and colleagues have applied the place identity and dependence constructs to resource management conflicts. Results from a park study in California showed that as place identity increased and the recreationists' attitude toward the fee program became more positive, support for spending fee revenue also increased; however, place dependence contributed little in each of the models examined (Kyle et al., 2003). In contrast, both place identity and dependence were significant predictors of visitor reactions to setting densities along an Appalachian Trail (Kyle et al., 2004). Respondents scoring high on the place identity dimension were more likely to report feeling crowded; however, respondents scoring high on the place dependence dimension were more inclined to have favorable attitudes towards the setting.

We also recognize other researchers consider place attachment as a separate place dimension, to be examined alongside place identity and place dependence (Jorgensen & Stedman, 2006; Stedman, 2002, 2003). But for the purposes of this study, we consider place identity and place dependence to be integral components of place attachment.

Landscape values and place attachment

Brown (2005) developed a landscape values typology that included a mapping component for soliciting place-based meanings that was applied in five separate surveys of the general public in Alaska (Brown, 2003; Brown & Alessa, 2005; Brown, Reed, & Harris, 2002; Brown, Smith, Alessa, & Kliskey, 2004; Reed & Brown, 2003) and two separate surveys in Australia (Brown, 2006; Raymond & Brown, 2006, 2007). In recent versions of the typology, a measure was included allowing the survey participant to identify and map up to six special places using sticker dots. The ability to identify and map landscape values and special places is viewed as an operational bridge between sense of place and place attachment. Findings from the Chugach National Forest (US) planning study suggest that people in communities with strong place attachment are more cohesive, enjoy a higher quality of life, and tend to identify more landscape values and special places near their communities (Brown et al., 2002).

Black and Liljeblad (2006) mapped place attachment by asking interviewees to locate "special areas" using polygons and to explain why each value was important during recorded interviews. This approach seeks to maximize internal validity by focusing on the conceptual foundations of mapped place attachment using a relatively small number of key informant interviews ($n = 15$). This approach is complimentary, but different from Brown's method (2005) that uses a predefined set of generalized landscape values and special places and regional random sampling procedures to achieve a degree of external validity in mapped place attachment to assess the risks associated with landscape modification.

The place attachment concepts embedded in Brown's landscape values and special place approach have not been fully examined. The recent validation of Williams and Vaske's (2003) place attachment scale provides an opportunity to review the relationship between place attachment and the assignment of landscape values and special places. We included their scale items pertaining to place identity and place dependence in a survey of residents and visitors to the Otways region, Victoria, to determine potential

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associations between place identity and place dependence constructs and landscape value mapping.

The inclusion of special place dots in the study survey instrument also provides an opportunity to compare the results of scale-based versus map-based place attachment measures. By map-based measure, we mean the propensity for the survey participant to directly identify up to six special places in the region. Map-based measures of place attachment can provide place-specific information about where the landscape bonds exist. If map-based measures of place attachment can provide both generalized place attachment scores as well as more specific, geographic information about where the intensities of place attachment exist on the landscape, these measures would offer a distinct advantage in land use planning applications.

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Methods

Study area

The Otways region is located in southwest Victoria, Australia, and covers an area of 337,410 ha (VEAC, 2004). We divided the region into the three zones of "coast", "hinterland", and "plains" (Fig. 1). The Otway Coast, the region within 5 km of the coastline, contains a world class driving experience named the Great Ocean Road (GOR).

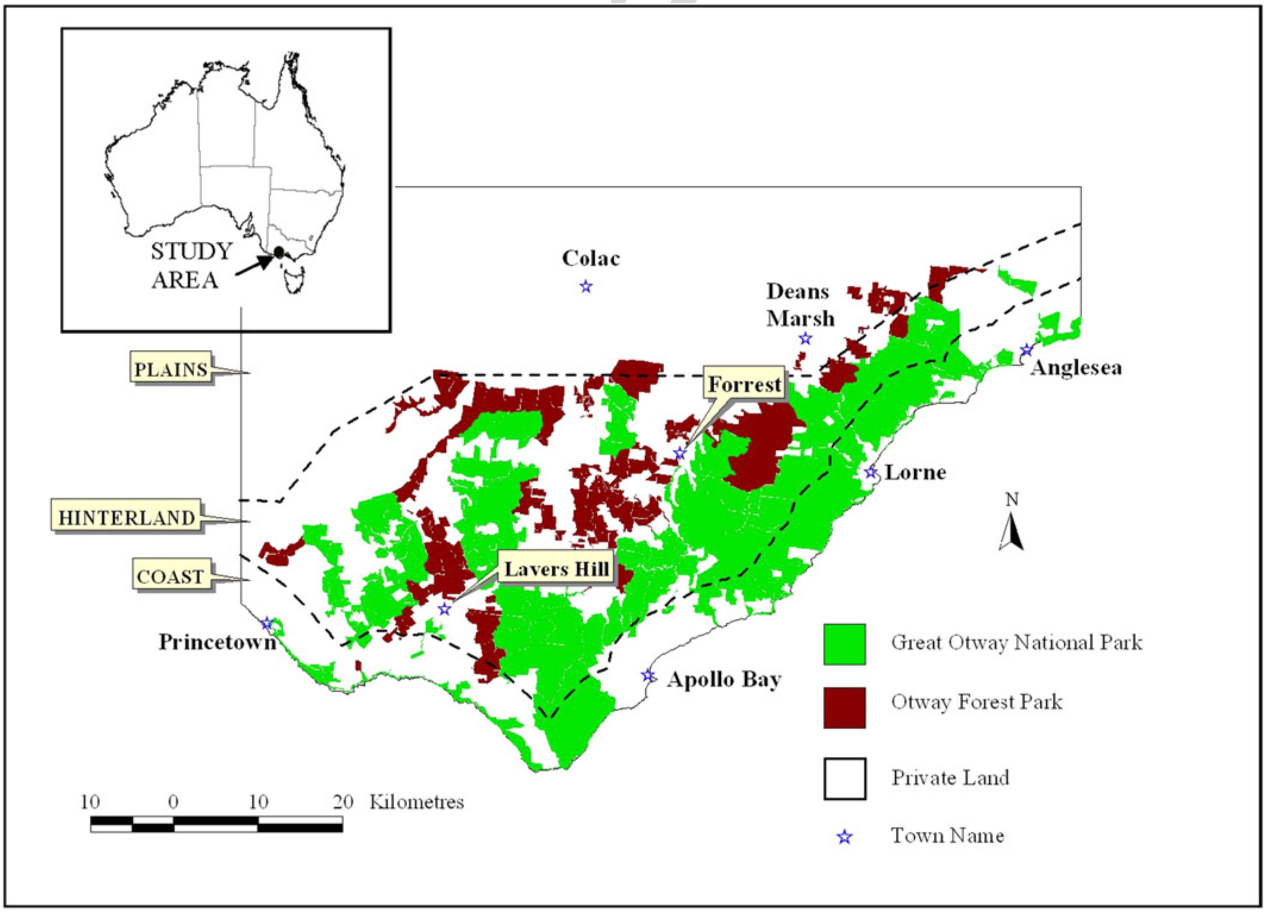

Fig. 1. The Otways region of Victoria, Australia was divided into three study zones: coast, hinterland, and plains.

Over 4.7 million day trips occurred along the GOR in 2002 (Bureau of Tourism Research, 2002), placing extreme pressure on physical infrastructure, particularly within the coastal townships of Lorne and Apollo Bay. Tourism strategies aim to disperse some of the visitor activity into the largely undeveloped Otway Hinterland (DSE, 2005).

The Otway Hinterland broadly contains the mountains and the forests up to 30 km from the coast. Some of the largest trees in the world named *Eucalyptus regnans* inhabit this area. Historically, much of the Otway Hinterland was under state forest ownership and open to clearfelling; however, recent public opposition to the practice led to a commitment by the Victorian Government to double the total area of permanent conservation reserve in the Otways from 49,355 to 101,960 ha. The expanded conservation reserve has been gazetted as the Great Otway National Park in the *National Parks (Otways and Other Amendments) Act (Vic)* 2005. The remaining state forest, recently renamed the Otway Forest Park, is designated for recreational use and minor extractive industries, such as harvesting of tea-tree for garden stakes. Broad scale logging of native forests will cease by 2008.

The remaining low relief lands to the north of the Otway Hinterland are the Otway Plains. This area is the most densely populated region and contains the regional hub of Colac with a strong retail and commercial economy.

Sampling

The study consisted of two phases. Phase one consisted of a survey administered to 1400 residents of the Otways region of Victoria. We collected names and addresses through a systematic random sample of the 2003 electoral roll for the division of Corangamite, Victoria (Australian Electoral Commission, 2003). We then separated the sample into coastal, hinterland, and plains residents according to the regional boundaries identified in Fig. 1. Phase two consisted of a survey administered to 500 visitors, convenience-sampled at the entrance to a tree-top canopy walk named the Otway Fly and a rainforest walk named Maits Rest. Visitors were also sampled in the coastal township of Lorne.

Instrument

Part 1 of the survey instrument consisted of 15 place attachment statements, taken from studies that previously demonstrated good internal consistency (Jorgensen & Stedman, 2001; Williams & Vaske, 2003). We used six scale items to represent place identity and five items to represent place dependence. The scale items were preceded by the following directions: "Below are a set of statements about your attachment to the Otways region. Please indicate your level of agreement or disagreement with each statement". Items were presented on a 5-point Likert scale where "1—Strongly Agree", "5—Strongly Disagree", and "3—Neither Agree or Disagree".

Part 6 of the survey solicited landscape values and special places for the Otways region. We first asked survey participants to place mnemonically coded sticker dots describing 12 landscape values on a 1:125,000 greyscale map of the Otways region (Spatial Vision, 2001). The question was worded: "Find the enclosed Otway map and set of sticker dots. There are 12 sets of dots that identify different values for places in the Otways such as scenic value or recreation value. Stick the dots on the Otway map where you think these values are. These

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dots also have 'importance' ratings from 5 to 50 points. Put the largest scenic dot (e.g., 50a) on the most scenic places, the largest recreation dots (50r) on places with the highest recreation value, and so on with the other value dots. Use as many or few dots as you like.'' Each value was accompanied by a short phrase to communicate its intended meaning (Fig. 2). Respondents were also asked to identify six ''special places'' in the Otways region using sticker dots coded from ''P1'' to ''P6'' and to explain why each of these places were special to them.

The survey also contained several questions that provide an opportunity to explore the criterion-related (predictive) validity of the place attachment scale—the extent to which the scale results are consistent with place attachment concepts. Respondents were asked to identify their length of residence, knowledge of the Otways region, and whether they saw themselves as an advocate for the environment. Questions included: ''About how long have you lived in the Otways region?'' and ''How would you rate your knowledge of places in the Otways?'' The knowledge question was presented on a scale where ''1—Excellent'', ''2—Good'', ''3—Fair'', and ''4—Poor''. The advocacy question asked respondents: ''Do you consider yourself an advocate for the environment?'' on a ''Yes'', ''No'', or ''Somewhat'' scale. Based on place attachment concepts, one would expect individuals with greater knowledge of the region, who have lived in the Otways longer, and with greater concern for the environment to show higher levels of place attachment.

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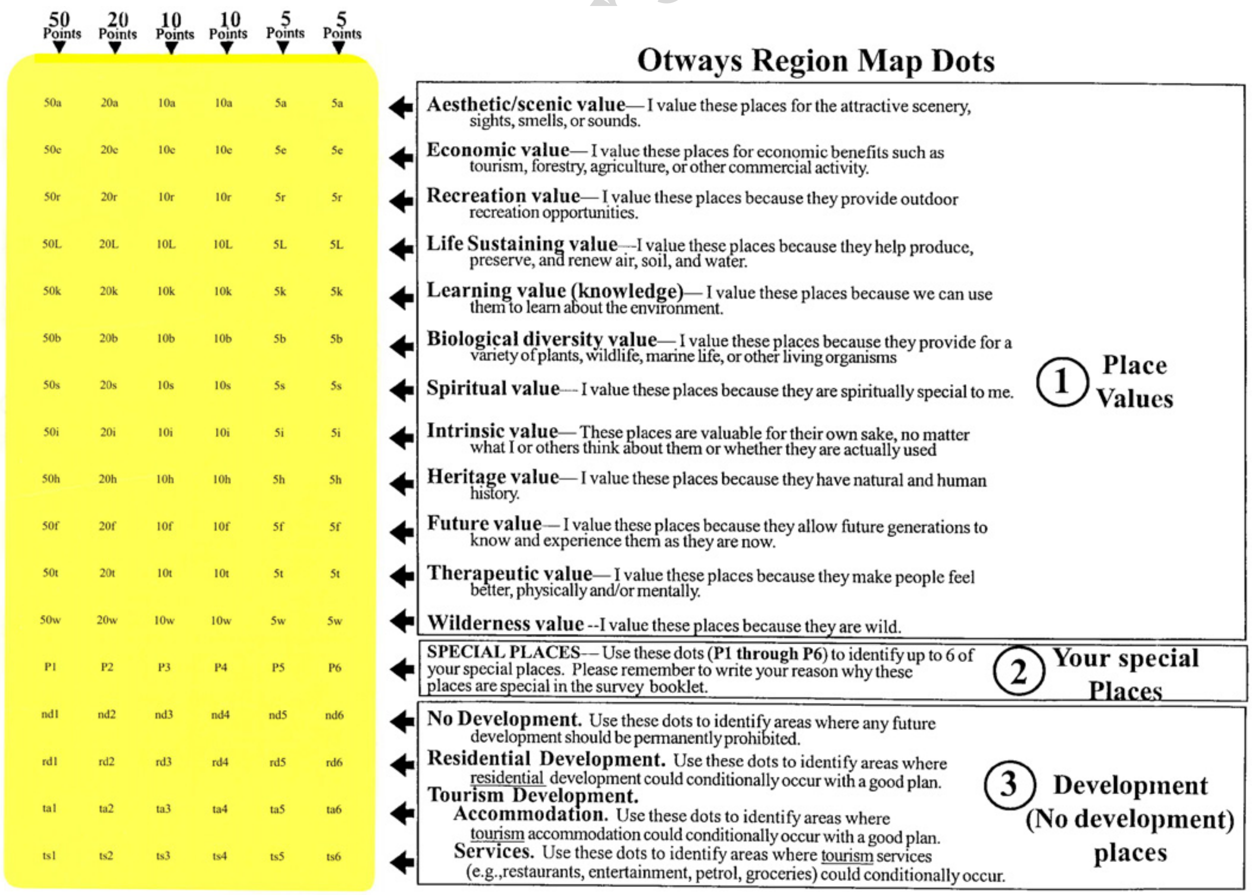

Fig. 2. Mnemonic sticker dots and landscape value legend used in Otways region survey.

Analyses

To determine potential sample biases in the Otways sample, we compared respondent socio-demographic characteristics such as age and education level with Australian Bureau of Statistics (ABS) data. We also examined the proportional differences between resident and visitor perceived knowledge of the Otways and their level of advocacy for the environment. Responses were grouped by resident, visitor, and subregion of residence (coast, hinterland, and plains).

We ranked the mean landscape value importance scores to understand what values were most important to residents and visitors. Each of the 12 landscape values had six mnemonically sticker dots with varying importance ratings ranging from 5 to 50 points, with the total number of points equalling 100 (see Fig. 2). Survey participants could place any combination of landscape value sticker dots on the enclosed Otways map to indicate both the location and the importance of the value. Thus, importance scores for each landscape value could range from 0 to 100 depending on the number of dots placed on the map. To further examine value importance rankings, we coded the special place descriptions into the 12 landscape values, as well as two recurring themes of "home" (the place where I live) and "family connection" (a place where I have met family). The coded special place descriptions were then ranked based on frequency of response category.

We used principal components analysis with Varimax rotation in SPSS® (Version 11.0) to determine the number of linear components that provide a good fit for the latent constructs of place identity and place dependence (factor validity). Principal component analysis is a type of exploratory factor analysis that explains the maximum amount of common variance in a correlation matrix using the smallest number of explanatory factors (Field, 2000). The greatest variance by any projection of the data comes to lie on the first coordinate (called the first principal component), the second greatest variance on the second coordinate, and so on.

To examine the criterion-related validity of the place attachment scale, we ran bivariate correlations between place identity and dependence summative scales and respondent variables of length of residence, knowledge, and advocacy for the environment. We also ran bivariate correlations between the map-based measure of place attachment and these respondent variables.

To explore the relationship between landscape values and place attachment, we used two different measures of place attachment—the scale-based measures previously described and a map-based measure of place attachment. The map-based measure of place attachment is a score ranging from 0 to 6 representing the number of optional "special places" mapped by the survey participant. We believe the propensity for the respondent to identify and map special places in the region is a type of *prima facia* place attachment measure. For this supposition to hold, one would expect to find a significant correlation between the place attachment scale and the number of special places mapped. Before proceeding with further analyses, we examined this relationship. The bivariate correlation between the place attachment scale score (identity and dependence combined) and the map-based score was modest, but statistically significant ($r = 0.27$, $p < 0.001$).

We examined the relationship between landscape values and both the scale and map-based measures of place attachment using multiple regression analysis. In the regression

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model using the place attachment scale, the landscape value importance scores (range 0–100) for the combined resident and visitor groups were treated as independent variables and the mean scale scores for place identity and dependence were treated as dependent variables. We used the "enter" method to force all landscape values into the regression model and included the variance inflation factor (VIF) collinearity diagnostics to assess the extent to which predictor variables were interrelated. To examine the relationship between landscape values and the map-based measure of place attachment, we regressed the 12 landscape value importance scores (range 0–100) against the number of special places identified by respondents (range 0–6).

The final analysis examined the spatial relationship between mapped special places and landscape values using spatial cross-correlation and multiple regression analyses. The analyses were accomplished by generating continuous density surfaces from the landscape value and special place point locations in the study area using a kernel density function and then regressing landscape value densities against special place density using a sample of randomly generated locations. To conduct the spatial analysis, some preliminary data preparation was required. Each of the 12 landscape values and special place point distributions were converted to raster data (grids) in ArcView Spatial Analyst® by calculating the density of point locations using a consistent density criteria (500 m grid cell, 2000 m search radius). Each grid was then clipped to the study area polygon resulting in 20,473 grid cells for analysis.

Each grid cell represents three values (x, y, z) with x and y denoting unique spatial coordinates (latitude and longitude) and z denoting the calculated landscape value or special place point density. Thus, a given grid cell would have 12 separate landscape value densities and one special place density associated with it. The 13 density grids were exported as (x, y, z) data and imported into SPSS® for correlation and regression analyses.

Spatial cross-correlation coefficients were computed from a set of 1000 randomly located points between landscape value and special place surfaces to describe the extent of spatial co-location between the special place and landscape value locations. The use of a set of random points rather than the entire grid surface avoids the potential confounding effects of spatial autocorrelation.

Regression analysis was used to determine the relative strength of the predictor variables (landscape value locations) in determining the locations of map-based place attachment (special places). With the special place density variable as the dependent variable, multiple regressions was performed with the 12 landscape value densities as independent variables. Lacking sound theoretical reasons for including or excluding predictors in the regression model, the "stepwise" method of regression was chosen to select predictors based on a purely mathematical criterion. The primary methodological concern is with the expected collinearity that can influence the importance of predictor variables shown by the model's standardized beta coefficients. In the absence of serious collinearity problems, the larger the absolute value of the standardized beta coefficients, the stronger the spatial association of the landscape value to the special places.

The final step in the analysis was to visually display the density of mapped special place locations in the Otways region using a standardized density scale ranging from 0 to 1 to serve as a prospective place attachment index.

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Results

Socio-demographic characteristics

Resident respondents were older and had completed a higher level of education (37.3% with tertiary or postgraduate degree) than would be expected based on comparable ABS statistics. The proportions of male and female respondents were similar to ABS data. The views expressed in the survey appear credible based on the significant collective experience and knowledge of the respondents. The majority of residents indicated good (57.5%) or fair knowledge (24.6%) of places in the Otways (Table 1). Visitors indicated less knowledge of places in the Otways than residents, with the majority expressing good (34.3%) or fair (45.5%) knowledge of the Otways.

There were significant differences in the length of residence by subregion. Overall, most resident respondents have lived in the Otways for 11–30 years (44.3%), but proportionately more plains residents (45.6%) than coastal residents (22.1%) have lived in the Otways for greater than 30 years ($X^2 = 38.77$, $p < 0.001$).

The majority of resident (50.6%) and visitor (51.9%) respondents were self-reported advocates for the environment with one significant difference based on subregion of residence. Plains residents (44.4%) were less likely to consider themselves environmental advocates than hinterland residents (58.7%).

In summary, respondent characteristics indicate some bias toward older, more educated, and knowledgeable Otways residents. While sample deviations from true population characteristics are generally viewed negatively, this bias can be placed in a positive light

Table 1
Otways region respondent characteristics

Characteristic	*n*	Residents (%)	Visitors (%)	X^2	Coastal residents (%)	Hinterland residents (%)	Plains residents (%)	X^2
Knowledge of Otways region								
Excellent	93	15.0	5.2		8.2	21.7	16.7	
Good	388	57.5	34.3		57.7	63.3	54.3	
Fair	232	24.6	45.5	85.87***	30.2	15.0	25.3	22.11***
Poor	48	2.9	15.0		3.9	0.0	3.7	
Total	761	100.0	100.0		100.0	100.0	100.0	
Length of residence								
$\leqslant$10 yr	114	21.0	n/a		33.1	19.0	12.9	
11–30 yr	241	44.3	n/a		44.8	49.6	41.5	38.77***
$>$30 yr	189	34.7	n/a		22.1	31.4	45.6	
Total	544	100.0			100.0	100.0	100.0	
Advocate for the environment								
Yes	390	50.6	51.9		51.1	58.7	44.4	
No	78	11.6	6.5	4.52	10.3	6.6	15.5	9.85*
Somewhat	297	37.7	41.6		38.5	34.7	40.2	
Total	765	100.0	100.0		100.0	100.0	100.0	

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

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because greater knowledge and experience with the Otways is likely to have increased the reliability of the mapping component of the survey.

Relative importance of landscape values

Table 2 shows the mean importance scores for the 12 landscape values in the study. Both residents and visitors perceived aesthetic and recreation values to be most important and spiritual and intrinsic values to be least important. Residents perceived economic values (rank = 3) to be more important than visitors (rank = 8), but visitors assigned higher relative importance to future values (rank = 3). There are minor variations in landscape value importance by subregion of residence. Hinterland residents assigned higher relative importance to biological diversity values (rank = 5) than coastal residents (rank = 6) and plains residents (rank = 7).

We found an association between the number of value dots assigned to the map and value importance scores. With the exception of aesthetic values, visitors placed proportionately fewer value dots on the Otways map resulting in generally lower mean importance scores. The low intrinsic and spiritual importance scores for both residents and visitors may reflect difficulty in assigning intangible qualities to landscape features. This finding is supported by the frequency of descriptions that accompanied special place designations (Table 3). Respondents infrequently identified spiritual value as a special place description ($n = 11$) and more commonly referred to special places as areas associated with aesthetic, recreation, or therapeutic value.

Generalisability of place identity and place dependence constructs in Australia

In the Varimax rotated model, resident factor loadings for the place identity dimension ranged from 0.61 to 0.86, and visitor responses ranged from 0.70 to 0.87 (Table 4). The factor loadings were similar for coastal, hinterland, and plains residents (range = 0.56–0.89).

All items in the place dependence dimension followed a pattern similar to place identity. For residents, factor loadings ranged from 0.67 to 0.87 and for visitors 0.66–0.83. Again, the factor loadings were similar for coastal, hinterland, and plains residents (range = 0.61–0.88).

Overall, the exploratory factor analysis demonstrated an acceptable fit for the place identity and dependence dimensions for Otways region residents and visitors. High Cronbach's alpha (reliability analysis) scores indicate that both place identity (six items) and dependence (five items) constitute cohesive subscales and contribute significantly to the reliability of the overall place attachment scale (11 items, Cronbach's alpha $\geqslant 0.92$) for all analysis groups.

Relationships between place attachment and respondent variables

We first ran a three-way full factorial model to determine potential interaction effects between the three respondent variables and place identity and dependence; however, no interactions were statistically significant. The knowledge, length of residence, and advocacy for environment variables explained 23% of the variance in place identity and 10% of the variance in place dependence.

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Table 2
Relative landscape value importance as perceived by residents and visitors

Residents							Visitors			
Value	n[a]	Mean importance[b]	Overall resident rank[c]	Coast rank	Hinter-land rank	Plains rank	Value	n	Mean importance	Visitor rank
Aesthetic	1780	78.15	1	1	1	1	Aesthetic	714	78.11	1
Recreation	1557	70.75	2	2	2	2	Recreation	517	59.49	2
Economic	1393	64.98	3	3	3	3	Future	378	46.65	3
Wilderness	1202	57.48	4	4	4	5	Heritage	345	46.35	4
Heritage	1163	55.44	5	7	6	4	Wilderness	367	45.97	5
Life sustaining	1134	54.33	6	5	7	6	Biological diversity	369	44.35	6
Biological diversity	1128	53.98	7	6	5	7	Therapeutic	369	44.24	7
Future	1051	50.20	8	9	8	8	Economic	378	43.86	8
Knowledge	1023	49.51	9	8	9	9	Life sustaining	324	39.05	9
Therapeutic	963	45.75	10	11	10	10	Intrinsic	311	38.32	10
Intrinsic	924	44.20	11	10	12	11	Knowledge	307	37.84	11
Spiritual	802	39.87	12	12	11	12	Spiritual	241	31.46	12
Total	14,120						Total	4620		

[a]The total number of value dots placed on the Otways landscape by Otways residents or visitors.
[b]The mean resident landscape value importance score. Scores range from 0 to 100 depending on the number of dots placed on the map.
[c]Landscape values are ranked based on mean importance.

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Table 3
Frequency and type of values associated with special place designations

Value	n[a]	Rank
Aesthetic	303	1
Recreation	281	2
Therapeutic	102	3
Biological diversity	100	4
Wilderness	99	5
Home[b]	96	6
Heritage	82	7
Family connection[c]	51	8
Intrinsic	42	9
Economic	30	10
Spiritual	12	11
Life sustaining	8	12
Learning	2	13
Future	1	14

[a]The total number of value dots placed on the Otways landscape by Otways residents.
[b]Home refers to "I live here".
[c]Family connection refers to a special place for family meetings.

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We ran bivariate correlations to determine the strength of the relationship between each respondent variable and place identity and dependence (Table 5). For all analysis subgroups, respondents who expressed more knowledge of the Otways region had significantly higher place identity and place dependence than those who expressed less knowledge of the region ($r \geqslant 0.175$, $p < 0.05$). These relationships are stronger for place identity than place dependence, with the exception of hinterland residents.

We found weak but significant, positive relationships between length of residence and place identity ($r = 0.144$, $p < 0.05$), and advocacy for the environment and place identity ($r = 0.328$, $p < 0.001$), with the exception of hinterland residents ($r \leqslant 0.133$, $p > 0.05$). Place dependence showed weaker, but still significant relationships with length of residence and environmental advocacy.

We also ran bivariate correlations between the map-based measure of place attachment (range 0–6) and the respondent variables of length of residence, knowledge of the Otways region, and advocacy for the environment. There was no significant relationship between length of residence and map-based place attachment ($r = 0.072$, $p > 0.05$), but there were significant relationships between knowledge of the Otways region ($r = 0.250$, $p < 0.01$) and advocacy for the environment ($r = 0.115$, $p < 0.01$) for all resident subgroups and visitors.

Overall, these findings augment the external validity of the place identity and place dependence scales for use in Australia. The scale-based measure of place attachment is significantly, but moderately, related to knowledge of the Otways region, length of residence, and advocacy for the environment. Respondent variables generally have stronger relationships with place identity than place dependence with some exceptions among hinterland subgroups. These respondent variables have weaker, but consistent relationships with the map-based measure of place attachment.

Table 4
Exploratory factor analyses for place identity and place dependence items for residents and visitors, including resident subregions

Place attachment items	Residents ($n = 522$)	Visitors ($n = 199$)	Coastal residents ($n = 168$)	Hinterland residents ($n = 116$)	Plains residents ($n = 238$)
Place identity					
I feel the Otways are a part of me	0.78	0.78	0.83	0.75	0.76
The Otways are very special to me	0.86	0.84	0.86	0.86	0.86
I identify strongly with the Otways	0.86	0.87	0.85	0.82	0.89
I am very attached to the Otways	0.85	0.86	0.84	0.79	0.88
Living in the Otways says a lot about who I am	0.61	0.70	0.56	0.66	0.60[b]
The Otways mean a lot to me	0.84	0.85	0.85	0.86	0.83
Cronbach's alpha (place identity)	0.93	0.93	0.92	0.92	0.94
Place dependence					
The Otways are the best place for what I like to do	0.67	0.66	0.73	0.61	0.64
No other place can compare to the Otways	0.79	0.79	0.81	0.73	0.78
I get more satisfaction out of living in the Otways than any other place	0.76	0.83	0.76	0.78	0.77
Doing what I do in the Otways is more important to me than doing it in any other place	0.85	0.82	0.83	0.83	0.87
I would not substitute any other area for doing the types of things that I do in the Otways	0.87	0.83	0.86	0.88	0.87
Cronbach's alpha (place dependence)	0.90	0.89	0.89	0.89	0.90
Cronbach's alpha (all items)	0.94	0.92	0.92	0.93	0.94

Note: All factor loadings are significant for the corresponding sample size.

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Associations between place attachment and landscape values

Regression models were used to help identify the landscape values that best predict the scale and map-based measures of place attachment as determined by the magnitude of the standardized beta coefficients. The results from regressing landscape value importance scores against the place identity and place dependence scales appear in Table 6. Although the results of both regression models were statistically significant ($p < 0.05$), landscape values explain a relatively small amount of the variance in place identity and place dependence ($R^2 = 0.18$ and 0.12, respectively). Three landscape values were significant predictors of both place identity and place dependence: spiritual value ($\beta = 0.314$, $\beta = 0.258$, $p < 0.001$), wilderness value ($\beta = 0.171$, $\beta = 0.160$, $p < 0.01$), and aesthetic value ($\beta = -0.118$, $\beta = -0.125$, $p < 0.01$). Future value was an additional significant predictor of place identity ($\beta = -0.165$, $p < 0.01$) and intrinsic value was an additional significant predictor of place dependence ($\beta = -0.156$, $p < 0.05$).

The collinearity diagnostics on the regression models suggest a tolerable level of multicollinearity in the independent variables. The diagnostics in both models show VIF values ranging from 1.3 to 2.7, below the threshold of 10 for obvious concern (Myers, 1990). Analysis of the regression residuals does not provide sufficient evidence to reject the

Table 5
Relationships between place attachment and respondent variables for different subregions of residence.

Variable	Residents		Visitors		Coastal residents		Hinterland residents		Plains residents	
	Place identity	Place dependence	Place identity	Place dependence	Place identity	Place dependence	Place identity	Place dependence	Place identity	Place dependence
Length of residence (0–100 yr)										
Pearson correlation										
r	0.144*	0.110*	n/a	n/a	0.317***	0.218**	0.133	0.208*	0.143*	0.047
Knowledge of Otways (1—Poor, 2—Fair, 3—Good, 4—Excellent)										
Spearman correlation										
r	0.398***	0.253***	0.481***	0.329*	0.371***	0.175*	0.213*	0.227*	0.496***	0.287***
Advocate for the environment (1—No, 2—Somewhat, 3—Yes)										
Spearman correlation										
r	0.328***	0.163**	0.291***	0.150*	0.278*	0.027	0.130	−0.042	0.419***	0.291***

Note: ***$p<0.001$, **$p<0.01$, *$p<0.05$
n/a denotes not applicable for visitors
Place identity and place dependence items were based on a scale ranging from 1—Strongly Agree, 2—Agree, 3—Neither Agree Nor Disagree, 4—Disagree, 5—Strongly Disagree.

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Table 6
Linear regression results for landscape values regressed against place identity and place dependence scale-based measures

Model results	Dependent variable: place identity scale				Dependent variable: place dependence scale			
	R	R^2	*F*	*p*	*R*	R^2	*F*	*p*
	0.420	0.18	10.19	0.000	0.352	0.12	6.69	0.000
Independent variables	β	*t*	Tolerance	VIF	β	*T*	Tolerance	VIF
Aesthetic	**−0.118**	**−2.712****	0.775	1.290	**−0.125**	**−2.795****	0.775	1.291
Economic	0.092	−1.900	0.624	1.602	0.081	1.644	0.630	1.586
Recreation	0.024	0.482	0.597	1.675	0.033	0.649	0.597	1.675
Life sustaining	0.036	0.619	0.432	2.314	0.004	0.071	0.434	2.304
Knowledge	0.051	0.939	0.374	2.674	0.126	1.956	0.374	2.676
Biological diversity	0.020	0.326	0.410	2.438	0.006	0.102	.419	2.388
Spiritual	**0.314**	**5.945*****	0.531	1.882	**0.258**	**4.764*****	0.529	1.891
Intrinsic	−0.086	−1.459	0.427	2.344	**−0.156**	**−2.568***	0.421	2.376
Heritage	0.078	1.386	0.465	2.150	0.073	1.268	0.462	2.166
Future	**−0.165**	**−2.832****	0.433	2.310	−0.108	−1.793	0.425	2.354
Therapeutic	−0.033	−0.557	0.412	2.426	−0.079	−1.281	0.410	2.438
Wilderness	**0.171**	**3.012****	0.460	2.172	**0.160**	**2.752****	0.457	2.189

Note: Bold indicates variable is statistically significant as follows: ***$p<0.001$, **$p<0.01$, *$p<0.05$, β—standardized coefficients. Dependent variables reflect the mean place identity and place dependence scores of Otways region residents and visitors combined.

hypothesis that the residuals in both the place identity and dependence models are normally distributed using the Kolmogorov–Smirnov test for normality (KS = 0.033 and 0.036, $p>0.05$).

The relationship between landscape value importance scores and the map-based measure of place attachment was explored by treating the landscape value importance variables as independent variables and the number of special places identified (range 0 to 6) as the dependent variable. The results of the regression analysis appear in Table 7. The overall model fit is relatively poor but statistically significant ($R^2 = 0.19$, $p<0.001$). Two landscape values were significant predictors of special place value designation: wilderness value ($\beta = 0.204$, $p<0.001$) and spiritual value ($\beta = 0.130$, $p<0.05$). The collinearity diagnostics on this regression model also suggest a tolerable level of multicollinearity in the independent variables.

Spatial relationship between map-based place attachment and landscape values

We examined the spatial relationship between map-based place attachment and mapped landscape values using spatial cross-correlation and multiple regression analyses. The spatial cross-correlation coefficients between the densities of the 12 landscape values and special places appear in Table 8. The spatial cross-correlation coefficients from a previous study in Kangaroo Island, South Australia (Brown, 2006) are provided in the table for comparison. The largest correlation coefficients are associated with aesthetic ($r = 0.92$), recreation ($r = 0.94$), spiritual ($r = 0.90$), and therapeutic ($r = 0.87$) landscape values. Although the correlation coefficients are larger for most landscape values in the Otways study, the relative magnitude of the correlation coefficients appear consistent with the

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Table 7
Linear regression results for landscape values regressed against number of special places identified by Otways region residents and visitors

Model results	Dependent variable: frequency of special place identification			
	R	R^2	*F*	*P*
	0.438	0.19	11.755	0.000
Independent variables	*β*	*t*	Tolerance	VIF
Aesthetic	−0.040	−0.962	0.783	1.28
Economic	0.071	1.526	0.631	1.58
Recreation	0.037	0.781	0.600	1.67
Life sustaining	0.042	0.751	0.437	2.29
Knowledge	0.060	1.012	0.390	2.56
Biological diversity	−0.046	−0.808	0.424	2.36
Spiritual	**0.130**	**2.563****	0.527	1.90
Intrinsic	0.006	0.097	0.423	2.37
Heritage	−0.015	−0.278	0.457	2.19
Future	0.035	0.627	0.430	2.33
Therapeutic	0.059	1.034	0.422	2.37
Wilderness	**0.204**	**3.766********	0.463	2.16

Note: Bold indicates variable is statistically significant as follows: ***$p<0.001$, **$p<0.01$, *$p<0.05$, *β*—standardized coefficients.

Table 8
Spatial cross-correlations between landscape value locations and special place locations for Otways regional study (Victoria) and study of Kangaroo Island residents, South Australia (see Brown, 2006)

Landscape value	Otways region study ($n = 1000$)	Kangaroo Island study ($n = 1000$)
Aesthetic	0.92	0.88
Economic	0.84	0.47
Recreation	0.94	0.86
Life sustaining	0.41	0.21
Knowledge	0.81	0.49
Biological diversity	0.76	0.44
Spiritual	0.90	0.80
Intrinsic	0.80	0.83
Heritage	0.58	0.45
Future	0.82	0.61
Therapeutic	0.87	0.90
Wilderness	0.47	0.35

results from Kangaroo Island; aesthetic, recreation, spiritual, and therapeutic values also have the largest correlation coefficients in the Kangaroo Island study.

In the regression of landscape value densities against the densities of map-based place attachment (special places), 7 of the 12 landscape predictor variables emerged as statistically significant predictor variables using stepwise regression (see Table 9). In this model, these landscape value variables were strongly predictive of the location of special places ($R^2 = 0.97$, $p<0.001$). The standardized beta coefficients of the predictor variables

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Table 9
Linear regression results for landscape values densities regressed against special place location densities

Model results	Dependent variable: density of special place locations			
	R	R^2	*F*	*p*
	0.984	0.97	4454.68	0.000
Independent variables	Standardized coefficients	*T*	Tolerance	VIF
Recreation	0.349	21.592	0.119	8.38
Aesthetic	0.348	22.733	0.133	7.54
Economic	0.168	13.543	0.202	4.94
Spiritual	0.135	10.183	0.177	5.65
Life sustaining	0.042	5.311	0.508	1.96
Biological	0.030	2.626	0.231	4.33
Knowledge	0.066	5.196	0.192	5.19

All independent variables are significant predictors of special place locations ($p<0.001$).

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indicate the relative strength and direction of relationship between landscape value locations and special place locations. The most significant predictor variables were recreation ($\beta = 0.349$), aesthetic ($\beta = 0.348$), economic ($\beta = 0.168$), and spiritual ($\beta = 0.135$) values, all of which were positively associated with special place locations. Unlike the previous regression analysis, multicollinearity among the independent variables is a concern and the regression analysis of multiple trials ($n = 1000$) yield variable results beyond the first two predictor variables. Recreation and aesthetic value locations are consistently the strongest predictors of special place locations in the regression models, being stronger by a factor of at least two over all the other variables. In multiple regression trials ($n = 1000$) or with the inclusion of all landscape value densities in the analysis ($n = 20,437$), economic and spiritual, landscape value densities emerge as the most significant predictor variables following recreation and aesthetic values. The importance of recreation and aesthetic landscape values as key determinants of special place location is consistent with the findings from the open coding of special place descriptions (Table 3).

To illustrate how map-based measures of place attachment might be used for land use planning purposes, a map of special place location densities was generated and standardized on a scale of 0–1 for the Otways region (Fig. 3). The actual special place point locations used to derive the index also appear on the map. This special place index visually depicts geographic locations with variable levels of place significance to residents and visitors. The greatest concentration of special places is distributed primarily along the coast, with high densities near the coastal townships of Lorne and Apollo Bay and moderate intensities within the Cape Otway region (a popular tourist attraction). Low intensities of special places occur along the remaining coastal strip.

Discussion

The objectives of this study were to examine the relationships between place attachment and landscape values using two measures of place attachment—a psychometric, scale-based measure (Williams & Vaske, 2003) and a map-based measure derived from survey

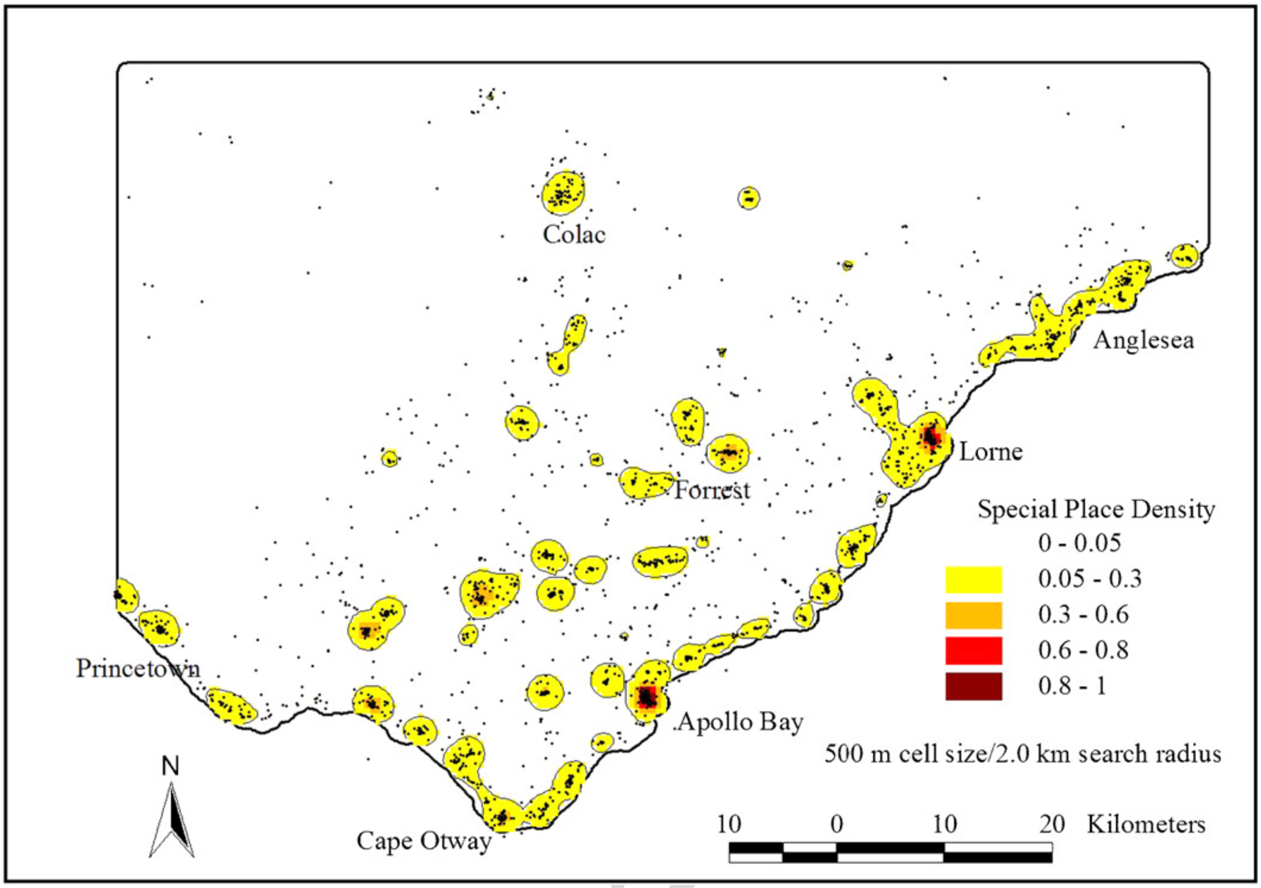

Fig. 3. Density map of special places in the Otways region of Victoria based on 500 m grid cell and 2 km search radius. Densities are indexed on 0–1 scale with index values closest to one reflecting greater risk to resident and visitor place attachment from landscape modification.

research (Brown, 2005). Exploratory factor analysis reveals that the place attachment scale separates into two principal components with high loadings supporting the findings of Williams and Vaske (2003). Visitors recorded similar factor loadings on each of the place identity and dependence items as residents, suggesting that the concept of "home" or "place" extends beyond one's place of residence to places visited. Traditionally, resident attitudes toward place have been an area of focus in the tourism planning literature (Harrill, 2004), but our results indicate comparable levels of place attachment such that both residents and visitors should be included in place-based tourism research.

The place dependence dimension had smaller factor loadings per item compared to place identity, consistent with the results of Williams and Vaske (2003). These researchers attributed the greater variance to the negatively worded question of "The things I do at 'X' I would enjoy doing just as much at a similar site" (p. 835); however, this question was omitted from the Otways survey, suggesting other factors may be leading to the difference between place identity and place dependence.

We did not expect the variance in place attachment in the psychometric scales to be fully captured by the finite list of respondent mapped landscape values. Indeed, participant mapping of landscape values explains a relatively small amount of the total variance in the place attachment constructs of identity and dependence. But the regression analyses did identify the landscape values that are most predictive of scale-based place attachment—respondents' perceptions of spiritual, wilderness (naturalness), and aesthetic connections to the landscape. These predictor variables are consistent with findings from Kaltenborn and Bjerke (2002) who found strong associations between place attachment and attractive, natural landscapes in southern Norway.

Given the success in measuring place attachment using psychometric scales, we sought to determine whether place attachment could be measured using mapped special places rather than psychometric scales. The scale-based measures of place attachment are generalized expressions derived from a multitude of cognitive, affective, and behavioural experiences by residents and visitors to the region. In contrast, respondent mapped special places represent place-based expressions of value based on a combination of place-based experiences and preferences as well as place-based symbolic expressions that are not necessarily derived from experiences (e.g., the spiritual and intrinsic special place descriptions in Table 3).

When the landscape values were regressed against the number of special places mapped, the map-based measure of place attachment, wilderness and spiritual values were statistically significant predictor variables. The importance of spiritual value in both the scale and map-based regression analyses, despite its relatively low frequency of map placement by participants, merits further supposition.

We posit that an abundance of aesthetic and wilderness/natural landscape features, along with recreation and therapeutic experiences in those landscapes, help create the conditions that lead to place attachment, but it is the individual's willingness to associate spiritual value with a landscape that best predicts the psychological state of place attachment. Although respondents are least likely to identify spiritual landscape values, these mapped landscape values are most important in identifying respondent attachment to place.

The spatial analysis of landscape value densities with the map-based measure of place attachment (special places) confirms the importance of human engagement with a landscape in developing some level of place attachment. The significant spatial co-location of recreation and aesthetic values with special place locations, and to a lesser extent, economic and therapeutic values, reflect the transactive nature of human–landscape interactions (Brown, 2005; Zube, 1987) where humans are active participants in the landscape—thinking, feeling, and acting—leading to the attribution of meaning and the valuing of specific landscapes and places. The place attachment construct is complex wherein individual, socio-cultural, and intrinsic landscape attributes contribute to its formation. The research presented herein does not attempt to parse the relative contribution of each domain, a research objective that remains challenging and illusive, but rather seeks to engage the place attachment construct in its 'gestalt' form for land use planning considerations.

From a pragmatic, land use planning perspective, map-based measures of place attachment offer an advantage over scale-based measures because of their place-specific attributes. The mapping of landscape values and special places can provide an operational bridge between place attachment and applied land use planning that seeks to minimize potential land use conflict. Learning that residents or visitors have regional place attachment through psychometric, scale-based measures may alert planning authorities to the general risk of introducing landscape changes, but map-based measures of place attachment offer a more specific, placed-based assessment of risk. With respect to the Otways, special place locations are concentrated along the coast, the most active region of current and prospective tourism and residential development (Fig. 3). These areas would

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appear to pose the greatest challenge to sustaining resident and visitor place attachment in the presence of high potential for landscape modification.

One of the persistent critiques of sense-of-place research in natural resource management has been the inability to translate research findings into rational management decision models. How does one specifically manage a landscape for sense of place or place attachment? Part of the shortcoming has been the inability to translate place attachment measures into much more than a list of place names or a generalized scale-based measure of place attachment.

We believe these study results suggest a potential pathway to improve land use decision-making by assessing and mapping the potential risk to resident or visitor place attachment. Maps of place attachment indices can be generated from mapped landscape values and special places to identify locations with higher and lower relative place attachment scores. The density map of special places indexed between 0 and 1 presented in this paper represents one of several possible place attachment map indices. Other potential indices might include maps that combine several landscape values such as aesthetic, recreation, and spiritual landscape values, values that predict special place locations in this study.

Maps that display indices of relative place attachment from landscape values and special places do not provide a set of decision rules regarding land use, nor provide a set of prescriptive land use options. However, map-based measures of place attachment can provide commensurable risk indices associated with potential land use change. These place attachment index maps can graphically display the potential negative consequences of introducing land use change. For example, commercial development along coastal strips in the Otways region will likely reduce the aggregate regional measure of place attachment.

Of course, land use decisions must necessarily be context specific and will involve many more decision variables than simply a hypothetical risk to place attachment. Further, some might argue that the mapping of landscape values and special places and their use to generate indices of risk to place attachment are biased toward land use preservation and can rightfully point to human modified landscapes that actually create or strengthen place attachment. We agree, which is why we advocate the inclusion of mapping methods that include spatial preferences for development and non-development (see Brown, 2006; Raymond & Brown, 2007). A place attachment risk index could be adjusted by overlaying development preferences that include spatial measures of land use change with assent.

While we have demonstrated in this paper that psychometric scales of place attachment represent valid and reliable measures in Australia, we find less practical advantage to their utilization in regional planning studies when the mapping of landscape values and special places can also provide reasonable measures of resident and visitor place attachment, while simultaneously providing a much richer set of analytical tools for assessing the consequences of potential land use change. Further research is needed to assess the utility of potential place attachment risk indices in the context of specific, proposal land use decisions.

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