

This article was downloaded by: [171.67.216.21]

On: 09 April 2015, At: 14:09

Publisher: Routledge

Informa Ltd Registered in England and Wales Registered Number: 1072954 Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK



Journal of Sustainable Tourism

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/rsus20>

Nature-based tourism's impact on environmental knowledge, attitudes, and behavior: a review and analysis of the literature and potential future research

Nicole M. Ardoin^a, Mele Wheaton^b, Alison W. Bowers^c, Carter A. Hunt^d & William H. Durham^e

^a Graduate School of Education & Woods Institute for the Environment, Stanford University, 485 Lasuen Mall, Cubberley, Room 212, Stanford, CA, USA

^b Graduate School of Education & Woods Institute for the Environment, Stanford University, 485 Lasuen Mall, Cubberley, Room 333, Stanford, CA, USA

^c School of Education, Virginia Tech, 210 East Eggleston Hall, Blacksburg, VA, USA

^d Department of Recreation, Park, and Tourism Management, 801 A Donald H. Ford Building, The Pennsylvania State University, University Park, PA, USA

^e Department of Anthropology & Program on Human Biology, Stanford University, Building 50, Room 51C, Stanford, CA, USA
Published online: 07 Apr 2015.



CrossMark

[Click for updates](#)

To cite this article: Nicole M. Ardoin, Mele Wheaton, Alison W. Bowers, Carter A. Hunt & William H. Durham (2015): Nature-based tourism's impact on environmental knowledge, attitudes, and behavior: a review and analysis of the literature and potential future research, *Journal of Sustainable Tourism*, DOI: [10.1080/09669582.2015.1024258](https://doi.org/10.1080/09669582.2015.1024258)

To link to this article: <http://dx.doi.org/10.1080/09669582.2015.1024258>

PLEASE SCROLL DOWN FOR ARTICLE

Taylor & Francis makes every effort to ensure the accuracy of all the information (the "Content") contained in the publications on our platform. However, Taylor & Francis, our agents, and our licensors make no representations or warranties whatsoever as to the accuracy, completeness, or suitability for any purpose of the Content. Any opinions

and views expressed in this publication are the opinions and views of the authors, and are not the views of or endorsed by Taylor & Francis. The accuracy of the Content should not be relied upon and should be independently verified with primary sources of information. Taylor and Francis shall not be liable for any losses, actions, claims, proceedings, demands, costs, expenses, damages, and other liabilities whatsoever or howsoever caused arising directly or indirectly in connection with, in relation to or arising out of the use of the Content.

This article may be used for research, teaching, and private study purposes. Any substantial or systematic reproduction, redistribution, reselling, loan, sub-licensing, systematic supply, or distribution in any form to anyone is expressly forbidden. Terms & Conditions of access and use can be found at <http://www.tandfonline.com/page/terms-and-conditions>

Nature-based tourism's impact on environmental knowledge, attitudes, and behavior: a review and analysis of the literature and potential future research

Nicole M. Ardoin^{a*}, Mele Wheaton^b, Alison W. Bowers^c, Carter A. Hunt^d
and William H. Durham^e

^aGraduate School of Education & Woods Institute for the Environment, Stanford University, 485 Lasuen Mall, Cubberley, Room 212, Stanford, CA, USA; ^bGraduate School of Education & Woods Institute for the Environment, Stanford University, 485 Lasuen Mall, Cubberley, Room 333, Stanford, CA, USA; ^cSchool of Education, Virginia Tech, 210 East Eggleston Hall, Blacksburg, VA, USA; ^dDepartment of Recreation, Park, and Tourism Management, 801 A Donald H. Ford Building, The Pennsylvania State University, University Park, PA, USA; ^eDepartment of Anthropology & Program on Human Biology, Stanford University, Building 50, Room 51C, Stanford, CA, USA

(Received 19 August 2014; accepted 23 February 2015)

Although nature-based tourism is often promoted as benefiting local destinations through income generation, employment, and direct conservation support, it is also believed to influence tourists' environmentally friendly attitudes, knowledge, and ultimately their behavior. Yet, few studies have empirically documented these outcomes, and those that do are inconsistent in the variables measured and the time frame analyzed. This paper examines the empirical research on nature-based tourism's ability to foster long-term stewardship behavior among travelers by conducting a systematic review of peer-reviewed tourism research published between 1995 and 2013. This search, focused on literature addressing changes in tourists' environmentally related knowledge, attitudes, intentions, and actual behaviors, yielded just 30 empirical studies. Outcomes related to new environmental knowledge were commonly reported in these studies, but findings related to environmental attitudes and behaviors were inconsistent. Few studies measured environmental behavior directly, and fewer still include longitudinal assessments of persistent changes in attitudes or behaviors. We suggest potential future areas for research as well as programmatic strategies that may facilitate favorable outcomes from nature-based tourism, particularly those related to tourists' knowledge, attitudes, and behaviors. Key areas include understanding visitors' prior experiences and background, designing and delivering more effective interpretive messages, and using social media.

Keywords: nature-based tourism; knowledge; attitudes; behavior; intentions; outcomes

Introduction

Nature-based tourism (NBT) – or leisure travel to natural areas – has shown tremendous growth over the past two decades (Balmford et al., 2009) and is expected to keep growing from an estimated 7% of global tourism in 2007 to as much as 25% by 2020 (Honey, 2008). Together with the closely related area of ecotourism – or NBT that actively

*Corresponding author. Email: nmardoin@stanford.edu

contributes both to conservation as well as local livelihoods – it is often promoted as a win–win scenario in which tourists have an enjoyable experience, tour operators earn a good profit, funds are raised for environmental conservation, and livelihoods within local communities are improved (Higham, 2007; Honey, 2008; Stronza & Durham, 2008). As debate continues with regard to the actual benefits that NBT offers for destination environments and local communities (Higham, 2007), another serious challenge is that we know little about (1) the ways in which NBT cultivates pro-environmental attitudes and behaviors in tourists, or (2) the ways in which NBT’s pro-environmental impacts can be extended once tourists return home. This is unfortunate, given the magnitude of the tourism sector today; even small changes arising from individual travel experiences could result in substantial and persistent impact on global sustainability.

Research has shown that many nature-based tourists are sympathetic to environmental issues and eager to learn (e.g. Wight, 2001). Moreover, they are more satisfied with their tourism experiences when those experiences are infused with educational messages (Orams, 1997). Intensive, place-based experiences can inspire and nurture an interest in biology, ecology, and natural history through direct contact with plant and animal species in their natural environments; in the process, these tours can stir a sense of responsibility and bolster tourists’ interest in hands-on stewardship activities (McGehee & Norman, 2001). Nature-based tourists who enjoy their experience may then be open to becoming more deeply involved in adopting pro-environmental behaviors (Ballantyne & Packer, 2011).

Nature-based tours have indeed been shown to be a powerful mechanism for transforming the environmental behavior of some visitors (Ballantyne & Packer, 2011; Christie & Mason, 2003; Powell, Brownlee, Kellert, & Ham, 2012). They can enhance environmental knowledge, attitudes, and behavioral intentions through meaningful, first-hand opportunities with wildlife, natural history, and conservation messaging (e.g. Ballantyne, Packer, & Sutherland, 2011; Powell, 2005; Powell & Ham, 2008). Such experiences – when individuals are eager to learn something new and do something different – may in turn prime long-term learning (Falk, Ballantyne, Packer, & Benckendorff, 2012). Not surprisingly, visitors may leave NBT experiences poised to undertake action (Ballantyne, Packer, & Falk, 2010, 2011; Powell, 2005) or serve as “opinion leaders” on environmental issues in their respective communities (Crompton & Lamb, 1986).

Yet, despite this hypothetical inclination toward action, little empirical evidence demonstrates that this occurs. We are not even sure whether nature-based tourists are more likely to engage in pro-environmental behaviors than other types of tourists upon returning home. We need a better understanding of how these presumed “spikes” in tourist interest, motivation, and behavior carry forward to home and into new environmental interests, commitments, intentions, and actual behaviors. One exception is a study by Hughes, Packer, and Ballantyne (2011), who explored the effects of providing visitors with post-trip resources that help them take specific conservation behaviors at home after a wildlife tourism experience. The researchers found that visitors provided with post-trip resources were significantly more likely to take conservation-related action; however, these actions were not necessarily related to those suggested during the tourism experience. Findings from their study, and others (e.g. Ballantyne, Packer, & Sutherland, 2011; Beaumont, 2001), indicate that we still know little about how to extend NBT’s “mountaintop experiences” into sustained environmental behaviors (Powell, 2005).

Motivated to address this conceptual gap, we analyzed the scholarship on documented learning, attitudinal, and behavioral outcomes among people who participate in NBT experiences. Our analysis reveals that, over the past 20 years, the approach of researchers on this topic has differed widely in parameters and focus, and behavior change has rarely

been investigated directly. More common is a focus on visitors' knowledge, attitudes, or behavioral intentions. When behavior change is measured, self-reports are most often employed. Overall, this analysis suggests that NBT practices have not yielded comprehensive changes in behavior once visitors return home. Even when it appears that behavioral practices do change, the causality and mechanisms remain only loosely understood. Our conclusions offer avenues for bridging the field-based tourism experience with visitors' home environments.

Methods

For this literature analysis, we searched several databases: Scopus, PsycINFO, Academic Search Premier, and Web of Knowledge (simultaneously including Web of Science and CABI: CAB Abstracts and Global Health). We focused our search on two areas: NBT and specific visitor outcomes. This necessitated two layers of search terms. The first set of terms narrowed the field to peer-reviewed journal articles on NBT (see Table 1, Level 1). We also searched with the terms "ecotourism" and "sustainable tourism". Based on Weaver and Lawton's (2007) inclusion of wildlife watching, whale watching, and bird watching in their review of ecotourism research, we also included "wildlife tourism". We looked for the search terms in the articles' title, abstract, or keywords (see Table 2 for the number of results returned from each database and the search fields used).

After narrowing the search to NBT literature, we sought to identify writings focused on changes in visitors' environmental knowledge, attitudes, and behaviors. To identify these publications, we employed the following search terms:

- Knowledge: environmental learning, environmental knowledge, conservation learning, science learning
- Attitudes: environmental attitudes, environmental values, environmental identity
- Behavior: environmental behavior, environmental action, conservation behavior, philanthropy

We later added the terms "environmental education" and "interpretation" because our preliminary results showed that numerous papers addressing changes in visitors' knowledge, attitudes, and behaviors were approaching the topic with a strong interest in environmental education or interpretation (see Table 1 for all search terms).

Of the 909 articles identified using the four databases, approximately 300 duplicates occurred and were removed. The remaining publications were further vetted by the following criteria:

Table 1. Literature review search terms.

Records were selected if they contained at least one term from each level of search terms

Search term Level 1: "ecotourism" or "nature-based tourism" or "sustainable tourism" or "wildlife tourism"

Search term Level 2: "environmental learning" or "environmental behavior" or "environmental behaviour" or "environmental attitudes" or "environmental values" or "environmental identity" or "environmental knowledge" or "environmental action" or "conservation behavior" or "conservation behaviour" or philanthropy or "conservation learning" or "science learning" or "environmental education" or interpretation

Table 2. Results from database searches and search fields used.

	Academic search premier	Web of knowledge	PsychINFO	Scopus
Results returned	77	494	30	308
Search fields used	Title, Abstract or Author-supplied abstract, Subject terms	Topic (includes abstract, title, keywords, CABICODES, and descriptors)	Document title, Abstract, Subject heading	Article title, Abstract, Keywords

- (1) Empirical studies that examined changes in participants' environmental knowledge, attitudes, or behavior as a result of an NBT experience;
- (2) Peer-reviewed journal articles or book sections;
- (3) A publication date between 1995 and September 2013;
- (4) Articles written in English.

Articles that did not formally meet the four criteria included

- Studies focused solely on visitor demographics and characteristics;
- Theoretical papers, essays, and editorials;
- Descriptive studies examining the NBT experience as a whole;
- Studies investigating outcomes for local residents, but not for visitors;
- Research exploring the role of guides and interpreters;
- Studies focused only on on-site behavior change where behaviors helped protect the actual site¹;
- Literature reviews, with the exception of including comprehensive literature reviews focused on NBT visitor outcomes.

Analysis

Our review focuses hereafter on the 30 articles that met all criteria. In keeping with a system based, in part, on Stern, Powell, and Hill (2014), we first coded articles' findings according to changes related to environmental knowledge, attitudes, behavioral intentions, and actual behavior. We coded whether the articles' findings indicated a decrease, increase, or no change related to those outcomes. The data were compiled in an Excel spreadsheet according to categories related to research theory, design, and main findings. As we iteratively reviewed and discussed the literature, preliminary trends emerged and areas of interest were recognized.

Challenges arose when authors did not clearly define the outcomes being measured (e.g. environmental knowledge, awareness, or attitudes) or when authors did not differentiate among these constructs in a way consistent with one another. Because of varying methods and the use of terminology, we found that information on specific study outcomes was occasionally ambiguous and difficult to classify. When an article's constructs were unclear or questionable, three members of our research team reviewed the article's methods and descriptions of the constructs, and we then used consensus to classify the study outcomes (Table 3).

Table 3. Codes for evaluating outcomes related to environmental knowledge, attitudes, behavioral intentions, and behavior.

Code	Type of study		
	Quantitative studies using inferential statistics	Quantitative studies using descriptive statistics	Qualitative studies (or studies analyzing qualitative data)
Not applicable	Specified outcome was not measured or results were not reported. Includes studies involving a quantitative comparison that lacked evidence of statistical significance		
Negative (decrease in outcome)	Only statistically significant decreases	Only decreases	Only decreases
Null (no change in outcome)	No statically significant decreases or increases	No decreases or increases	No decreases or increases
Mixed (mixed results or when increases are reported, but only for some groups of participants)	Statistically significant increases reported for some but not all measures	Mixed results reported. For percentages, this is used when $\leq 50\%$ of participants self-report an increase	Mixed results reported
Positive (increase in outcome)	Statistically significant increases	Increases (i.e. more than 50% of participants self-report an increase)	Only increases

Findings

Types of nature-based tourism experiences

The 30 articles describe research on an array of nature-based experiences. Many explored NBT as carried out in publically owned protected areas. Over half focused on marine tourism; the remainder examined tourism in other environments (numbers overlap when studies considered both marine and non-marine experiences). Research sites were evenly split between tourism experiences that focused on wildlife and those without a specific wildlife focus. All studies examine aspects of interpretation and, for most studies, interpretation was an integral part of the visit. Only one study (Hill, Woodland, & Gough, 2007) describes an NBT experience lacking interpretation; in this case, the interpretation-free condition was developed by the researchers to compare the effects of rainforest visits with and without the use of information sheets.

It was occasionally difficult to ascertain whether interpretation was included in all of the experiences that visitors undertook (Dearden, Bennett, & Rollins, 2007; Skibins, Powell, & Hallo, 2013; Stamation, Croft, Shaughnessy, Waples, & Briggs, 2007). For example, Skibins et al. (2013) surveyed safari participants departing from a Tanzanian airport. Since respondents could have participated in a range of safaris, it is impossible to specify the amount of interpretation they received; however, since almost all safaris are guided, it is likely that visitors were exposed to at least some interpretive guiding. In the

context of diving and whale-watching trips respectively, it was similarly difficult to determine whether interpretation was consistently provided by dive personnel (Dearden et al., 2007; Stamation et al., 2007).

A total of 32 countries served as research sites in the studies we reviewed. Australia is the dominant study location, with two-thirds of the studies (20) examining NBT there. Two studies took place in Thailand (Dearden et al., 2007; Rattan, Eagles, & Mair, 2012) and two studies researched US sites (Powell, Kellert, & Ham, 2009; Skibins et al., 2013). Many studies considered NBT in more than one country. Other countries that were represented just once included Antarctica, Costa Rica, Ecuador, Greece, New Zealand, Peru, Tanzania, and the United Kingdom.

Most articles examined NBT experiences of one day or less. Seven of the studies (23%) explored multi-day experiences or included overnight visitors in their sample, such as live-aboard diving tours in Thailand (Dearden et al., 2007) and multi-day Antarctic cruises (Powell, Kellert, & Ham, 2008). Individuals were the most common unit of analysis, although a number of studies focused on families or other groups (e.g. Hughes, 2011, 2013; Hughes et al., 2011).

Features of nature-based tourism experiences

Although some studies we reviewed consider the effect of the NBT experience holistically (e.g. Powell et al., 2008; Rattan et al., 2012; Sander, 2012), others identified particularly influential elements of the experience such as:

- Visitor demographics and pre-visit levels of environmental knowledge, attitudes, and behavior (e.g. Ballantyne, Packer, & Falk, 2011; Dubin, 2008; Hovardas & Poirazidis, 2006; Powell et al., 2009);
- The types of experiences provided and visitors' level of involvement in those experiences (e.g. Coghlan, Fox, Prideaux, & Lück, 2011; Higham & Carr, 2002; Lee & Moscardo, 2005; Mayes & Richins, 2009; Skibins et al., 2013; Stamation et al., 2007);
- Purpose and type of interpretation (e.g. Coghlan et al., 2011; Coghlan & Kim, 2012; Hill et al., 2007; Hughes & Morrison-Saunders, 2002, 2005a; Mayes & Richins, 2009; Stamation et al., 2007; Weiler & Smith, 2009);
- Presence of post-visit action resources (e.g. Hughes 2011, 2013; Hughes et al., 2011);
- Length of stay (e.g. Beaumont, 2001; Dearden et al., 2007);
- Satisfaction (e.g. Hovardas & Poirazidis, 2006);
- Witnessing of environmental damage during visit (e.g. Dearden et al., 2007);
- Educational preparation prior to experience (e.g. Dubin, 2008); and
- Repeat visitation (e.g. Hughes & Morrison-Saunders, 2002).

The range of research methods

Despite calls for more qualitative research in understanding visitor outcomes (e.g. Walker & Moscardo, 2006), the majority of studies included in our review (27, or 90%) employed quantitative techniques. This paucity of qualitative studies does not reflect intentional exclusion on our part or an overall persistent dearth of qualitative studies in the literature but, rather, is a function of the parameters we placed on our literature search. Although a number of relevant studies producing qualitative data exist (e.g. Arnould & Price, 1993;

Table 4. Timing of instrument administration.

	Number of studies
Pre/post only	11
Post only	8
Pre/post/long-term follow-up	10
Post/long-term follow-up	1

Maher, Steel, & McIntosh, 2003; Powell et al., 2012; Stewart, Hayward, Devlin, & Kirby, 1998; Walker, 2007; Walker & Moscardo, 2006), they were not captured by our search criteria either due to timeframe, type of publication, or the specificity of our search terms. Methods producing qualitative data have often been employed to explore outcomes other than the knowledge, attitudes, and behavior on which we focus here (Walker & Moscardo, 2006). Although the studies in our review occasionally incorporated open-ended survey items and used qualitative thematic analysis to identify key concepts and themes (e.g. Ballantyne, Packer, & Sutherland, 2011), or grouped similar responses into categories (e.g. Hughes et al., 2011), Higham and Carr (2002) authored the lone qualitative study involving observation at ecotourism sites and interviews with visitors. Tubb (2003) and Mayes and Richins (2009) employed mixed-methods designs using a combination of observation at the study sites and quantitative-data surveys completed by visitors.

Twenty-one studies (70%) incorporated pre-visit and post-visit surveys. The remaining nine studies used a post-visit-only design, including one study (Smith, Broad, & Weiler, 2008) that conducted both an immediate and long-term post-visit survey but no pre-visit survey. Eleven (37%) included long-term follow-up measures (see Table 4). The length of time that elapsed between the nature-based experience and the follow-up contact from the researchers ranged from 3 to 12 months, though in one case, a low response rate to long-term follow-up measures prevented meaningful analyses (Lee & Moscardo, 2005).

Of the 22 studies (73%) that administered a survey at more than one point in time, 17 followed the same panel of visitors throughout the study. By contrast, five studies used independent samples to complete surveys at different points in time (e.g. pre-visit, immediate post-visit, or long-term post-visit).

Defining variables of interest

We noted variation in how authors delineated the variables of environmental knowledge, attitudes, and behavior. The following section describes the differing definitions used for the variables of interest.

Environmental knowledge

The conceptualization of environmental knowledge ranged from specific factual information, to conceptual understanding, to self-definition by the visitor. Stamation et al. (2007) included multiple-choice items focused on whale-related facts such as why humpback whales go to Antarctica for the summer and the proper terms for a group of whales. By contrast, Powell et al. (2008), on a post-visit instrument with Antarctic cruise participants, included self-report items that asked about the change in participants' knowledge around

five themes: oceanography, marine biology, natural history, environmental conservation, and general environmental awareness. For self-definitions of environmental knowledge, Tisdell and Wilson (2005) asked those taking night-time walks at a turtle rookery in Australia to explain if their experience had been informative and educational. Smith et al. (2008), for example, asked zoo visitors in Australia whether they could “recall hearing any actions that could be taken to conserve birds of prey and/or their habitats” (p. 550). Most articles focused on environmental knowledge specific to the geographic area under study.

Environmental attitudes

Studies often defined environmental attitudes as appreciation for specific natural contexts, such as the Great Barrier Reef (Coghlan et al., 2011; Coghlan & Kim, 2012) or rainforests (Hill et al., 2007). Beyond site-specific conservation issues, some researchers gauged attitudes about protection and conservation of the environment and nature in general (e.g. Ballantyne, Packer, & Falk, 2011; Hughes et al., 2011). Other studies focused on either attitudes toward site-specific management practices (Powell & Ham, 2008; Powell et al., 2008, 2009) or attitudinal items exploring visitors’ tendencies on a continuum from anthropocentric to ecocentric (Hughes & Morrison-Saunders, 2005a, 2005b). Others evaluated environmental attitudes by exploring multiple attitudinal measures (Lee & Moscardo, 2005; Tubb, 2003; Weiler & Smith, 2009).

Environmental behavior

Certain studies included here (e.g. Hughes, 2013; Stamation et al., 2007) considered environmental behaviors occurring outside of the study site such as, for instance, once visitors returned home.² Although some researchers asked about environmental behaviors in a general manner that allowed respondents to specify the type of behavior impacted by the experience (e.g. Ballantyne, Packer, & Sutherland, 2011), most researchers also requested information about specific behaviors. The range of specific behaviors often dealt with the purchase, consumption, and disposal of goods and services (Stern, 2000), such as personal recycling habits, using public transportation, avoiding certain consumer goods, seeking environmentally friendly products, and properly disposing of harmful materials. Some researchers specifically assessed visitors’ willingness to pay for conservation and protection (Powell & Ham, 2008; Tisdell & Wilson, 2005) or willingness to pay for eco-friendly accommodations (Lee & Moscardo, 2005). Although many studies examined a combination of visitors’ general and personal behaviors, three studies (10%) examined only personal behaviors (Lee & Moscardo, 2005; Smith et al., 2008; Tisdell & Wilson, 2005).

Studies also assessed social behaviors, which included joining environmental organizations, attending meetings or rallies, writing letters to government officials, and considering environmental issues when voting for political candidates. Three studies focused solely on social behaviors (Dearden et al., 2007; Dubin, 2008; Rattan et al., 2012). Fifteen remaining articles (50%) addressed personal and social behaviors.

Researchers examined behaviors that were explicitly linked with the tourism site yet could be performed once visitors returned home. For example, in their study of participants on a turtle walk in Australia, Tisdell and Wilson (2005) queried behaviors that might affect sea turtles (e.g. intentions to turn off lights when near the ocean or to avoid purchasing products made from sea turtles). Skibins et al. (2013) compared tourists on safari in Tanzania and visitors to US zoos and aquariums; in each venue, visitor behaviors

reflected concern for wildlife – both species-specific actions (e.g. giving money to buy habitat for a named species) and actions related to biodiversity in general (e.g. supporting policies to protect wildlife).

Two studies (Ballantyne, Packer, & Falk, 2011; Ballantyne, Packer, & Sutherland, 2011) included broad, open-ended questions about environmental behavior that allowed respondents to indicate behaviors they felt were linked to the tourism site. Another study (Hovardas & Poirazidis, 2006) assessed behaviors with open-ended as well as site-specific questions. Another seven (23%) assessed both general and site-related behaviors using close-ended questions. Seven studies (23%) focused only on behaviors related to the environment more generally (e.g. recycling, donating to environmental organizations, or signing petitions unrelated to places recently visited).

A number of articles chose behaviors that were specifically highlighted during the tourism experience under study. Smith et al. (2008), for instance, looked at two behaviors central to interpretive messages of a zoo tour: the conservation and protection of birds. Hughes (2013) also crafted questions based on the interpretive components of the visitors' experience to a turtle rookery; however, in that case, the focus was on general behaviors that could be enacted anywhere. Thus specific behaviors, such as staying away from dunes where sea turtles may have nests, were not assessed, while more general behaviors, such as picking up litter, were.

Three studies (10%) used surveys to measure behaviors on the basis of social desirability and locus of control (Powell & Ham, 2008; Powell et al. 2008, 2009). These behaviors include recycling at home, reading about the environment, joining environmental organizations, and voting for elected officials based on their support for the environment. Hovardas and Poirazidis (2006) queried proxy behavioral intentions of visitors to a Greek forest reserve: intentions to adopt a tree (a proxy for visitors' appreciation of nature and concern for biodiversity) and intentions to volunteer for a week at the reserve (another proxy behavior requiring higher visitor input than paying a one-time tree adoption fee). Several researchers did not explain their reasoning for selecting the behaviors they assessed.

Measuring visitor outcomes

Our review focuses on investigations of specific visitor outcomes, namely environmental knowledge, attitudes, and behavior. Twelve studies (40%) evaluated self-reported changes in attitudes or behavioral intentions. Another seven studies (23%) calculated change by comparing differences in pre-visit and post-visit responses of visitors. The remaining eleven studies (37%) assessed changes with a combination of post-visit self-reports and pre-/post-test comparisons. To evaluate knowledge change, Powell and Ham (2008) used a 15-item quiz and a self-assessment where visitors reported their knowledge change across five thematic areas.

Most researchers created their own survey or interview instruments, allowing tailoring of questions to a specific tourism context. Data gathering techniques involved using a combination of open- and closed-ended questions, and many questions involved a scaled response. Other authors employed measures that were, at least in part, based on previously published research, often their own (e.g. Ballantyne, Packer, & Falk, 2011; Powell & Ham, 2008). A few studies (e.g. Beaumont, 2001; Hughes & Morrison-Saunders, 2005a, 2005b; Lee & Moscardo, 2005) used well-known instruments such as the Ecological Social Paradigm (ESP) or the New Environmental Paradigm (NEP) to source some or all of their attitudinal questions. Others (e.g. Weiler & Smith, 2009) surveyed tourists

about environmental attitudes using existing evaluation measures designed for interpretive experiences.

The reviewed articles encourage reinforcing or changing tourists' environmental behavior as a goal of NBT, yet the authors often acknowledged the difficulties in evaluating actual behavior change despite using a range of methods in their attempt to do so. Thus, many researchers resort to asking visitors about their behavioral *intentions* instead of actual behavior. The obvious advantage of assessing intentions is that they can be documented on-site immediately after the tourism experience, and, unlike actual behavior, they do not require a long-term follow-up survey. Yet, with these approaches, uncertainty persists about links between behavioral intentions and actual behavior (see Hughes, 2013 for a discussion of this concern). Of the articles in our review, 22 (73%) considered either behavioral intentions, actual behavior, or both. Of those, 21 examined visitors' behavioral intentions and 11 assessed self-reports of actual behaviors. Ten of these assessed both constructs, 11 looked only at behavioral intentions, and 1 asked about actual behavior only.

Notably, all of the studies that measured actual behavior did so through self-reports. In their study of tour participants in Galapagos National Park and resulting donations made to the Galapagos Conservation Fund (GCF), Powell and Ham (2008) expressed a desire to confirm visitors' intentions to donate by tracking actual donations, although they were prevented from doing so because of the confidentiality clauses surrounding financial contributions to GCF. Thus, none of the studies measured behavior directly, although many described interest in doing so.

Findings: characterizing the literature

Our findings are summarized in Table 5 by key variables and the number of studies that assessed changes in those variables. Behavioral outcomes are presented in two categories: behavioral intentions and actual behavior. Studies presenting outcomes that we coded as mixed or positive are marked with an asterisk, indicating that at least some positive results were reported. Lack of an asterisk indicates that the findings were coded as null or that the study did not provide enough information for that specified outcome to be coded. Many of the studies in our review examined more than one variable and, thus, are included multiple times in the table.

Table 6 further summarizes the findings as either null, mixed, or positive. We calculated percentages based on the total number of studies that reported findings for a given variable; therefore, the percentages differ from the number of studies investigating each variable in Table 5. For example, while 24 studies discuss measuring environmental knowledge as part of their methodology, we were only able to code the findings from 20 of these based on the information presented in the article.

Given the small number of studies in our sample, it is difficult to make definitive statements about the relationship between study methods and type of findings reported, but in general, studies that used only immediate post-visit methods reported more positive outcomes than studies using pre- and post-visit design or a long-term post-visit measure. Studies that contacted NBT participants 3–12 months following their experiences were more likely to report mixed or null findings for changes in knowledge, attitudes, or behavioral intentions, than studies using either immediate post-visit only or pre- and post-visit designs. The eight studies that used only post-visit measures reported a total of 14 findings for knowledge, attitudes, and behavior. Of those 14 findings, 11 (79%) were coded positive and 3 (21%) were coded mixed. Twenty-one findings were reported by 11 studies

Table 5. Studies investigating the four variables of interest.

Variable	Number of studies	Articles
Environmental knowledge	24	*Ballantyne, Packer, and Falk (2011); *Ballantyne, Packer, and Sutherland (2011); *Beaumont (2001); *Coghlan et al. (2011); *Coghlan and Kim (2012); *Dubin (2008); *Higham and Carr (2002); *Hill et al. (2007); *Hughes et al. (2011); *Hughes (2011); Hughes (2013); *Hughes and Morrison-Saunders (2002); Hughes and Morrison-Saunders (2005b); *Madin and Fenton (2004); Mayes and Richins (2009); *Powell and Ham (2008); *Powell et al. (2008, 2009); *Rattan et al. (2012); Sander (2012); *Smith et al. (2008); *Stamation et al. (2007); *Tisdell and Wilson (2005); *Tubb (2003)
Environmental attitudes	22	*Ballantyne, Packer, and Falk (2011); *Ballantyne, Packer, and Sutherland (2011); Beaumont (2001); *Coghlan et al. (2011); *Coghlan and Kim (2012); Hill et al. (2007); *Hughes (2011); Hughes (2013); *Hughes et al. (2011); *Hughes and Morrison-Saunders (2005a, 2005b); Lee and Moscardo (2005); *Mayes and Richins (2009); *Powell and Ham (2008); Powell et al. (2008, 2009); *Rattan et al. (2012); Sander (2012); *Skibins et al. (2013); *Tisdell and Wilson (2005); Tubb (2003); *Weiler and Smith (2009)
Environmental behavioral intentions	21	Ballantyne, Packer, and Falk (2011); *Beaumont (2001); *Coghlan and Kim (2012); *Dearden et al. (2007); *Dubin (2008); *Hovardas and Poirazidis (2006); Hughes (2011); *Hughes (2013); Hughes et al. (2011); Lee and Moscardo (2005); *Mayes and Richins (2009); *Powell and Ham (2008); *Powell et al. (2008, 2009); *Rattan et al. (2012); Sander (2012); *Skibins et al. (2013); *Smith et al. (2008); *Stamation et al. (2007); *Tisdell and Wilson (2005); Tubb (2003)
Environmental behavior	11	*Ballantyne, Packer, and Falk (2011); *Ballantyne, Packer, and Sutherland (2011); Beaumont (2001); *Hughes (2011, 2013); *Hughes et al. (2011); Powell and Ham (2008); Powell et al. (2008, 2009); *Smith et al. (2008); *Stamation et al. (2007)

*Partially positive or positive findings.

using a combined pre- and post-visit design, with 10 (48%) positive, 3 (14%) null, and 8 (38%) mixed. Of the 23 findings from the 11 studies with delayed post-visit measures, 5 findings (22%) were positive, 5 (22%) were null, and 13 (57%) were mixed.

Environmental knowledge

The 20 studies that assessed environmental knowledge found at least some positive changes in knowledge. Eleven studies (55%, coded as positive) reported increases across all groups sampled and all measures used. The other nine studies (45%) described mixed findings,

Table 6. Number of studies with outcomes coded as null, mixed, or positive for each variable.

Findings	Environmental knowledge ($n = 20$)	Environmental attitudes ($n = 20$)	Environmental behavioral intentions ($n = 17$)	Environmental behavior ($n = 10$)
Null	0 (0%)	6 (30%)	2 (12%)	3 (30%)
Mixed	9 (45%)	8 (40%)	9 (53%)	7 (70%)
Positive	11 (55%)	6 (30%)	6 (35%)	0 (0%)

noting increases in certain measures of knowledge, yet no change in knowledge for other measures. Madin and Fenton (2004), for example, surveyed two independent groups of visitors to the Great Barrier Reef – one sample before the experience and another sample after the experience. These researchers found that outcomes varied for four self-reported knowledge composites: general knowledge about the reef, human impacts on the reef, health of the reef, and tourism-related issues concerning the reef. Only one composite measure – general knowledge about the reef – improved significantly.

Seven articles addressing knowledge change included follow-up measures administered one month or more after the tourism experience. Five of these (71%) found that immediate knowledge gains persisted well after the visit, including up to three months after a nature-based cruise (Powell et al., 2008). Hughes et al. (2011) found mixed results when measuring knowledge increases three months after a nature tourism experience. Visitors who received post-visit support (such as a printed kit with fact and trivia sheets, coloring pages, family activities, and quizzes; an informative website; and weekly email updates, among other elements) maintained or increased scores on knowledge measures; not surprisingly, those without such support scored lower on the same knowledge-related measures. Another study found null results in the longer term (6–8 months post-visit), even when immediate post-visit results initially indicated increased environmentally and visit-related knowledge (Stamation et al., 2007).

Environmental attitudes

Twenty studies assessed changes in environmental attitudes. Six of these (30%) found no changes in environmental attitudes related to the tourism experience. Powell et al. (2008) found positive attitudes about Antarctic resource management before visitors participated in an Antarctic cruise. When no change was subsequently reported, researchers concluded that visitors arrived already largely in support of management practices. Six studies (30%) indicated positive changes for participants on all attitudinal change measures, whereas eight studies (40%) found only partially positive outcomes. Powell and Ham's (2008) study of visitors to Galapagos National Park found increased support for all ten items related to conservation of the Galapagos ecosystem, although only five of these increases were statistically significant. Two studies of visits to natural areas in Australia, each offering a different type of nature-based activity, found positive outcomes for some visitors and theorized a link between attitude change and site experience, type of activities undertaken, and visitor characteristics (Hughes & Morrison-Saunders, 2005a, 2005b).

In terms of long-term impacts, only five studies (17%) investigated changes in environmental attitudes using delayed post-visit surveys. Since three of these did not find changes in attitudes immediately after the tourism experience, it is not surprising that no attitude change was noted months after the visit. Ballantyne, Packer, and Falk (2011) initially saw environmental attitude changes in visitors to four different wildlife tourism sites in Australia, yet follow-up surveys conducted four months after the experience revealed that the changes did not persist. In contrast, Hughes et al. (2011) reported long-term (three month) changes in environmental attitudes among families visiting an Australian turtle rookery, although these changes persisted only among the sample of families who received post-visit support in the form of weekly emails, a website specifically designed to support visitors to this experience, and a family activity/information packet. Data from Hughes (2011) and Ballantyne, Packer, and Sutherland (2011) hint at long-term attitudinal changes in visitors although measurements of these changes were not undertaken.

Environmental behavioral intentions

Of the 17 studies that evaluated behavioral intentions, two studies (12%) reported no changes as a result of the NBT experience, while six studies (35%) reported positive changes in behavioral intentions. Dearden et al. (2007), for example, surveyed scuba divers in Thailand before and after their dive trips and found a significant increase in the number of divers wanting to participate in a reef-monitoring project after diving. Nine other studies (53%) reported partially favorable changes in behavioral intentions. Mayes and Richins (2009), for example, asked dolphin-watching-tour participants to reflect on the influence of the trip on their intention to engage in 10 pro-environmental behaviors. Seven of these received support from more than half of the respondents. Predictably, visitors were most likely to intend to undertake behaviors that required little time, money, or effort.

Actual environmental behavior

Of the 10 studies assessing behavior, none demonstrated positive outcomes for all of the behavioral measures at all points in time; however, seven studies (70%) presented partially positive findings. Smith et al. (2008) found that 50% of the zoo visitors who received followed-up communication later indicated that they started an action or increased their commitment to an action to protect birds and their habitats; still, three studies (30%) reported no changes in environmental behavior. Ballantyne, Packer, and Sutherland (2011) examination of visits to four Australian marine-wildlife tourism venues revealed that only 7% of respondents ($n = 240$) reported engaging in a specific, new environmental behavior in the four months following their visit. Research on behavior change resulting from Antarctic cruises (Powell et al., 2008) and Grand Canyon river rafting trips (Powell et al., 2009) found increases in behavioral intentions immediately following the nature-based tour although actual behaviors did not manifest in follow-up surveys three months and one year later.

Features of NBT that influence knowledge, attitudes, and behavior

Looking across the studies we analyzed, researchers described many factors that influenced visitor outcomes related to environmental knowledge, attitudes, and behaviors (Table 7). Interpretation and education-related components of the tourism experiences received the most attention. Studies that focused on the interpretive experience supported the need for more and higher quality interpretation (e.g. Dearden et al., 2007; Higham & Carr, 2002; Mayes & Richins, 2009; Powell & Ham, 2008; Stamation et al., 2007). This finding suggests that structured interpretation from trained interpreters increases environmental knowledge, attitudes, and behavior. The range of suggestions for improving such outcomes include increased use of interactive audio and visual materials (Tubb, 2003), educational programs focused on reinforcing visitors' existing behaviors (Smith et al., 2008), in-depth content and powerful wildlife viewing experiences (Mayes & Richins, 2009), and multi-layered interpretation that includes signage, volunteer interpreters, dramatic role-plays, and behind-the-scenes tours (Weiler & Smith, 2009).

Beyond interpretation, researchers called attention to encouraging emotional connections with wildlife (Ballantyne, Packer, & Sutherland, 2011; Hughes, 2011, 2013; Skibins et al., 2013) and providing visitors with time for reflection (Ballantyne, Packer, & Falk, 2011; Ballantyne, Packer, & Sutherland, 2011; Hughes, 2011, 2013). Others emphasized the importance of foregrounding the conservation-related actions during the ecotourism experience by discussing strategies for action or providing on-site opportunities to act

Table 7. Salient features of research on the nature-based tourism experience.

Identified feature	Supporting articles
Interpretation/education	Coghlan et al. (2011); Dearden et al. (2007); Higham and Carr (2002); Hill et al. (2007); Hughes and Morrison-Saunders (2002); Mayes and Richins (2009); Powell and Ham (2008); Smith et al. (2008); Stamatou et al. (2007); Tubb (2003); Weiler and Smith (2009)
Time for reflection	Ballantyne, Packer, and Falk (2011); Ballantyne, Packer, and Sutherland (2011); Hughes (2011, 2013)
Creating an emotional connection	Ballantyne, Packer, and Sutherland (2011); Hughes (2011, 2013); Skibins et al. (2013)
Strategies and opportunities for action	Ballantyne, Packer, and Sutherland (2011); Hughes (2011); Powell et al. (2009); Rattan et al. (2012); Skibins et al. (2013)
Exposure to wildlife	Hovardas and Poirazidis (2006); Mayes and Richins (2009); Skibins et al. (2013); Tisdell and Wilson (2005)
Level of participation and type/intensity of activities offered	Coghlan and Kim (2012); Hughes and Morrison-Saunders (2005a, 2005b)
Viewing actual environmental damage	Dearden et al. (2007)
Trip duration	Dearden et al. (2007)
Pre-existing visitor characteristics	Ballantyne, Packer, and Falk (2011); Hughes and Morrison-Saunders (2005a)
Prior preparation	Dubin (2008)
Post-visit support	Ballantyne, Packer, and Falk (2011); Ballantyne, Packer, and Sutherland (2011); Hughes (2011, 2013); Hughes et al. (2011); Rattan et al. (2012)

(Ballantyne, Packer, & Sutherland, 2011; Hughes, 2011; Powell et al., 2009; Rattan et al., 2012; Skibins et al., 2013). Three papers (Hovardas & Poirazidis, 2006; Mayes & Richins, 2009; Tisdell & Wilson, 2005) demonstrated how direct, first-hand experience of seeing wildlife contributed to positive attitudinal and behavioral outcomes. Skibins et al. (2013) found that such outcomes were possible even when the wildlife was *ex situ*.

A few researchers argued that factors not directly part of the on-site NBT experience influence outcomes. Ballantyne, Packer, and Falk (2011) and Hughes and Morrison-Saunders (2005a) identified pre-existing visitor attributes as important factors contributing to visitors' post-trip environmental knowledge, attitudes, and behaviors. Dubin (2008) found a link between pre-trip preparation and trip-related increases in pro-environmental and culturally relevant knowledge and attitudes. Another common topic of discussion involved post-visit support. Six studies either demonstrated increased positive outcomes with regard to conservation-related attitudes, knowledge, and behaviors from the use of post-visit action resources, or made explicit calls for the use of and research into such extensions of the experience (Ballantyne, Packer, & Falk, 2011; Ballantyne, Packer, & Sutherland, 2011; Hughes, 2011, 2013; Hughes et al., 2011; Rattan et al., 2012).

Limitations of the reviewed studies

Across the literature analyzed, sampling bias was a common concern. Coghlan et al. (2011) felt that the distribution of surveys by boat crewmembers may have led to bias. Tisdell and Wilson (2005) acknowledged that more conservation-minded tourists may be

more likely to participate in surveys. Other authors discussed design-related challenges, noting that the instruments used to measure environmental knowledge, attitudes, and behaviors are imperfect, partial, and imprecise (e.g. Hughes & Morrison-Saunders, 2005b; Madin & Fenton, 2004). In particular, the use of self-reports and self-ratings was debated, as was the issue of social-desirability bias (e.g. Hughes, 2013; Rattan et al., 2012; Smith et al., 2008). Universally, researchers acknowledged the difficulties inherent in researching environmentally related behaviors, the complex nature of behavior, the reliance on self-reports and intentions to measure behavior, and the incubation period needed for behavior change to manifest.

Researchers also noted spatio-temporal limitations. Researchers cautioned that findings in a single study may not be appropriate to generalize beyond that particular site or sample; replication on larger and more diverse scales would be needed to apply the findings to broader contexts (Coghlan et al., 2011; Hughes, 2011; Weiler & Smith, 2009). Temporal concerns revolved around measures applied immediately post-experience versus long-term follow-up. Furthermore, for those conducting delayed post-experience research, questions arose about the duration of the post-trip effects (Hughes, 2013). None of the measures taken in our sample studies extended beyond a year. Such discrepancies suggest a strong need for continued discussion in this area.

Another concern involves the “ceiling effect” occurring among nature-based tourists who arrive with high levels of pro-environmental knowledge, attitudes, and behavior. This effect complicates the detection of changes related to the tourism experience (Ballantyne, Packer, & Sutherland, 2011; Beaumont, 2001; Hill et al., 2007; Hovardas & Poirazidis, 2006; Lee & Moscardo, 2005; Powell et al., 2008, 2009; Sander, 2012). Beaumont’s (2001) description of challenges related to “preaching to the converted” was often invoked; however, several authors noted that participants with the lowest levels of environmental knowledge, attitudes, and behaviors were particularly likely to exhibit significant change in the outcomes under study.

Discussion and opportunities for future research

In this section, we offer suggestions for (1) theoretical perspectives that may enhance how NBT and its outcomes are conceptualized; (2) opportunities for structuring NBT to achieve long-term sustainability in pro-environmental attitudes, knowledge, and stewardship, based on what is known from other fields; and (3) methods for documenting environmentally related behavior changes through the social communities that may develop during a travel experience.

With regard to theory, many of the studies in our review conceptualized NBT as separated in space and time from the visitors’ home environment. Few described the tour as part of the ongoing fabric of experience that contributes to visitors’ learning about the world and to their constant (re)making of identity, concepts, and places (Falk et al., 2012). Yet, constructivist perspectives suggest that learning continuously builds on prior experiences and conceptions (Driver & Oldham, 1986). Therefore, in a recursive way, NBT experiences derive from and contribute to tourists’ understandings of the (natural) world and cannot be separated from their everyday lives.

Similarly, knowledge builds on prior experiences and is constructed and reconstructed through social practices (Greeno, Collins, & Resnick, 1996), including those occurring before, during, and after the tourism experience. Social context and place – both the “home” place and the “tourism” place – are, thus, inseparable from visitor learning. Both social and place-based practices influence how visitors situate themselves in relation to

the NBT experience and its goals of encouraging pro-environmental attitudes and stewardship behaviors. This suggests a scholarly shift from viewing knowledge, attitudes, and behavior as products of the tourism experience to viewing them as processes as well. To better understand visitor outcomes (and the connections among them), we suggest – in alignment with Falk et al. (2012) and Ballantyne and Packer (2011) – that future research investigate not only visitors' social interactions as they participate in nature-based experiences, but also their prior experiences with and understandings of the natural world. This will enhance the value, and the associated interpretation, of tourism experiences (Ballantyne & Packer, 2011; Falk et al., 2012).

Attending to broader social contexts of NBT experiences is also essential in designing tourism that encourages desired shifts in attitudes and behaviors. Eleven studies reviewed here highlight interpretation's direct contribution to positive changes in knowledge, attitudes, and behavior. Given that this was the most supported aspect of the "effective" NBT experience in our review, the findings emphasize the critical role of high-quality, tailored, and meaningful interpretive programming for promoting positive outcomes of the tourism experiences. Researching NBT with these contexts in mind will likely support pro-environmental outcomes aligned with the aspirations for this form of tourism.

From the programmatic perspective, our literature analysis suggests that some of these aspirations – for example, influencing visitors' attitudes, knowledge, and behavior in the long term – remain poorly documented or are not being achieved to the extent desired. Although some NBT experiences may be marginally successful in the short, medium, and potentially longer term, our analysis suggests that studies have indeed found several key elements that seem to consistently contribute to achieving positive visitor outcomes: high-quality interpretive experiences that incorporate specific content tied to conservation messaging; promoting and offering direct contact with and viewing of wildlife in the tourism context; and encouraging presenting visitors with opportunities to take environmentally related action on-site (Table 7).

In terms of future research, studies that measure direct behavior of the visitors and track these behaviors longer than a year post-trip are lacking. Promising scholarship in other related fields, such as environmental education and conservation psychology, suggests that extended and repeated experiences are important for sustaining the initial motivation to develop new long-term behaviors (see, for example, Chawla, 2007). One opportunity to extend the experience, for example, is to provide post-visit engagement. Research suggests that scaffolding post-visit resources may better connect the nature-based tour with visitors' everyday home lives (e.g. Adelman, Falk, & James, 2000; Ballantyne & Packer, 2011).

Technology (e.g. websites, smartphone apps) provides another opportunity to extend the experience. Technology is now ubiquitous in the everyday lives of most of the touring public, and social media plays a large role in travelers' search for tourist information (Xiang & Gretzel, 2010). Software-based technological extensions, such as Facebook, Twitter, and Instagram, among others, facilitate social elements of sharing one's experience in a place, and creating online communities that endure beyond the travel experience.

Health sciences and community development researchers also provide examples of strategies for initiating and maintaining positive behaviors through using cohort groups and technology platforms (cf, Robelia, Greenhow, & Burton, 2011). In addition to building social communities, these platforms can foster loyalty to the destination site. Moore, Rodger, and Taplin (2013) suggest that loyalty is a critical component in the effort to protect natural areas, including those essential to the NBT experience. Moore et al. (2013), and others (e.g. Pearce & Kang, 2009), also discuss the potential for transferred loyalty

when visitors who develop loyalty to one natural area may extend their support to other natural areas. Clearly, technology is now important for delivering interpretive opportunities that emphasize social interactions, facilitating community-building among visitors and guides and nurturing place loyalty – whether during or after the tour, face-to-face, or virtually.

With regard to methods, our review reveals that few empirical studies have rigorously substantiated the claim that NBT changes the environmental knowledge, attitudes, and behaviors of visitors over the long term. Surely, this small number directly reflects the challenges to measuring these outcomes. To date, research has been imprecise in capturing or characterizing when and how trip-related changes occur; when, how, and why these changes dissipate; and when and how we may better support persistence of these changes. Therefore, creative methods that directly measure behavior in the field, as well as in the longer term once visitors return home, could strengthen the analyses.

To address the ongoing issue of fidelity between intentions and actual behaviors, direct observation of conservation behavior or stewardship activities remain indispensable. Researchers are making efforts in this respect, including some tourism experiences designed to include citizen science components (Crabbe, 2012; Marshall, Kleine, & Dean, 2012; Pattengill-Semmens & Semmens, 2003). Insight may also come from scholarship on voluntourism, where visitors may move from being tourists to also undertaking meaningful conservation or research activities while in the tourism site (Wearing & McGehee, 2013). Another opportunity exists for using embedded assessment measures more common in, for example, informal science education (e.g. Ardoin et al., 2014; Camargo & Shavelson, 2009). Sensors or utility service documentation may offer creative measures to track actual environmental behaviors (cf, water or power usage at home, e.g. Allcott & Mullainathan, 2010). Using such objective measures could provide a better indication of the efficacy of NBT to engender general stewardship attitudes and behaviors among visitors – and perhaps more importantly, suggest which aspects of the experience influence desired affective, cognitive, and behavioral outcomes among visitors, and in what manner.

Conclusion

NBT presents a tremendous opportunity to build on the existing interests and motivation of visitors to learn and do more on behalf of threatened spaces and species. Yet, it may fail to realize its full potential unless further supported by experiences designed to emphasize conservation messaging, leverage interpretive opportunities, and connect motivating travel experiences with the travelers' home environments. Our analysis of the empirical research on NBT's ability to foster longer term, and broader, stewardship behavior among travelers highlights where scholarly consensus exists and where it is lacking. On this basis, we offer potentially promising directions for future research likely to advance the understanding of the ways in which NBT can positively influence pro-environmental stewardship behavior, in the short and longer term. In broader terms, the paper is a contribution to the growing debate in sustainable tourism studies (cf, Higham, Cohen, Peeters, & Gosling, 2013) about how best to encourage, support, and sustain positive pro-environmental behaviors across travelers of all kinds.

Acknowledgements

We are grateful to our advisors and research colleagues, whose insights helped inform our thinking around this paper and related studies, in particular John Falk, B.J. Fogg, Carol Saunders, and Wes

Schultz. We also appreciate the assistance of Claire Menke with project management and Chandana Rao with early explorations of the literature. We also are grateful to the editors and reviewers for their excellent suggestions, which strengthened this manuscript.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This work was supported by a grant from the Environmental Ventures Project Fund of the Stanford Woods Institute for the Environment.

Notes

1. Because we were interested in broader impacts beyond the tourism site, we excluded studies focused solely on behavior at the visitor site itself.
2. Based on our search criteria, we excluded studies that examined on-site behavior only; however, some of the included studies considered both on- and off-site behaviors. Coghlan and Kim (2012), for example, asked visitors to Australia's Great Barrier Reef about their intentions to avoid standing on the reef as well as about their intentions to adopt environmental practices and become more involved in environmental behaviors post-trip.

Notes on contributors

Nicole M. Ardoin is an assistant professor in the Graduate School of Education and Woods Institute for the Environment at Stanford University. Her research focuses on sense of place and stewardship behavior in a range of environments, including parks and protected areas, zoos and aquariums, museums, and other informal and community-based settings.

Mele Wheaton is a social science research associate in the Graduate School of Education and Woods Institute for the Environment at Stanford University. Her research interests include nature-based tourism, environmental education, and informal science education.

Alison W. Bowers is a PhD student in the Educational Research and Evaluation Program at Virginia Tech. Her research interests include human dimensions of natural resource management and the intersection of education and the natural environment.

Carter A. Hunt is an assistant professor of Recreation, Park, and Tourism Management in the College of Health and Human Development at Penn State University. His research explores tourism in Latin America as a means of supporting biodiversity conservation and sustainable community development.

William H. Durham is Bing Professor in Human Biology and Senior Fellow in the Woods Institute for the Environment at Stanford. As an environmental anthropologist, his work focuses on ways to meet the dual challenges of biodiversity conservation and local community development in tropical areas, especially in Latin America.

References

References marked with an asterisk indicate studies that met our criteria and were included in the review. Others were referenced in this article, but not included in the review.

- Adelman, L., Falk, J., & James, S. (2000). Impact of national aquarium in Baltimore on visitors' conservation attitudes, behavior, and knowledge. *Curator: The Museum Journal*, 43(1), 33–61.
- Allcott, H., & Mullainathan, S. (2010). Behavior and energy policy. *Science*, 327, 1204–1205.

- Ardoin, N., DiGiano, M., Bundy, J., Chang, S., Holthuis, N., & O'Connor, K. (2014). Using digital photography and journaling in evaluation of field-based environmental education programs. *Studies in Educational Evaluation, 41*, 68–76.
- Arnould, E.J., & Price, L.L. (1993). River magic: Extraordinary experience and the extended service encounter. *Journal of Consumer Research, 20*(1), 24–45.
- Ballantyne, R., & Packer, J. (2011). Using tourism free-choice learning experiences to promote environmentally sustainable behavior: The role of post-visit “action resources”. *Environmental Education Research, 17*(2), 201–215.
- Ballantyne, R., Packer, J., & Falk, J. (2010). Exploring the impacts of wildlife tourism on visitors’ long-term environmental learning and behaviour. *International Zoo Education Journal, 46*(8), 12–15.
- *Ballantyne, R., Packer, J., & Falk, J. (2011). Visitors’ learning for environmental sustainability: Testing short- and long-term impacts of wildlife tourism experiences using structural equation modelling. *Tourism Management, 32*(6), 1243–1252.
- *Ballantyne, R., Packer, J., & Sutherland, L.A. (2011). Visitors’ memories of wildlife tourism: Implications for the design of powerful interpretive experiences. *Tourism Management, 32*(4), 770–779.
- Balmford, A., Beresford, J., Green, J., Naidoo, R., Walpole, M., & Manica, A. (2009). A global perspective on trends in nature-based tourism. *PLoS Biology, 7*(6), e1000144.
- *Beaumont, N. (2001). Ecotourism and the conservation ethic: Recruiting the uninitiated or preaching to the converted. *Journal of Sustainable Tourism, 9*(4), 317–341.
- Camargo, C. & Shavelson, R. (2009). Direct measures in environmental education evaluation: Behavioral intentions versus observable actions. *Applied Environmental Education and Communication, 8*(3), 165–173.
- Chawla, L. (2007). Childhood experiences associated with care of the natural world: A theoretical framework for empirical results. *Children, Youth, and Environments, 17*(4), 144–170.
- Christie, M.F., & Mason, P.A. (2003). Transformative tour guiding: Training tour guides to be critically reflective practitioners. *Journal of Ecotourism, 2*(1), 1–16.
- *Coghlan, A., Fox, K.R., Prideaux, B., & Lück, M. (2011). Successful interpretation in Great Barrier Reef tourism: Dive in or keep out of it? *Tourism in Marine Environments, 7*(3/4), 167–178.
- *Coghlan, A., & Kim, A.K. (2012). Interpretive layering in nature-based tourism: A simple approach for complex attractions. *Journal of Ecotourism, 11*(3), 173–187.
- Crabbe, J. (2012). From citizen science to policy development on the coral reefs of Jamaica. *International Journal of Zoology*, Article ID 102350.
- Crompton, J.L., & Lamb, C.W. (1986). *Marketing government and social services*. New York, NY: Wiley.
- *Dearden, P., Bennett, M., & Rollins, R. (2007). Perceptions of diving impacts and implications for reef conservation. *Coastal Management, 35*(2–3), 305–317.
- Driver, R., & Oldham, V. (1986). A constructivist approach to curriculum development in science. *Studies in Science Education, 13*(1), 105–122.
- *Dubin, J. (2008). Educating ecotourists: Lessons from the field. In A. Stronza & W.H. Durham (Eds.), *Ecotourism and conservation in the Americas* (pp. 141–152). Wallingford: CABI.
- Falk, J., Ballantyne, R., Packer, J., & Benckendorff, P. (2012). Travel and learning: A neglected tourism research area. *Annals of Tourism Research, 39*(2), 908–927.
- Greeno, J.G., Collins, A., & Resnick, L.B. (1996). Cognition and learning. In D. Berliner & R. Calfee (Eds.), *Handbook of educational psychology* (pp. 15–46). New York, NY: Macmillan Library Reference.
- Higham, J. (2007). *Critical issues in eco-tourism: Understanding a complex tourist phenomenon*. Oxford: Elsevier.
- *Higham, J., & Carr, A. (2002). Ecotourism visitor experiences in Aotearoa/New Zealand: Challenging the environmental values of visitors in pursuit of pro-environmental behavior. *Journal of Sustainable Tourism, 10*(4), 277–294.
- Higham, J., Cohen, S.A., Peeters, P., & Gossling, S. (2013). Psychological and behavioural approaches to understanding and governing sustainable mobility. *Journal of Sustainable Tourism, 21*(7), 949–967.
- *Hill, J., Woodland, W., & Gough, G. (2007). Can visitor satisfaction and knowledge about tropical rainforests be enhanced through biodiversity interpretation, and does this promote a positive attitude towards ecosystem conservation? *Journal of Ecotourism, 6*(1), 75–85.

- Honey, M. (2008). *Ecotourism: Who owns paradise?* (2nd ed.). Washington, DC: Island Press.
- *Hovardas, T., & Poirazidis, K. (2006). Evaluation of the environmentalist dimension of ecotourism at the Dadia Forest Reserve (Greece). *Environmental Management*, 38(5), 810–822.
- *Hughes, K. (2011). Designing post-visit action resources for families visiting wildlife tourism sites. *Visitor Studies*, 14(1), 66–83.
- *Hughes, K. (2013). Measuring the impact of viewing wildlife: Do positive intentions equate to long-term changes in conservation behaviour? *Journal of Sustainable Tourism*, 21(1), 42–59.
- *Hughes, K., Packer, J., & Ballantyne, R. (2011). Using post-visit action resources to support family conservation learning following a wildlife tourism experience. *Environmental Education Research*, 17(3), 307–328.
- *Hughes, M., & Morrison-Saunders, A. (2002). Impact of trail-side interpretive signs on visitor knowledge. *Journal of Ecotourism*, 1(2–3), 122–132.
- *Hughes, M., & Morrison-Saunders, A. (2005a). Influence of on-site interpretation intensity on visitors to natural areas influence of on-site interpretation intensity on visitors to natural areas. *Journal of Ecotourism*, 4(3), 161–177.
- *Hughes, M., & Morrison-Saunders, A. (2005b). Interpretation, activity participation, and environmental attitudes of visitors to Penguin Island, Western Australia. *Society and Natural Resources*, 18(7), 611–624.
- *Lee, W.H., & Moscardo, G. (2005). Understanding the impact of ecotourism resort experiences on tourists' environmental attitudes and behavioural intentions. *Journal of Sustainable Tourism*, 13(6), 546–565.
- *Madin, E.M.P., & Fenton, D.M. (2004). Environmental interpretation in the Great Barrier Reef Marine Park: An assessment of programme effectiveness. *Journal of Sustainable Tourism*, 12(2), 121–137.
- Maher, P.T., Steel, G., & McIntosh, A. (2003). Examining the experiences of tourists in Antarctica. *International Journal of Tourism Research*, 5(1), 59–62.
- Marshall, N.J., Kleine, D.A., & Dean, A.J. (2012). CoralWatch: Education, monitoring, and sustainability through citizen science. *Frontiers in Ecology*, 10(6), 332–334.
- *Mayes, G., & Richins, H. (2009). Dolphin watch tourism: Two differing examples of sustainable practices and pro-environmental outcomes. *Tourism in Marine Environments*, 5(2–3), 201–214.
- McGehee, N.G., & Norman, W.C. (2001). Alternative tourism as impetus for consciousness-raising. *Tourism Analysis*, 6(3–4), 239–251.
- Moore, S.A., Rodger, K., & Taplin, R. (2013). Moving beyond visitor satisfaction to loyalty in nature-based tourism: A review and research agenda. *Current Issues in Tourism*, 1–17. doi: 10.1080/13683500.2013.790346.
- Orams, M.B. (1997). The effectiveness of environmental education: Can we turn tourists into 'greenies'. *Progress in Tourism and Hospitality Research*, 3, 295–306.
- Pattengill-Semmens, C.V., & Semmens, B.X. (2003). Conservation and management applications of the Reef Volunteer Fish Monitoring Program. *Environmental Monitoring and Assessment*, 81, 43–50.
- Pearce, P.L., & Kang, M.H. (2009). The effects of prior and recent experience on continuing interest in tourist settings. *Annals of Tourism Research*, 36(2), 172–190.
- Powell, R.B. (2005). *Nature-based tourism within protected areas: Effects of participation on knowledge, attitudes, values, and behaviors and the factors that influence these outcomes* (Unpublished doctoral dissertation). Yale University, New Haven, CT.
- Powell, R.B., Brownlee, M.T., Kellert, S.R., & Ham, S.H. (2012). From awe to satisfaction: Immediate affective responses to the Antarctic tourism experience. *Polar Record*, 48(02), 145–156.
- *Powell, R.B., & Ham, S.H. (2008). Can ecotourism interpretation really lead to pro-conservation knowledge, attitudes and behaviour? Evidence from the Galápagos Islands. *Journal of Sustainable Tourism*, 16(4), 467–489.
- *Powell, R.B., Kellert, S.R., & Ham, S.H. (2008). Antarctic tourists: Ambassadors or consumers? *Polar Record*, 44(230), 233–241.
- *Powell, R.B., Kellert, S.R., & Ham, S.H. (2009). Interaction theory and the sustainable nature-based tourism experience. *Society and Natural Resources*, 22(8), 761–776.
- *Rattan, J.K., Eagles, P.F.J., & Mair, H.L. (2012). Volunteer tourism: Its role in creating conservation awareness. *Journal of Ecotourism*, 11(1), 1–15.

- Robelia, B.A., Greenhow, C., & Burton, L. (2011). Environmental learning in online social networks: Adopting environmentally responsible behaviors. *Environmental Education Research, 17*(4), 553–575.
- *Sander, B. (2012). The importance of education in ecotourism ventures: Lessons from Rara Avis ecolodge, Costa Rica. *International Journal of Sustainable Society, 4*(4), 389–404.
- *Skibins, J.C., Powell, R.B., & Hallo, J.C. (2013). Charisma and conservation: Charismatic megafauna's influence on safari and zoo tourists' pro-conservation behaviors. *Biodiversity and Conservation, 22*(4), 959–982.
- *Smith, L., Broad, S., & Weiler, B. (2008). A closer examination of the impact of zoo visits on visitor behaviour. *Journal of Sustainable Tourism, 16*(5), 544–562.
- *Stamation, K.A., Croft, D.B., Shaughnessy, P.D., Waples, K.A., & Briggs, S.V. (2007). Educational and conservation value of whale watching. *Tourism in Marine Environments, 4*(1), 41–55.
- Stern, M.J., Powell, R.B., & Hill, D. (2014). Environmental education program evaluation in the new millennium: What do we measure and what have we learned? *Environmental Education Research, 20*(5), 581–611
- Stern, P.C. (2000). New environmental theories: Toward a coherent theory of environmentally significant behavior. *Journal of Social Issues, 56*(3), 407–424.
- Stewart, E.J., Hayward, B.M., Devlin, P.J., & Kirby, V.G. (1998). The “place” of interpretation: A new approach to the evaluation of interpretation. *Tourism Management, 19*(3), 257–266.
- Stronza, A., & Durham, W. (2008). *Ecotourism and conservation in the Americas*. Cambridge, MA: CAB International.
- *Tisdell, C., & Wilson, C. (2005). Perceived impacts of ecotourism on environmental learning and conservation: Turtle watching as a case study. *Environment, Development and Sustainability, 7*(3), 291–302.
- *Tubb, K.N. (2003). An evaluation of the effectiveness of interpretation within Dartmoor National Park in reaching the goals of sustainable tourism development. *Journal of Sustainable Tourism, 11*(6), 476–498.
- Walker, K.B. (2007). *The role of interpretation in sustainable tourism: A qualitative approach to understanding passenger experiences on expedition cruises* (Unpublished doctoral dissertation). James Cook University, Townsville, Australia. Retrieved 21 February 2015 from <http://researchonline.jcu.edu.au/2098/2/02whole.pdf>
- Walker, K., & Moscardo, G. (2006). The impact of interpretation on passengers of expedition cruises. In R.K. Dowling (Ed.), *Cruise ship tourism* (pp. 105–114). Cambridge, MA: CAB International.
- Wearing, S., & McGehee, N. (2013). Volunteer tourism: A review. *Tourism Management, 38*, 120–130.
- Weaver, D.B., & Lawton, L.J. (2007). Twenty years on: The state of contemporary ecotourism research. *Tourism Management, 28*(5), 1168–1179.
- *Weiler, B., & Smith, L. (2009). Does more interpretation lead to greater outcomes? An assessment of the impacts of multiple layers of interpretation in a zoo context. *Journal of Sustainable Tourism, 17*(1), 91–105.
- Wight, P.A. (2001). Ecotourists: Not a homogenous market segment. In D. Weaver (Ed.), *The encyclopedia of ecotourism* (pp. 37–62). New York, NY: CABI Publishing.
- Xiang, Z., & Gretzel, U. (2010). Role of social media in online travel information search. *Tourism Management, 31*(2), 179–188.