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Place attachment, place satisfaction and pro-environmental behaviour: a comparative assessment of multiple regression and structural equation modelling

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Abstract

Using data collected from 452 visitors at the Dandenong Ranges National Park, Australia, this paper applies multiple regression and structural equation modelling (SEM) approaches to test the relationships between the respective sub-constructs of place attachment (place dependence, place identity, place affect, place social bonding), place satisfaction, and visitors’ pro-environmental behavioural intentions. Findings revealed differences in strength and magnitude of the regression paths. The SEM analysis further reveals insignificant regression paths between place identity and place satisfaction, and place social bonding and low effort pro-environmental behavioural intentions in contrast to the multiple regression results. An empirical comparison of the MR and SEM results is expected to shed light on the application of these two powerful techniques in tourism research.

Key words: Multiple regression, structural equation modelling, place attachment; place satisfaction; low effort and high effort pro-environmental behaviour
Introduction

National parks constitute important venues for tourist experiences (Kaltenborn, Nyahongo, Kidegesho, & Haaland, 2008; Selby, Petajisto, & Hural, 2011). They often are strong icons for nature-based tourism (Eagles, 2001; Wall-Reinius & Fredman, 2007) and act as catalysts to attract large number of visitors, especially when diverse recreational attractions are provided (Boyd & Hall, 2005). As a consequence, many of these environments are unfortunately highly impacted by human activities (Reimann, Lamp, & Palang, 2011). Recognising the deleterious impacts of tourist activities on the environment, there has been increasing calls to promote environmentally sustainable practices in national parks (Stockdale & Barker, 2009).

Sustainability practices in parks and other natural areas can be improved by encouraging environmentally responsible practices among visitors (Ballantyne, Packer & Hughes, 2009; Halpenny, 2010). Researchers note that place attachment is a potentially important antecedent to pro-environmental attitudes and pro-environmental behaviours in nature-based settings (Lee, 2011; Raymond, Brown, & Robinson, 2011; Scannell & Gifford, 2010). Given the central role played by tourists’ pro-environmental behaviour in fostering sustainability in national park settings (Curtis, Weiler, & Ham, 2010), better understanding is needed regarding how place attachment relates to pro-environmental behavioural intentions. The future of national parks will depend on the interaction between people and these protected areas (Ramkissoon, Weiler, and Smith, 2012).

The increasing call for encouraging sustainable behaviour among visitors has led to a number of studies that investigated the relationship between place attachment and pro-
environmental behaviour. Researchers have used several multivariate statistical techniques to test the relationship between the two constructs. A review of existing literature on this topic suggest that multiple regression and structural equation modelling are the most common data analytic techniques used by researchers. For example, Scannell and Gifford (2010) used regression analyses to examine the relations between natural and civic place attachment and pro-environmental behaviour. Raymond et al., (2011) investigated the relationship between place attachment, moral and normative concerns and conservation of native vegetation using multiple regression. Hernandez, Martin, Ruiz, & Hidalgo (2010) used structural equation modelling (SEM) to analyse the relationship between place attachment, place identity and environmental attitudes in investigating environmental protection laws. Gosling and Williams explored the relationship between place attachment, connectedness to nature and pro-environmental behaviour using a series of regression analyses. Ramkissoon, Smith, & Weiler (in press) used multiple regression to analyze the associations between place attachment, place satisfaction, and pro-environmental behavioural intentions, while Halpenny (2010) employed SEM to test similar relationships.

The popularity of multiple regression and SEM in place attachment and pro-environmental research can be attributed to the fact that environmental researchers deal with constructs that are not directly observable. They are not only interested in the measurements of latent variables, but also in analysing associations between and among latent variables (Lu, Thomas, Zumbo, 2005), fuelling the growth of these multivariate techniques. Use of these statistical methods has allowed behavioural researchers and scholars to solve complex research problems (Nunkoo & Ramkissoon, 2011) and test multivariate models involving a number of dependent and independent latent variables (Weston & Gore, 2006). However,
multiple regression, though rigorous, can test regression models with only one dependent variable at a time.

Given this limitation, researchers have relied on more sophisticated data analytic methods such as SEM which has the ability to test several relationships, involving more than one dependent variable concurrently. This has fuelled the use of SEM which is considered more sophisticated in its ability to test several relationships concurrently. Both techniques are widely used in behavioural science research (e.g., Halpenny, 2010; Ramkissoon, Smith, & Weiler, in press; Scannell & Gifford, 2010). Increasing use of these techniques can be expected in environmental research, and it is also unlikely that SEM will completely replace multiple regression despite it being a superior technique. However, even though SEM and multiple regression serve similar purposes, they are fundamentally different in applications and produce different results (Nunkoo & Ramkissoon, 2012; Nusair & Hua, 2010). This may, to some extent, explain contradictory findings regarding the relationship between place attachment and pro-environmental behaviour, although it should be explicitly acknowledged that inconsistency in findings is largely the result of theoretical and measurement issues in place attachment research.

In an attempt to shed light on some of the above issues, this study tests an identical model predicting pro-environmental behaviours from place attachment using multiple regression and SEM. Given that increasing use of SEM and multiple regression is to be expected in place attachment and environmental behavioural research, this paper provides future researchers with an understanding of both techniques, and shed lights on the different results they produce. Such differences are discussed in the light of existing simulation research on SEM and multiple regression. Advantages and disadvantages of each statistical procedure are also described using the statistical analyses results. It is important to point out
that it is not the intention of this paper to undergo a formal comparison between multiple regression and structural equation modelling to establish the superiority of one technique over the other. It is hoped that this empirical piece provides researchers with a good understanding of the application of both techniques in behavioural research. An understanding of the strengths and limitations of each technique would further benefit neophytes and scholars. The paper starts by an overview of multiple regression and SEM before providing theoretical support for each of the proposed relationships in the model shown in Figure 1.

Place attachment

![Diagram of place attachment](image)

**Multiple Regression**

Multiple regression, a sophisticated form of correlation analysis existing over more than 100 years (Nusair & Hua, 2010) has been one of the most popular techniques for theory testing across a range of disciplines (Hair et al., 1998) including psychology, sociology, environmental science, consumer behaviour and many others. An outcome variable (Y) is
specified as well as one or more predictor (X) variables are specified. Multiple regression follows a three-step process: (1) model specification which is based on relevant theory to develop the regression model, (2) model identification which refers to deciding whether a set of unique parameter estimates can be obtained, and (3) model estimation which involves estimating the parameters in the regression equation (Schumacker & Lomax, 2004). Results from the regression show the overall explanatory power of all predictor variables with measures of $R^2$ and adjusted $R^2$ together with the relative importance of each individual predictor variable after b coefficients are calculated (Musil et al., 1998; Neter, Wasserman, & Kutner, 1990). The closer the $R^2$ value is to 1, the better the model accuracy. However, despite being a sophisticated data analysis technique, multiple regression is not robust to measurement error and usually assumes perfect measurement of variables. Yet, perfect reliability is rarely achieved in social science research (Bohrnstedt & Carter, 1971; Musil et al., 1998). Measurement error in even a single independent variable can lead to statistical inaccuracies and biased results (Mackenzie, 2001; Musil et al., 1998; Nusair & Hua, 2010) by increasing or decreasing all other regression coefficients in a multiple regression equation.

**Structural Equation Modelling**

Structural equation modelling (SEM) has been widely applied across a range of disciplines including psychology, sociology, environmental studies and tourism among other disciplines (e.g., Kenny, 1996; Shen, Bentler & Comrey, 1995). Its ability to estimate a series but independent multiple regression equations simultaneously has fuelled its use in tourism and related research over the past decades (Nunkoo & Ramkissoon, 2012). It incorporates latent variables in the analysis taking into account measurement errors (Hair et al., 1998) assisting researchers in solving complex relationships (Nunkoo & Ramkissoon, 2012; Nusair & Hua, 2010).
SEM involves the testing of the measurement and structural models. The measurement model also known as the confirmatory factor model outlines the items that constitute the elements of an underlying latent variable (Bryne, 1994). It is that component of the general model in which latent variables are prescribed. The measurement model is evaluated before the final measurement and structural equation models are examined (Anderson & Gerbing, 1988). The structural model is the hypothetical model that prescribes relationships among latent variables and their observed variables, together with the direct arcs connecting them, and the disturbance error for the variables (Hoyle, 1995; Reisinger & Movondo, 2007). The structural model represents the combined measurement and path models. It is known as the component of a general model that relates the constructs to other constructs by providing path coefficients (parameter values) for each of the research hypotheses.

Researchers recommend a number of fit indices to evaluate measurement and structural models. These model fit indices were the root mean square error of approximation (RMSEA), goodness of fit index (GFI, Joreskog & Sorbom, 1989), comparative fit index (CFI, Bentler, 1990), incremental fit index (IFI, Hu, & Bentler, 1995), parsimonious goodness of fit index (PGFI, Mulaik et al., 1989) and parsimonious normed fit index (PNFI, Mulaik et al., 1989). Values for GFI, CFI, IFI, PGFI and PNFI range from 0 to 1, with values closer to 1.00 indicating a good model fit (Bryne, 1989; Hair, Black, Babin, & Anderson, 2010; Mulaik et al., 1989).

Prior to data collection, the researcher should specify a model that should be confirmed by the pooled data. A theoretical model is a pre-requisite for conducting the confirmatory factor analysis (CFA). Following model specification and model modifications
(if required), the overall measurement model is evaluated for its reliability and validity. Composite reliability is the commonly used reliability measure. A value greater than 0.70 is considered as evidence of construct reliability (Hatcher, 1994). To assess validity, convergent and discriminant validity are often used. Convergent validity is assessed from the measurement model by determining whether each indicator’s estimated pattern coefficient on its posited underlying construct factor is significant. Statistically significant large factor loadings indicate convergent validity. To assess discriminant validity, the average variance extracted (AVE) for each construct must be greater than the squared correlations between the construct and other constructs in the model (Fornell & Larcker, 1981; Nusair & Hua, 2010). The AVE should be equal to 50% or higher (Fornell & Larcker, 1981).

**Conceptual Discussion**

This section focuses on a brief description of place attachment, place satisfaction and pro-environmental behaviour outlining current findings regarding each construct’s relationship to each other. An introductory treatment of place attachment sub-constructs and place satisfaction including their relationships to pro-environmental behaviour is provided in Ramkissoon et al. (2012), Ramkissoon et al., (in press) and others.

**Place attachment: a multidimensional concept**

Place attachment is conceptualized as the extent to which an individual values or identifies himself/herself with a particular environmental setting (Kyle, Absher, & Graefe, 2003). Considered by many as a multidimensional construct, it encompasses affect, beliefs, emotions, knowledge and behaviour (Chow, & Healy, 2008). Place dependence and place identity are the two most commonly used sub-constructs of place attachment in literature (Prayag & Ryan, 2012; Williams, Patterson, Roggenbuck, & Watson 1992). Other
researchers have investigated other sub-dimensions, for example place affect (Halpenny, 2010; Kals, Shumaker, & Montada, 1999; Ramkissoon et al., 2012) and place social bonding (Ramkissoon et al., 2012; Wynveen, Kyle & Sutton, 2012). Place dependence reflects the functional attachment of a setting in achieving the specific goals of the individual (Stokols & Schumaker, 1981). Place identity is the cognitive connection of the self with the setting (Prohansky, 1978). Place affect is emotional bond which is developed between an individual and the place (Kals & Maes, 2002). Place social bonding has been conceived as social ties developed through shared experiences in a place (Mesch & Manor, 1998). Although researchers have attempted to refine place attachment as a multidimensional, there remains a paucity a studies investigating the construct with its four sub-concepts (dependence, identity, affect, social bonding) and its relationship with place satisfaction and pro-environmental behaviour.

**Place attachment and place satisfaction**

Stedman (2002) defined place satisfaction as a multidimensional summary judgement of the perceived quality of a setting, meeting an individual’s needs for the physical characteristics of a place, its services, and social dimensions. Although some studies have demonstrated the links between place attachment and place satisfaction (e.g., Neal & Gursoy, 2008; Sirgy, 2010; Yuksel et al., 2010), there is a paucity of studies investigating the relationship between these two constructs. Studies show that place attachment, conceptualised as place dependence, place identity (Hwang, Lee & Chen, 2005; Prayag and Ryan, 2012) and place affect (Ramkissoon et al., in press; Yuksel et al., 2010) could be significantly predictive of visitors’ satisfaction. Some evidence also suggests that place social bonding may exert an influence on place satisfaction (Ramkissoon et al., in press).
However, the association between place social bonding and place satisfaction is far from being conclusive and still needs to be more established in the literature (Ramkissoon et al., 2012; Ramkissoon et al., in press). The above review suggests a need to further examine place attachment with its four sub-dimensions (dependence, identity, affect and social bonding), and its role in predicting place satisfaction. Consequently, the following hypotheses are developed:

Hypothesis 1: Place dependence positively influences visitors’ place satisfaction.
Hypothesis 2: Place identity positively influences visitors’ place satisfaction.
Hypothesis 3: Place affect positively influences visitors’ place satisfaction.
Hypothesis 4: Place social bonding positively influences visitors’ place satisfaction.

Place attachment and pro-environmental behaviour

National parks provide opportunities for healthy outdoor recreation and they often become favourite places holding special meanings for many people (Ferreira, 2011). Visitors often get emotionally and physically attached to these environments, resulting in increased visitation to such areas. Increased and continued visitation may however harm the parks’ resources if not well managed. It is therefore important to promote pro-environmental behaviours among visitors in order to mitigate the negative impacts, and thus protect and improve the parks’ environmental surroundings.

A number of studies have demonstrated significant associations between these two constructs in different contexts and situations (e.g., Devine-Wright & Howes, 2010; Gosling & Williams, 2010; Halpenny, 2010; Hernandez, et al., 2010; Raymond et al., 2011). Visitors with high levels of place dependence were found to be more concerned with resource development and maintenance while those with high levels of place identity were keener to
maintain and protect the primitive settings of a place. Stedman (2002) noted that individuals holding a high level of place identity were more willing to advocate place-protective behaviours. Place affect was seen as an important predictor of environmental attitudes (Pooley and O’Conner, 2000) leading to increasing commitment to environmental organisations (Kals et al., 1999). Some researchers further argue that meanings of pro-environmental behaviours are constructed through the social interaction of people and may foster environmental actions and pro-environmental behaviours in different settings (e.g., Georg, 1999; Nye & Hargreaves, 2009). However, despite the significant attention devoted to the above sub-constructs of place attachment and pro-environmental behavioural intentions, more research is warranted to confirm the strength and magnitude of the relationships (Scannell and Gifford, 2010). Accordingly, the following hypotheses are developed:

Hypothesis 5: Place dependence positively influences pro-environmental behavioural intentions of park visitors.

Hypothesis 6: Place identity positively influences pro-environmental behavioural intentions of park visitors.

Hypothesis 7: Place affect positively influences pro-environmental behavioural intentions of park visitors.

Hypothesis 8: Place social bonding positively influences pro-environmental behavioural intentions of park visitors.

**Place satisfaction and pro-environmental behaviour**

Studies have demonstrated positive correlations between satisfaction and willingness to pay in relation to green spaces (Baral, Stern & Bhattarai, 2008; Bigné, Andreu & Gnoth, 2005; Lospez-Mosquera & Sanchez, 2011). Individuals who are more satisfied with a place
are in some cases more willing to engage in pro-environmental intentions and behaviours (Jabarín & Damhoureyeh, 2006; Lospež-Mosquera & Sanchez, 2011; Oguz, 2000). Davis, Le & Coy (2011) noted that individuals with greater satisfaction with the environment were more likely to feel committed to the latter, in turn leading to greater willingness to sacrifice for the environment. Jabarin & Damhoureyeh (2006) also noted that more satisfied visitors reported higher willingness to pay for the park. Stedman’s (2002) research however found that place satisfaction inhibits environmental behaviour. Visitors with lower levels of satisfaction were more willing to engage in place-protective behaviours, and showed greater willingness to counter environmental changes to their lake. While most of these studies suggest that place satisfaction is likely to be a significant predictor of pro-environmental intentions and behaviours, the direction of the relationship may vary in different contexts. More research is warranted to clarify the above. Based on the above review, the following hypothesis is developed:

**Hypothesis 9:** Place satisfaction positively influences park visitors’ pro-environmental behavioural intentions.

Exploratory factor analysis results for the pro-environmental behavioural intentions construct led to the development of a post-hoc hypothesis on the positive spill-over (Thorgensen, 2004) of pro-environmental behaviours.

**Hypothesis 10:** Visitors’ low effort pro-environmental behavioural intention positively influences their intention to engage in higher effort park-related pro-environmental behaviours.

**Study Context and Research Methodology**

The Dandenong Ranges National Park attracts over one million visitors annually due to its easy accessibility (Parks Victoria, 2007). Located in the state of Victoria in Australia, it
is on the fringes of Melbourne, about 35 km east of the centre of the city. The park serves as a convenient recreational spot offering a variety of outdoor activities such as picnicking, bushwalking, photography, nature study, bird watching, car touring, cycling, and horse riding. Managed by Parks Victoria, the park has multiple access points, all with no entrance fee, and also provides food and beverage outlets, free parking space, toilet facilities and other amenities for its visitors. Finally, the park offers a number of volunteering opportunities to assist in the protection of its rich flora and fauna.

Based on an extant review of the literature on place attachment, place satisfaction and pro-environmental behaviour, the survey instrument was designed. The measurement scales included 12 items measuring the four distinct sub-dimensions of place attachment (dependence, identity, affect, social bonding), 3 items measuring place satisfaction and 12 items measuring pro-environmental behavioural intentions. As a result of modifications made to the pro-environmental behavioural scale, it was subjected to an exploratory factor analysis (EFA) using principal component method on a pre-test sample of 115 respondents intercepted at different locations in the Dandenong Ranges National Park. This process resulted in the elimination of two items, “encourage others to reduce their waste and pick up their litter when they are at this national park” and “pick up litter at this national park left by other visitors”, reducing the number of items from twelve to ten. The pro-environmental behavioural intentions scale was subjected to another EFA analysis using the main sample size (n=452) to further confirm scale dimensionality. This resulted in the deletion of one item which was the respondent’s stated likelihood to “contribute to donations to ensure protection of this national park” due to cross-loadings (Gursoy & Gavcar, 2003). The nine remaining items used to measure the pro-environmental behavioural intent construct loaded onto two factors. Based on the items, factor 1 was labelled ‘low effort pro-environmental
behavioural intent’ while factor 2 was labelled ‘high effort pro-environmental behavioural intent’. Internal consistency was evaluated using Cronbach’s alpha and both factors showed a measurement greater than 0.7, indicating adequate to strong levels of internal consistency (Nunally, 1978). Further, given the two-factor structure of the pro-environmental behavioural construct, hypotheses 5, 6, 7, 8, and 9 were divided into two sub-hypotheses each as follows:

Hypothesis 5a: Place dependence positively influences low effort pro-environmental behavioural intentions of park visitors.

Hypothesis 5b: Place dependence positively influences high effort pro-environmental behavioural intentions of park visitors.

Hypothesis 6a: Place identity positively influences low effort pro-environmental behavioural intentions of park visitors.

Hypothesis 6b: Place identity positively influences low effort pro-environmental behavioural intentions of park visitors.

Hypothesis 7a: Place affect positively influences low effort pro-environmental behavioural intentions of park visitors.

Hypothesis 7b: Place affect positively influences high effort pro-environmental behavioural intentions of park visitors.

Hypothesis 8a: Place social bonding positively influences low effort pro-environmental behavioural intentions of park visitors.

Hypothesis 8b: Place social bonding positively influences high effort pro-environmental behavioural intentions of park visitors.

Hypothesis 9a: Place satisfaction positively influences park visitors’ low effort pro-environmental behavioural intentions.
Hypothesis 9b: Place satisfaction positively influences park visitors’ high effort pro-
environmental behavioural intentions.

Data were collected with self-administered questionnaires distributed to visitors in the
months of June to September 2011 at four locations within the Dandenong Ranges National
Park, namely the Thousand Steps, Ferntree Gully Picnic Ground, Grants Picnic Ground, and
a children’s playground. Adult visitors in both off-peak (weekdays) and peak times (during
weekends and school holidays) were approached on a next person basis. These timings
ensured that a range of visitors (locals and non-locals; intrastate and interstate; individuals,
families, and other groups; first-time and repeat visitors) were included in the survey. Data
collection at exit was considered impractical, as there are multiple entry and exit options
necessitating interception in car parks, where visitors are often in a hurry to leave. A total
number of 452 questionnaires were retained for the final analysis after eliminating 22
questionnaires with any missing data (Hair, Anderson, Tatham, & Black, 1998).

Results of Dandenong Ranges National Park study

Profile of Respondents

More than half of the respondents were under the age of 35, with 53% females and
47% males; the age distribution was 23% (18-25 years), 29% (25-34 years), 19% (35-44
years), 15% (45-54 years), 11% (55-64 years) and 9% (65+ years of age); 70% had
completed tertiary education. Visitors were mostly from Australia (97%) with 47% on repeat
visits. The visitor profile is comparable to statistics collected by Parks Victoria (2010) for the
Dandenong Ranges National Park.

Multiple Regression analysis
Multiple regression, a useful technique in exploratory research (Nunkoo & Gursoy, 2012) was used to identify the relationships among the constructs. This statistical technique continues to be widely applied in place attachment, tourism and environmental studies (e.g., Hinds & Sparks, 2008; Raymond et al., 2011; Rioux & Werner, 2011; Rosentraub & Joo, 2009). Results of the multiple regression analyses are shown in Table 1. Results suggest that place dependence, place identity, and place affect have a positive influence on place satisfaction ($\beta = 0.23; p < 0.001; \beta = 0.05; p < 0.001; \beta = 0.27; p < 0.001$) while place social bonding negatively influences place satisfaction ($\beta = -0.21; p < 0.001$). A significant effect of place affect on both low effort and high effort pro-environmental behavioural intentions ($\beta = 0.14; p < 0.10; \beta = 0.22; p < 0.01$) was noted. Findings further confirmed the significant association of place social bonding with low effort and high effort pro-environmental behaviour, although with differential effects ($\beta = -0.09; p < 0.10; \beta = 0.32; p < 0.001$). Results of multiple regression analysis also suggest that while place satisfaction has a positive influence on low pro-environmental behavioural intentions, it exerts a negative influence on high effort pro-environmental behavioural intentions ($\beta = 0.15; p < 0.05; \beta = -0.15; p < 0.001$).

Hypothesis 10 was supported ($\beta = 0.27; p < 0.01$) by the multiple regression analysis confirming the findings of Hergeselle and Zins (2011) and Ramkissoon et al (in press).

**Structural Equation Modelling results**

**Measurement model**

The proposed model illustrated in Figure 1 was tested using AMOS version 19. The initial testing of the overall measurement model resulted in the deletion of three items on the ‘low effort pro-environmental behavioural intentions’ due to low factor loadings. The model fit indices for the final overall measurement model were as follows: $\chi^2 = 444.4$ ($p = 0.00$);
GFI = 0.92; CFI = 0.94; PGFI = 0.67; PNFI = 0.73; IFI = 0.94 and RMSEA = 0.06. The CMIN/df value was 2.65 which was an acceptable fit (Hair et al., 2010).

Reliability

The measurement model was further validated for its reliability. Composite reliability and average variance extracted were used as reliability measures. Composite reliability is analogous to a co-efficient alpha, indicating the internal consistency of the indicators (Hatcher, 1994). A value higher than 0.70 is acceptable for composite reliability. The amount of variance captured by a factor is measured by the variance extracted estimate which should be equal to 50% or higher (Fornell & Larcker, 1981). Table 1 shows all constructs’ composite reliabilities were above 0.70, and the average variance extracted for each construct met the recommended minimum level of 50% (Hair et al., 1998).
Table 1. Overall measurement model results

<table>
<thead>
<tr>
<th>Constructs and Scale items</th>
<th>Factor loadings</th>
<th>Composite reliability</th>
<th>Average Variance extracted</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Place Attachment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Place Dependence</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PD1 For what I like to do, I could not imagine anything better than the settings and facilities provided by this National Park</td>
<td>0.81</td>
<td>0.76</td>
<td>0.53</td>
</tr>
<tr>
<td>PD2 For the activities I enjoy the most, the settings and facilities provided by this National Park are the best</td>
<td>0.76</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PD3 I enjoy visiting this National Park and its environment more than any other parks</td>
<td>0.57</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Place Identity</strong></td>
<td></td>
<td>0.86</td>
<td>0.68</td>
</tr>
<tr>
<td>PI1 I identify strongly with this park</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PI2 I feel this National Park is part of me</td>
<td>0.88</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PI3 Visiting this National Park says a lot about who I am</td>
<td>0.76</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Place Affect</strong></td>
<td></td>
<td>0.90</td>
<td>0.74</td>
</tr>
<tr>
<td>PA1 I am very attached to this park</td>
<td>0.88</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PA2 I feel a strong sense of belonging to this National park and its settings/facilities</td>
<td>0.85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PA3 This National Park means a lot to me</td>
<td>0.85</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Place Social Bonding</strong></td>
<td></td>
<td>0.78</td>
<td>0.54</td>
</tr>
<tr>
<td>PSB1 Many of my friends/family prefer this National Park over many other parks</td>
<td>0.65</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PSB2 If I were to stop visiting this park, I would lose contact with a number of friends</td>
<td>0.78</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PSB3 My friends/family would be disappointed if I were to start visiting other settings and facilities</td>
<td>0.76</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Place Satisfaction</strong></td>
<td></td>
<td>0.83</td>
<td>0.62</td>
</tr>
<tr>
<td>SAT1 I believe I did the right thing when I chose to visit this National Park</td>
<td>0.69</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SAT2 Overall, I am satisfied with my decision to visit this National Park</td>
<td>0.84</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SAT3 I am happy about my decision to visit this National Park</td>
<td>0.83</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Low effort pro-environmental behavioural intent (Factor 1)</strong></td>
<td></td>
<td>0.73</td>
<td>0.50</td>
</tr>
<tr>
<td>PEB6 Volunteer to reduce my use of a favourite spot in this National Park if it needs to recover from environmental damage</td>
<td>0.65</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEB8 Tell my friends not to feed animals in this National Park</td>
<td>0.70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEB9 Sign petitions in support of this National Park</td>
<td>0.70</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>High effort pro-environmental behavioural intent (Factor 2)</strong></td>
<td></td>
<td>0.87</td>
<td>0.69</td>
</tr>
<tr>
<td>PEB1 Participate in a public meeting about managing this National Park’s programs</td>
<td>0.85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEB2 Volunteer my time to projects that help this National Park</td>
<td>0.91</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEB3 Write letters in support of this National Park</td>
<td>0.74</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Validity

Assessing validity is an important component of SEM. It reflects how accurately a set of measures represent the concept studied (Hair et al., 1998). To assess construct validity, convergent and discriminant validity were evaluated. Convergent validity was assessed from the measurement model by determining whether each indicator’s estimated pattern coefficient on its posited underlying construct factor was significant (Anderson & Gerbing, 1988; Marsh & Grayson, 1995). Convergent validity is the overlap between alternative measures that are intended to measure the same construct, but which have different sources of undesired variation (Judd, Smith, & Kidder, 1991). The statistically significant factor loadings retained were greater than 0.5 (see Table 1) indicating convergent validity (Cabrera-Nyugen, 2010). Further, the average variance extracted ranged from 0.50 to 0.74 meeting the recommended level of 0.50 (Hair et al., 1998). Hence, convergent validity was achieved. Discriminant validity was further assessed. To assess discriminant validity, the average variance extracted for each construct must be greater than the squared correlations between the construct and other constructs in the model (Fornell and Larcker, 1981; Nusair & Hua, 2010). The average variance extracted for high effort pro-environmental behavioural intentions was 0.69 while the shared variance between high effort PEB and other constructs ranged from 0.01 to 0.47. This was an indication that discriminant validity has been achieved. Discriminant validity results are shown in Table 2.

<table>
<thead>
<tr>
<th>Table 2 Discriminant validity matrix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Place attachment</td>
</tr>
<tr>
<td>Place attachment</td>
</tr>
<tr>
<td>Place satisfaction</td>
</tr>
<tr>
<td>Low PEB</td>
</tr>
<tr>
<td>High PEB</td>
</tr>
</tbody>
</table>
**Structural model**

Following the overall measurement model testing, the structural equation model proposed in Figure 1 was tested. This model is known as that component of a general model that relates the constructs to the other constructs by providing path coefficients for each of the proposed relationships to determine their relative significance. Each parameter value can be evaluated for its respective statistical significance for the hypothesised relationship, while including standard errors and calculated t-values (Bollen, 1989; Hair et al., 1998). The fit indices of the structural model were as follows: \( \chi^2 = 444.4 \) (p = 0.00); GFI = 0.92; CFI = 0.94; PGFI = 0.67; PNFI = 0.73; IFI = 0.94; RMSEA = 0.06 and CMIN/df = 2.64. All indices suggest a good fit (Hair et al., 2010) showing that the model fits the data well.

**Discussion and implications**

Both multiple regression and SEM allows the evaluation of direct and indirect effects of variables in a model and are widely used tools to investigate whether the data are consistent with a hypothesised model (Musil et al., 1998). In the present study, both techniques were used to allow for a comparison of results (Table 3).

**Table 3: MR and SEM results**

<table>
<thead>
<tr>
<th>Hypotheses</th>
<th>Path relationships</th>
<th>MR</th>
<th>SEM</th>
<th>Hypotheses</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1</td>
<td>PD → SAT</td>
<td>.23****</td>
<td>.27****</td>
<td>Supported</td>
</tr>
<tr>
<td>H2</td>
<td>PI → SAT</td>
<td>.19***</td>
<td>( R^2 = .29 )</td>
<td>.17</td>
</tr>
<tr>
<td>H3</td>
<td>PA → SAT</td>
<td>.27****</td>
<td>.35**</td>
<td>Supported</td>
</tr>
<tr>
<td>H4</td>
<td>PSB → SAT</td>
<td>-.21****</td>
<td>-.28****</td>
<td>Supported</td>
</tr>
<tr>
<td>H5a</td>
<td>PD → Low PEB</td>
<td>.05</td>
<td>.03</td>
<td>Rejected</td>
</tr>
<tr>
<td>H6a</td>
<td>PI → Low PEB</td>
<td>.10</td>
<td>-.12</td>
<td>Rejected</td>
</tr>
<tr>
<td>H7a</td>
<td>PA → Low PEB</td>
<td>.14*</td>
<td>( R^2 = .11 )</td>
<td>.44***</td>
</tr>
<tr>
<td>H8a</td>
<td>PSB → Low PEB</td>
<td>-.09*</td>
<td>-.07</td>
<td>Supported</td>
</tr>
<tr>
<td>H9a</td>
<td>SAT → Low PEB</td>
<td>.15**</td>
<td>.23***</td>
<td>Supported</td>
</tr>
<tr>
<td>H5b</td>
<td>PD → High PEB</td>
<td>-.08</td>
<td>-.10</td>
<td>Rejected</td>
</tr>
<tr>
<td>H6b</td>
<td>PI → High PEB</td>
<td>.02</td>
<td>-.10</td>
<td>Rejected</td>
</tr>
<tr>
<td>H7b</td>
<td>PA → High PEB</td>
<td>.22****</td>
<td>( R^2 = .27 )</td>
<td>.31*</td>
</tr>
<tr>
<td>H8b</td>
<td>PSB → High PEB</td>
<td>.32****</td>
<td>.39***</td>
<td>Supported</td>
</tr>
<tr>
<td>H9b</td>
<td>SAT → High PEB</td>
<td>-.15***</td>
<td>-.15**</td>
<td>Supported</td>
</tr>
<tr>
<td>H10</td>
<td>Low PEB → High PEB</td>
<td>.27***</td>
<td>.23****</td>
<td>Supported</td>
</tr>
</tbody>
</table>
Unlike multiple regression, the SEM analysis allowed the modelling of measurement errors. This accounted for the differences in the MR and SEM results. The differential results may be further attributed to the use of different default estimation methods applied in the two techniques. SEM uses the maximum likelihood (ML) method of estimation (Enders, 2001) while multiple regression applies ordinary least squares (Morris, Sherman, & Mansfeld, 1986). On the other hand, in SEM, every absent path is a potential source of misfit, and misfit can bias the estimated parameters. A misfit in one part of the measurement or structural model affects the goodness-of-fit of the whole model (Musil et al., 1998).

Multiple regression and SEM analyses results suggest that the different attachment dimensions have differential influence on place satisfaction and pro-environmental behavioural intentions and do not act uniformly, confirming earlier arguments of some researchers (Bricker & Kerstetter, 2000; Kyle et al., 2003). Place dependence, place identity, place social bonding, and place affect have different psychological properties and their effects on place satisfaction and pro-environmental behaviours are different and sometimes opposing. Both analyses results demonstrate that the two dimensions of pro-environmental behaviours delineated in the exploratory factor analysis are distinct, but intentions to undertake one type of pro-environmental behaviour may influence intention to undertake the other. The findings further suggest that sub-dimensions of place attachment and place satisfaction have differential effects on the two types of visitors’ pro-environmental behaviours, suggesting the need for future studies to investigate further into the nature of park-related pro-environmental behaviours.
The findings of this study may benefit park managers who strive to achieve both sustainability and increase visitor satisfaction. Both the MR and SEM findings suggest that place affect is an important construct park managers may wish to focus on to improve place satisfaction and promote pro-environmental behaviours among park visitors. Designed as protected areas national parks add value to the overall tourism product of a destination and has significant implications for sustainable tourism management. Park managers may take cognisance of the positive spill-over of low effort onto high effort behavioural intentions and encourage visitors’ engagement in low effort behaviours during the visit. Park managers may further communicate opportunities for visitors to engage in high effort pro-environmental behavioural intentions and communicate the outcomes of such behaviours through leaflets, information desk, tour guides, websites, and other communication channels.

Conclusion

The aim of this study is to show that both multiple regression and structural equation modelling are popular and powerful analytic tools although they both have their advantages and limitations over the other. The authors argue that both techniques are well employed in tourism research and other disciplines. There is a close connection between linear regression and SEM although often this is not realised. Regression analyses can be drawn by a path diagram dictating the set of regression analyses and statistics that need to be examined (Jaccard, Guilamo-Ramos, Johansson, & Bouris, 2010) and in SEM the conceptual model often guides the analysis. Researchers interested in these techniques should keep track of empirical and seminal work noting the differences, some of which favour the use of multiple regression, and some the use of SEM.
References


