



Understanding the multi-dimensional structure of pro-environmental behavior



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ABSTRACT

We examined the multi-dimensional structure of pro-environmental behavior (PEB) in a mixed-methods study of rural residents of New York, USA. In Phase 1, we asked 41 landowners to identify a range of behaviors that might enhance local environmental quality. We then developed a 13-item PEB scale based on interview responses and literature review. In Phase 2, we incorporated this self-reported PEB scale into a survey of 1082 rural landowners and recreationists. Confirmatory factor analysis identified four key PEB domains: conservation lifestyle behaviors (e.g., household actions in the private sphere), social environmentalism (e.g., peer interactions and group membership), environmental citizenship (e.g., civic engagement in the policy arena), and land stewardship (e.g., support for wildlife and habitat conservation). Results revealed variable participation rates in each type of PEB, confirmed the need to account for land stewardship in rural settings, and highlighted challenges and opportunities for PEB assessment across various social and geographical contexts.

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1. Introduction

A growing body of research has highlighted the importance of studying human–environment interactions and identifying factors that influence adoption of behaviors that minimize ecological harm and support natural resource conservation (Ardoin, Heimlich, Braus, & Merrick, 2013; Cook & Berrenberg, 1981; Dwyer, Leeming, Coburn, Porter, & Jackson, 1993; Ehrlich & Kennedy, 2005; Gardner & Stern, 2002; Kaplan, 2000). Although the practical value of understanding pro-environmental behavior (PEB) is not disputed (Ardoin et al., 2013), the ways in which these behaviors are operationalized and critically evaluated have varied substantially.

Over the past few decades, researchers have used a variety of terms to describe this suite of actions, including “pro-environmental behaviors” (Bamberg & Moser, 2007; Steg, Bolderdijk, Keizer, & Perlaviciute, 2014), “responsible environmental behaviors” (Cottrell, 2003; Hines, Hungerford, & Tomera, 1986; Vaske &

Kobrin, 2001), “environmentally responsible behaviors” (De Young, 2000; Thøgersen, 2006), “ecological behaviors” (Gray, Borden, & Weigel, 1985; Kasier, 1998), “conservation behaviors” (Gosling & Williams, 2010; Kaiser, Hubner, & Bogner, 2005; Monroe, 2003), “environmentally supportive behaviors” (Huddart-Kennedy, Beckley, McFarlane, & Nadeau, 2009), and “environmentally significant behaviors” (Stern, 2000). However, many studies that employ such language fail to explicitly define the term (Poortinga, Steg, & Vlek, 2004). For instance, two highly-cited meta-analyses that synthesized data from hundreds of papers examined correlates of PEB without adequately considering the diversity and dimensionality of pro-environmental actions (Bamberg & Moser, 2007; Hines et al., 1986). Although substantial research has examined PEB predictors and correlates (Fielding, McDonald, & Louis, 2008; Kaiser et al., 2005; Milfont, Duckitt, & Wagner, 2010; Oreg & Katz-Gerro, 2006; Stern, 2000), comparatively little has examined the structure of the dependent variable itself. The wide range of ways in which PEB is operationalized in the literature raises two important questions that are inadequately addressed in previous studies: (1) what behaviors have been (or should be) considered “pro-environmental”; and, (2) to what extent have (or should) researchers discriminate between types of behaviors within this nexus? Because PEB is a key component of human–environment interactions, answers to these questions

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have important implications for the field of environmental psychology. In this study, we adopted a broad definition of PEB that parallels *Steg and Vlek (2009)*, considering a range of behaviors that benefit the natural environment, enhance environmental quality, or harm the environment as little as possible. We then integrated conceptualizations of PEB derived from existing survey scales and participant responses to open-ended interview questions to design and test an instrument encompassing four distinct domains of PEB, each of which could be considered separately in future investigations.

1.1. Theoretical evidence for multiple dimensions of PEB

Early attempts to characterize and measure complex constructs such as PEB (*Maloney & Ward, 1973; Sia, Hungerford, & Tomera, 1986*) and environmental concern (*Dunlap & Van Liere, 1978; Weigel & Weigel, 1978*) focused on uni-dimensional scales. Although such efforts (and the work they have inspired) have greatly advanced the understanding of human–environment interactions, these approaches have contributed to the potentially problematic presumption that PEB can be functionally characterized as “a unitary, undifferentiated class” (*Stern, 2000, p. 409*). In the complex world of human behavior, this is rarely the case (*Steg & Vlek, 2009*). Such insights inspired a number of studies that have critically examined multi-dimensional constructs such as environmental attitudes (*Milfont & Duckitt, 2004; 2010*) and environmental concern (*Schultz, 2001; Schultz et al., 2005*). However, despite increasing acknowledgment of the heterogeneous structure of pro-environmental behaviors (*Stern, 2000; Turaga, Howarth, & Borsuk, 2010*), few studies have empirically explored the multiple dimensions of PEB.

Dimensionality of PEB can exist for several reasons. First, some behaviors are inherently more difficult to carry out than others (*Kaiser, 1998*), and participation levels are influenced by a wide array of social and structural factors (*Gatersleben, Steg, & Vlek, 2002; Steg & Vlek, 2009; Theodori & Luloff, 2002*). For example, individuals committed to household energy conservation may relatively easily engage in such behavior, whereas individuals motivated to participate in environmental groups may be limited by access to organizations and financial constraints. Similarly, recycling may be a daily or weekly activity for many individuals in areas where curbside pickup is available and encouraged, but not in contexts where opportunities are few or altogether absent.

Second, participation in PEB is influenced by both hedonic, gain, and normative goals and intent (*Stern, 2000; Steg et al., 2014*). In many cases, motives centered on personal costs and benefits such as personal satisfaction (i.e., hedonic goals) and saving money (i.e., gain goals) may conflict with motives focused on achieving the collective good (i.e., normative goals) such as clean water and air (*Steg et al., 2014*). These drastically different motives not only result in different rates of behavioral expression; they may also affect the ways in which people perceive actions and their environmental impacts. A behavior that might constitute PEB to one individual could be viewed as an anti-environmental behavior by another. For instance, hunting to control wildlife populations might be viewed as ecologically essential by some and environmentally destructive (as well as morally repugnant) by others. In some cases, motivation and intent may be poor predictors of pro-environmental outcomes. For example, individuals may readily engage in actions they perceive to be environmentally-neutral without realizing the behaviors generate unintended positive or negative consequences.

Finally, PEB varies substantially when it comes to type of impacts (e.g., direct vs. indirect) (*Poortinga et al., 2004; Stern, 2000*) and scope of influence or specificity (e.g., local to global) (*Halpenny, 2010; Ramkissoon, Weiler, & Smith, 2013*). For instance, household

decisions made by private sector consumers such as carpooling to save gasoline and purchasing energy-efficient products to minimize consumption may produce long-term benefits that include small reductions in global greenhouse gas emissions. On the other hand, stream revitalization projects in a local community may immediately generate more significant ecological impacts, albeit on smaller scales.

Distinctions among different types of PEB are not only conceptually important, but psychologically meaningful (*Stern, Dietz, Abel, Guagnano, & Kalof, 1999; Stern, 2000*). Some researchers have therefore called for disaggregated PEB scales that account for variability in behavior based on factors such as feasibility of participation, behavioral intent, perception of importance, and the nature/magnitude of projected environmental impacts (*Gatersleben et al., 2002*). Heightened focus on distinct domains of PEB has inspired an assortment of hypothesized behavioral typologies (e.g., *Stern, 2000; Steg & Vlek, 2009; Turaga et al., 2010*), but research has rarely assessed the psychometric structure of these typologies. Exceptions include *Stern et al.'s (1999)* “indicators of environmentalism,” which has been employed in other studies (*Dono, Webb, & Richardson, 2010*), and *Kaiser, Oerke, and Bogner's (2007)* behavior-based environmental attitudes scale. However, both of these instruments emphasized certain aspects of PEB at the expense of others. For example, *Stern et al. (1999)* focused on consumer choices and environmental citizenship without adequate consideration of lifestyle behaviors (e.g., energy conservation, recycling), whereas *Kaiser, Oerke, and Bogner (2007)* focused on lifestyle behaviors and grouped other potentially significant PEBs into a single category titled “vicarious behaviors towards conservation.” These omissions and agglomerations make it difficult to effectively measure the full range of potential pro-environmental behaviors in a single study. Nevertheless, investigations such as these have helped to highlight important domains of PEB that should be considered in future research.

1.2. Potential PEB domains

Most studies in the environmental psychology literature have primarily emphasized PEB that occurs within the private sphere (*Kaiser, Ranney, Hartig, & Bowler, 1999; Kaiser et al., 2007; Mobley, Vagias, & DeWard, 2009; Nordlund & Garvill, 2002; Steg & Vlek, 2009*). Such conservation “lifestyle” behaviors are common targets because they are universal actions (i.e., relevant to nearly everyone) that are typically associated with environmentalism and the environmental movement. Frequently studied behaviors in this category include recycling (*Corral-Verdugo, 1997; Guagnano, Stern, & Dietz, 1995; Oreg & Katz-Gerro, 2006; Schultz, Oskamp, & Mainieri, 1995*), waste reduction (*Ebreo & Vining, 2001*), water conservation (*Corral-Verdugo, Carrus, Bonnes, Moser, & Sinha, 2008; Kaiser, 1998*), energy conservation (*Abrahamse, Steg, Vlek, & Rothengatter, 2005; Gatersleben et al., 2002; Kaiser et al., 2005; Nordlund & Garvill, 2002; Poortinga et al., 2004*) environmentally-conscious transportation (*Kaiser et al., 2005; Oreg & Katz-Gerro, 2006; Poortinga et al., 2004*) and green or eco-friendly purchasing (*Kahn, 2007; Nordlund & Garvill, 2002; Sia et al., 1986; Stern, 2000; Young, Hwang, McDonald, & Oates, 2010*). If such everyday actions are sufficiently widespread in the general population, they will generate an array of positive environmental impacts. However, a singular focus on the consumer-oriented household behaviors that are prevalent in many behavior measures may preclude the consideration of other types of PEB that may be of equal or greater ecological and social importance (*Stern, 2000; Steg & Vlek, 2009*).

Another suite of behaviors that has generated substantial interest among PEB researchers are those focused on civic

engagement from both a non-activist and activist standpoint. Terms such as “environmental citizenship,” “policy support,” and “political consciousness” have been used to refer to pro-environmental actions in the socio-political arena, including actions such as signing petitions, writing letters, donating money to conservation causes, or conscientiously voting to support pro-environmental causes (Cottrell, 2003; Oreg & Katz-Gerro, 2006; Schultz et al., 2005; Sia et al., 1986; Stern, 2000). Social behaviors such as such as involvement in an environmental group or participation in a demonstration/protest related to environmental issues are also frequently associated with environmental activism (Fielding et al., 2008; Schultz et al., 2005; Stern et al., 1999). Less intensive forms of social interaction have emerged in the PEB literature as well, including various forms of pro-environmental persuasion (Schultz et al., 2005; Sia et al., 1986) and, in some cases, simply talking to or educating others about environmental issues (Kaiser, 1998; Vaske & Kobrin, 2001). Collectively, through their influence on formal policy and decision making and informal social norms, these actions may have a powerful influence on the trajectory of human–environment interactions. Effective measures of PEB should therefore account for these various forms of civic engagement.

Many previous PEB scales have included behaviors that transcend location, presumably based on the assumption that non site-specific behaviors are needed for generalizable scales. However, there is a growing need to examine the characteristics and frequencies of place-based behaviors, which play a critical role in local environmental quality, yet are rarely considered in PEB research. Depicted earlier as “physical interventions” (Sia et al., 1986) and recently referred to as “environmental stewardship” (Huddart-Kennedy et al., 2009), this set of behaviors generally describes conservation-oriented actions that improve the ecological features of a particular place (e.g., personal property, public park, neighborhood habitat). This might include activities such as planting trees or enhancing wildlife habitat in a natural area (Huddart-Kennedy et al., 2009), managing vegetation on personal land (Gosling & Williams, 2010), or directly engaging with conservation efforts to protect national parks and protected areas (Halpenny, 2010; van Riper & Kyle, 2014). Several studies have demonstrated that these elements of PEB are conceptually distinct from other behavioral domains described above (Halpenny, 2010; Huddart-Kennedy et al., 2009). This distinct subset of pro-environmental behaviors is also supported by studies documenting relationships between connection to place and PEB (Brehm, Eisenhauer, & Stedman, 2013; Halpenny, 2010; Hamilton, Colocousis, & Duncan, 2010; Kudryavtsev, Stedman, & Krasny, 2012; Scannell & Gifford, 2010; Vaske & Kobrin, 2001). Local land stewardship activities (i.e., efforts to physically enhance local environments) may therefore represent a particularly relevant component of PEB when “place” matters.

An additional consideration in scale development, and one that is rarely addressed in PEB studies, is the potential disconnect between expert and public perceptions with respect to PEB (MacDonald, Milfont, & Gavin, 2015). Most studies focused on PEB are constrained by conventional, investigator-developed measurement paradigms that can bias responses and lead to inaccurate reporting (Gatersleben et al., 2002), primarily because researchers and respondents often have very different perceptions about what constitutes pro-environmental action. This discrepancy stems from multiple factors, including variable levels of environmental knowledge, awareness, and emotional involvement among researchers and research subjects (Kollmuss & Agyeman, 2002). In many cases, instruments based solely on expert judgment are preferable. However, because public perceptions of actions that constitutes PEB often differ (MacDonald et al., 2015), it may be

important to consider both expert and lay perspectives – especially when non-experts are generally the individuals who actually engage (or do not engage) in behaviors they generate important conservation outcomes at both the local and global level. Our study therefore employed an exploratory sequential mixed methods design that used local respondents’ conceptualizations of PEB to inform scale development (Creswell & Clark, 2011).

1.3. Statement of purpose

Considering the wide range of behaviors outlined above, researchers should work to understand the multi-dimensional structure of PEB and develop comprehensive metrics that account for and integrate these diverse behavioral domains. Furthermore, because studies focused on PEB are often constrained by investigator-imposed measurement paradigms that fail to acknowledge the perspectives of individuals who actually engage in conservation-oriented actions, there is a growing need for research that identifies types of PEB that are recognized by study participants (i.e., members of the general population) in addition to academic researchers. In this study, we therefore adopted a participant-driven approach to explore the dimensionality of PEB. To gauge perceptions of PEB and evaluate PEB participation, we specifically chose to focus on rural residents in upstate New York, USA, many of whom were nature-based recreationists with strong connections to the natural environment (Cooper, Larson, Dayer, Stedman, & Decker, 2015). Although these individuals might not reflect the perspectives in other, more urbanized populations, we thought their pro-conservation orientations might help researchers and practitioners understand the full range of behaviors that could be considered in efforts to assess, predict, and influence pro-environmental actions.

2. Research context

We developed a mixed-methods research process involving multiple phases, one using semi-structured interviews and the other using quantitative mail and web-based survey instruments, to explore perceptions of and participation in PEB among rural residents of New York. Despite a wealth of natural capital, many rural areas such as upstate New York are in a state of economic and social decline (Thomas & Smith, 2009). In such places, residents often perceive conflicts between conservation-related activities and economic growth (Marvier, Grant, & Kareiva, 2006). Because of the complex interactions between environmental preservation and development in rural communities and the growing body of research focused on rural environmentalism (Jones, Fly, & Cordell, 1999; McBeth & Foster, 1994) and urban-rural differences in environmental concern and action (Arcury & Christianson, 1993; Huddart-Kennedy et al., 2009), we intentionally centered our sampling efforts on rural populations. With our emphasis on PEB, we were especially interested in the perspectives of individuals who might have important connections with local landscapes and, presumably, more developed concepts of actions that might enhance local environmental quality. We therefore chose to focus primarily on rural residents affiliated with the wildlife-based recreation community (Palmberg & Kuru, 2000). Methods and results for each phase of the study are presented sequentially below.

3. Phase 1: semi-structured interviews

3.1. Phase 1: methods

In the first phase of the study, we used snowball sampling based on interactions with key informants in two New York counties

(Cattaraugus and Chenango) to identify local hunters, birdwatchers, or other types of nature-based recreationists. Both of these counties featured declining populations (>2% decline in the last 20 years), relatively low population densities (<62 people per square mile), and an abundance of natural areas (>20 unique public recreation lands, including state parks, forests, and wildlife management areas; U.S. Census Bureau, 2013). Informants included private citizens living in the focal counties involved in conservation activities, including potential types of PEB, through associations with local wildlife organizations and employees of various state agencies (e.g., Dept. of Environmental Conservation; Office of Parks, Recreation, and Historic Preservation; Cooperative Extension).

Interviews were designed to cover a range of topics including perspectives regarding pro-environmental behavior – particularly those that were directly linked to the local landscape. Participants were asked to provide example of PEB with the prompt: “What actions are you taking (or could take) to maintain or enhance the quality the natural environment in the place where you live?” We emphasized local context to provide participants with a specific frame of reference for PEB, thereby enhancing their capacity to recall actions that generate tangible conservation outcomes (Fishbein & Manfredo, 2002). If participants asked for additional clarification, several potential behavioral subcategories were provided (e.g., actions related to environmental stewardship and conservation, actions related to education and community outreach, actions in your local area, actions relevant on a larger scale, etc.). Participants were also asked to “Provide specific examples of something you have done to improve the environment or protect natural resources in your local area?” Similar “free-listing” techniques have proven to be an effective tool for exploring novel conceptual domains related to other topics (Hines, 1993).

During the qualitative data collection phase, we conducted 41 individual interviews via telephone ($n = 30$) or in person ($n = 11$) from September–December 2012. Interviews ranged in length from 37 to 74 min, with an average duration of 55 min. A summary of interview participant characteristics appears in Table 1.

Interview responses were transcribed and coded into thematic

categories by a member of the research team with the assistance of Atlas.ti Version 7. A constant comparative method involving three coding steps was used to identify specific behaviors and relevant behavior domains: (1) comparison of responses to conservation behavior question within a single interview, (2) comparison between interviews within the same group (e.g., birdwatchers and hunters, private citizens and state employees), and (3) comparison of interviews within and between groups (Boeije, 2002). Themes and behavioral categories that emerged during qualitative data analysis were used to inform survey instrument development during Phase 2 of the research. Although the use of a single coder precluded an analysis of inter-rater reliability in Phase 1, the validity of the coding structure was examined (and confirmed) using confirmatory factor analysis in Phase 2 of the research.

3.2. Phase 1: results

Interview analysis revealed that most interviewees described multiple types of PEB, and most individuals had participated in one or more of these pro-environmental actions. Behaviors described by interviewees were grouped into four general categories that informed the content of the subsequent survey instrument (see Phase 2). After reading all interviews and synthesizing participant responses, these behavior domains were titled social environmentalism, land stewardship, conservation lifestyle, and environmental citizenship. Specific behaviors associated with each domain and the number of interviewees that mentioned them are depicted in Table 2.

3.2.1. Social environmentalism

The most common types of PEB mentioned by interviewees centered on social engagement. These behaviors typically included some type of interaction or communication designed to inform (or teach) others about the importance of conservation and the value of pro-environmental actions. Interviewees explained how such simple actions could impact conservation efforts:

“I try to get all my friends to recycle and grow their own food and, you know, do the right things in their yard. Things like that. So, just being a good citizen, talking to people, you have a lot of opportunity.” –Female, Birdwatcher

“I think the best bet is to do little common things that everybody should be doing and try to get other people that don't do it to do it. The little things, just get people to accept that this is such a little thing to do, you should just do it ... then maybe it will spiral out to other people.” –Male, Hunter

Others talked specifically about the value of working with youth to inspire a conservation ethos from an early age:

“When I take my children to places like walking in the creek or, you know, playing at [the local nature center], I feel like I'm teaching them how to treat the environment. Simple things like: don't leave garbage in the river, don't spill chemicals, don't break the limbs off of trees ... Just to talk about preserving the environment. Even though this sounds very simple, you have to start somewhere.” –Female, General nature-based recreationist

For many interviewees, social environmentalism was linked to involvement in a local conservation group. These group members described various forms of PEB associated with club involvement. This included a range of activities such as formal provision of input from county sportsmen's clubs at deer management task force meetings, neighborhood cleanups with an Earth Awareness Club at

Table 1
Summary of participants for interview and survey phases of study.

Variable	Percent. of interview Participants ($n = 41$)	Percent. of survey Participants ($n = 1082$)
Sample population	NA	
Hunters		18.9
Birdwatchers		49.6
Landowners		31.4
Preferred outdoor recreation activity		
Hunting	53.7	30.8
Birdwatching	29.3	55.4
Other nature-based activity	17.1	4.3
No nature-based recreation	0	9.6
Professional affiliation		NA
State employees	31.2	
Private citizens	68.3	
Gender		
Female	31.2	44.9
Male	68.3	55.1
Age group		
18–39 years old	26.8	8.5
40–59 years old	29.3	42.8
60+ years old	43.9	48.6
Education level	NA	
High school or less		24.6
Some college		23.0
Associates' or Bachelor's degree		31.7
Graduate degree		20.6

NA = Data not collected for particular sample.

Table 2

Types of pro-environmental behaviors identified by interviewees (n = 41).

Pro-environmental behavior category (with specific behaviors)	Number of interviewees mentioning behavior
Social environmentalism	37 (90.2%)
Talking to or educating others about environmental issues	28
Participating in a local environmental group	18
Working with others to address environmental issues	14
Working with youth in conservation context	10
Land stewardship	34 (82.9%)
Private land habitat enhancement or improvement	16
Public land habitat enhancement or improvement	15
Wildlife advocacy	14
Wildlife studies and ecological monitoring	8
Conservation lifestyle	27 (65.9%)
Recycling or reusing products	20
Energy or water conservation	14
Minimize or pick up trash/litter	13
Other lifestyle behaviors ^a	10
Eco-friendly consumption or purchasing	3
Environmental citizenship	24 (58.5%)
Voting and participation in policy process	15
Writing letters about environmental issues	8
Petitioning about environmental issues	5
Donating money for conservation causes	4

^a Other conservation lifestyle behaviors included actions such as using canvas grocery bags, composting, gardening for personal consumption, and minimizing use of chemicals and toxic waste.

a local community college, and eco-walks offered through a local hiking club. Socially engaged conservation actions were so important to many interviewees that some had even developed formal strategies to leverage social relationships and mobilize support for local conservation actions:

“You work with the group and you come up with strategies [to address a particular issue]. Then you do a diagram of what community groups, organizations - who has influence over this, and is it positive or negative? And who's in those [groups and organizations]? We'd invite ones where there are overlapping interests. That's a model that works ... it's called community mapping.” —Male, Hunter

3.2.2. Land stewardship

The next most commonly mentioned category of behaviors was directly related to improving the local landscape, including wildlife and habitat conservation actions. Such behaviors often centered on various forms of habitat enhancement. Many interviewees, including hunters and birdwatchers, explained how they had taken action to improve ecosystems on their own private land to benefit wildlife species. For these individuals, conservation benefits realized on local scales were very important:

“We've been more [habitat] conscious. We have some grass land. We have shrubs. We have a few younger trees coming in and some older growth timber up on the top. We have a little gorge too. I'm trying to keep different habitats. I want to make sure we keep the woodcocks, and meadowlarks, and everything. We're trying to maintain different habitats ... for the birds and the other animals too.” —Female, Birdwatcher

Interviewees also talked about how they have volunteered to clean up and enhance public land habitat on both small (e.g., local trash clean ups) and large (e.g., establishment of local ecological reserves) scales:

“I've participated in different litter clean ups. They [the local clubs] do one at least once a year at the Allegheny Trail. I've

participated in that. Also a couple of other cleanups and projects that different groups have done I've participated in. It sounds kind of small, but I think it's important for a lot of the nice places around here.” —Female, Birdwatcher

“We took a defunct recreational subdivision in the neighboring township and we consolidated down. Many home owners had bought and built in the subdivision expecting to get sewer and water, which they never did. Some of them had composting toilets, but most had septic tanks that were just leaching into the neighborhood. We had them form a home-owners association and we deeded whatever they needed to come into compliance with the health department for water and sewer. After we did that, we put the remaining wetland into the wetland reserve program - it was the third largest wetland reserve program property in the state at the time!” —Female, General nature-based recreationist

Some interviewees described the benefits of participating in ecological monitoring studies for wildlife and other species. According to these citizen science participants, such efforts led to tangible outcomes including the discovery of new species of frog in western New York, a book about wildflowers found in a local state park, and key contributions to Audubon bird count databases in understudied regions of the state.

3.2.3. Conservation lifestyle

For many people, conservation lifestyle behaviors were among the first things that came to mind when asked how an individual could help to protect his/her environment. These were typically household (i.e., private-sphere) behaviors that occurred on a daily basis. Recycling is perhaps the best example of a lifestyle behavior that affects the environment, but interviewees also talked about a range of other behaviors such as energy conservation (e.g., turning off the lights), energy-conscious transportation (e.g., riding a bicycle whenever possible), water conservation (e.g., taking shorter showers), and consumption of local, organically grown food. Litter cleanup (e.g., “picking up trash”) was among the more commonly cited lifestyle behaviors. For many interviewees, the instinct to pick up trash was directly linked to their nature-based recreation

preferences:

"In a very small, nearly insignificant level - when I'm fishing, I pick up trash on the stream. I do that anywhere I'm hunting too. One time I picked up several beer cans on state land and had them in the back of my car and got pulled over for speeding!"
—Male, Hunter

"If we're out hiking, we try to pick up garbage. Not only what we left but if we see others. Geocachers have a motto, 'Cache in, trash out.' So as you walk in, if you see garbage, you pick up other people's garbage. I always try to do that." —Male, Hunter

Interviewees who began talking about simple everyday acts such as picking up litter and recycling often began to discuss more involved forms of PEB (e.g., habitat enhancement, teaching others about environmental issues) as the interview conversation progressed.

3.2.4. Environmental citizenship

Environmental citizenship behaviors were less commonly mentioned. The simplest and most common form of civic engagement was aptly summarized by one interviewee, who noted that:

"I can vote for who I want to be in office and things like that. I can also go and voice opinions at community meetings." —Male, Hunter

Many others also indicated that their vote and political voice represented an important conservation tool and mechanism for generating policy support. Some acknowledged the powerful impact of monetary donations. For example, one interviewee observed that:

"A lot of people are willing to donate money if the cause is right. My friend, he knows these people, he's got an inventory in his head, and if you find it [the right cause] he could call up some people interested and possibly find some money" —Male, Birdwatcher

Others described a more active role in the process, including actual involvement in public meetings designed to inform policy and decision making with respect to environmental issues. Several interviewees described how they took a more aggressive approach to conservation involving tactics such as letter writing, petitioning, and other forms of lobbying:

"I go to public meetings. In fact, I had two letters in two different newspapers (Oneonta and Norwich) yesterday about fracking, and one last week (Binghamton). I'm a chronic pest that way! I belong to several organizations, including the Environmental Protection group out of Albany. If there's an issue that bothers me, I will get into it." —Male, Hunter

Although efforts to impact pro-environmental policies were valued by many interviewees, these activities generally seemed less commonly recognized and less frequently practiced by rural residents than other actions across the PEB spectrum.

Interviewees did not differ substantially across sample groups in their recognition and expression of PEB. For example, both birdwatchers and hunters spoke at length about the general value of land stewardship and activities such as habitat enhancement. Social forms of environmentalism were important to all interviewees, particularly those who engaged in nature-based recreation not directly tied to wildlife. Members of all groups discussed

conservation lifestyle behaviors and environmental citizenship, though birdwatchers and other types of nature-based recreationists were more likely to mention behaviors in both of these domains than hunters. Overall, qualitative results suggested that most interviewees generally acknowledged and appreciated behaviors aimed at protecting environmental quality, even if their self-reported participation in PEB occurred at very different rates.

4. Phase 2: mail & web-based surveys

4.1. Phase 2: methods

In the second phase of the study, we used a hybrid data collection approach involving mail and web-based surveys (Carrozzino-Lyon, McMullin, & Parkhurst, 2013) to explore rural residents' connections with their local environment. Survey instruments covered a variety of topics including self-reported participation in PEB. Based on categories that emerged during the Phase 1 interviews and items used in previous behavior research, we developed a brief 13-item scale to measure different types of PEB. Adapting an approach employed in many other PEB studies (Gatersleben et al., 2002; Gosling & Williams, 2010; Mobley et al., 2009; Oreg & Katz-Gerro, 2006; Schultz et al., 2005), we asked respondents to report their frequency of participation in each of these behaviors on a scale with the following options: 1 = Never, 2 = Rarely, 3 = Occasionally, 4 = Often, 5 = Very often. We used factor analysis to test the dimensionality of the four PEB categories that were identified by Phase 1 interview participants (Table 3):

- Conservation lifestyle behaviors reflect household choices made by consumers that influence environmental sustainability on broad scales, including activities such as recycling, energy and water conservation, and "green" consumerism (3 items, Cronbach's alpha = 0.786)
- Land stewardship behaviors include actions that generally involve more direct engagement with local ecosystems; these actions included wildlife habitat management on public and private lands and participation in ecological monitoring. (3 items, Cronbach's alpha = 0.638)
- Social environmentalism describes conservation activities whose efficacy is firmly rooted in social relationships and interactions such as participation in local environmental groups or talking to others about environmental issues (3 items, Cronbach's alpha = 0.782)
- Environmental citizenship behaviors include tangible contributions to environmental policy and decision making efforts that can be manifested in many ways such as voting to support environmental policies or candidates, writing letters to politicians or local papers, initiating or signing pro-environmental petitions, or donating money to support conservation causes (4 items, Cronbach's alpha = 0.839)

All survey data were collected during April and May 2013 using a multiple mailing/e-mailing approach with 4 separate contacts (initial contact plus three reminders) at approximately 1-week intervals (Dillman, 2007). Survey implementation targeted three different populations of residents in the same rural areas of upstate New York: landowners, hunters, and birdwatchers. These three groups were deliberately chosen to represent a range of potential conservation perspectives across the rural landscape. We selected landowners in the 2 focal counties (Cattaraugus and Chenango) by randomly identifying parcels in the 2010 GIS Clearinghouse database. We sent questionnaire instruments via mail to 1027 landowners, and received 388 (37.8% response rate). We selected hunters by randomly identifying 699 individuals living in 2 focal

Table 3

Pro-environmental behavior survey items and summary statistics (n = 1082).

Behavior domain (with items)	Item code	M ^a	SD	Participating often or very often (%)	Participating at least once (rarely) (%)
Conservation lifestyle^b	CL	4.42	0.63	83.6	99.8
Recycled paper, plastic and metal	CL1	4.62	0.67	94.0	99.4
Conserved water or energy in my home	CL2	4.41	0.75	88.9	99.3
Bought environmentally friendly and/or energy efficient products	CL3	4.23	0.83	81.5	99.3
Land stewardship^c	LS	2.82	0.88	13.0	81.7
Made my yard or my land more desirable for wildlife	LS1	3.95	1.03	71.8	95.9
Participated (provided data) in a wildlife study	LS2	2.40	1.27	20.0	66.2
Volunteered to improve wildlife habitat in my community	LS3	2.12	1.15	13.1	60.3
Social environmentalism^d	SE	2.36	0.91	6.8	69.8
Talked to others in my community about environmental issues	SE1	2.79	1.16	27.5	82.7
Worked with others to address an environmental problem or issue	SE2	2.40	1.03	11.7	77.4
Participated as an active member in a local environmental group	SE3	1.90	1.08	9.2	51.8
Environmental citizenship^e	EC	2.39	1.00	9.6	65.9
Voted to support a policy/regulation that affects the local environment	EC1	2.71	1.29	38.7	74.1
Signed a petition about an environmental issue	EC2	2.48	1.23	19.5	71.1
Donated money to support local environmental protection	EC3	2.44	1.20	20.0	70.2
Wrote a letter in response to an environmental issue	EC4	1.93	1.16	9.9	51.3

^a Participation Frequency Scale: 1 = Never, 2 = Rarely, 3 = Occasionally, 4 = Often, 5 = Very often.^b Cronbach's alpha = 0.786.^c Cronbach's alpha = 0.638.^d Cronbach's alpha = 0.782.^e Cronbach's alpha = 0.839.

counties (Cattaraugus and Chenango) from the 2012 hunting license records provided by the NYC Department of Environmental Conservation. We sent the questionnaire via the mail and received replies from 227 licensed hunters (32.5% response rate). We selected birdwatchers from the membership and citizen-science databases at the Cornell Lab of Ornithology. Due to insufficient numbers of birdwatchers in the 2 focal counties, we expanded the geographical range to include 8 additional rural counties in upstate New York with similar demographic characteristics (e.g., low population density, declining population size) (United States Census Bureau, 2013). Then, via email, we sent a web-based questionnaire to 1982 birdwatchers in the 10 rural New York counties comprising the expanded study area. We received 758 completed surveys (38.3% response rate) and excluded 112 of these individuals because they did not reside in any of the ten focal counties (i.e., some were birders simply traveling through the study area), resulting in an effective sample of 646 birdwatchers.

After pooling all three samples, the total sample population included 1261 respondents. However, 14.2% of this population failed to respond to one or more of the PEB items, and 55.9% were missing data on all of the PEB items. The PEB scale appeared near the end of a long survey instrument, so this missing data could likely be attributed to survey fatigue. Data imputation to populate these missing cells was precluded by the incomplete information associated with other key predictor variables that might be used in imputation calculations. For example, demographic items were also frequently skipped because they appeared at the end of the instrument. Nevertheless, successful measurement of a key potential PEB antecedents (e.g., nature-based recreation participation, place attachment, and community involvement) allowed us to test for differences between individuals who did (n = 1082) and did not respond (n = 179) to the PEB items. Using the Welch-Satterthwaite adjustment for groups with unequal variances, *t*-test results revealed that none of these differences were statistically significant ($t \leq 0.65$, $p \geq 0.426$). We therefore assumed that any missing information was not associated with the dependent variable itself (i.e., PEB) and elected to employ listwise deletion of cases with missing data (Allison, 2003). These deletions resulted in an effective sample size of 1082 respondents. A summary of these survey respondents' attributes appears in Table 1.

To test for potential non-response bias, we randomly selected 50 non-respondents from each sample (150 total) for follow-up telephone contact in June 2013. Non-respondents and respondents did not display significantly different participation rates in birdwatching, hunting, and other forms of nature based recreation. Although telephone survey participants were not directly asked about their participation in PEB, their responses on two related metrics (community involvement and place attachment) did not reveal significant differences. After observing these similarities between non-respondents and respondents on key variables indirectly related to PEB, we suggest that, despite the relatively low overall response rate (37.1%), non-response bias is likely not a problem.

4.2. Phase 2: model specification & quantitative data analysis

The convergent and discriminant validity of the PEB scale was examined using confirmatory factor analysis (CFA) in Stata Version 13.0 (Klem, 2002). Our measurement models tested relationships among the 13 self-reported PEB items and the relative fit of 5 different models featuring various combinations of latent behavior constructs. These models were:

- One-factor model (baseline): In this model specification, all 13 behavior items were used to measure a single, homogenous PEB construct.
- Two-factor model: In this model specification, three items measured conservation lifestyle behaviors, and the other 10 items measured a suite of land stewardship and civic engagement actions with more direct conservation implications for local contexts.
- Three-factor model: In this model specification, three items measured conservation lifestyle behaviors, six items measured place-based stewardship actions rooted in social interactions and ties to the local landscape and wildlife, and four items measured somewhat more generic forms civic engagement.
- Four-factor model (hypothesized based on qualitative analysis): In this model specification, items were associated with one of the four PEB domains described above: conservation lifestyle,

land stewardship, social environmentalism, and environmental citizenship.

- Five-factor model (four-factor model with additional latent construct): Finally, we tested the possibility that the three of the factors in the four-factor model (i.e., land stewardship, social environmentalism, and environmental citizenship) were derived from a single latent factor: place-based PEB.

Prior to the CFA, data were screened to confirm that the data structure did not deviate substantially from the assumptions of normality required for multivariate analyses, a common problem when considering Likert-type scales as continuous data (Kline, 2005). Skewness ($<|2.2|$) and kurtosis ($<|6.1|$) for the 13 behavior variables did not exceed values proposed as substantial departures from normality (West, Finch, & Curran, 1995), and Mahalanobis distance statistics ($D_M < 68.0$) did not reveal any significant outliers given the number of predictors ($p = 13$) and the sample size ($n = 1082$) (Stevens, 1984). Because assumptions of normality were not violated, we analyzed a positive definite covariance matrix using a maximum likelihood estimation procedure (Tabachnick & Fidell, 2007; van Riper & Kyle, 2014). Model fit was initially assessed using a χ^2 value, a statistic particularly sensitive to large sample sizes (Kline, 2005). Based on recommendations from SEM scholars (Hu & Bentler, 1999; Schreiber, Nora, Stage, Barlow, & King, 2006; Sivo, Fan, Witta, & Willse, 2006), we therefore used a multiple index approach with the following statistics and cutoff criteria to evaluate acceptable model fit: root mean square error (RMSEA) < 0.08 , standardized root mean square residual (SRMR) < 0.08 , and the comparative fit index (CFI) > 0.90 . The relative fit of the different nested models was directly compared using Akaike's Information Criterion (AIC) and χ^2 difference ($\chi^2 D$) tests. To provide an additional measure of validity for the PEB scale, we ran separate CFAs with each of the three distinct survey groups (landowners, hunters, and birdwatchers). Model fit within each survey group was assessed using the same criteria specified above.

4.3. Phase 2: results

Before the measurement properties of the multi-dimensional PEB scale were tested, we examined scale means and frequencies to assess respondents' relative frequency of participation in different types of PEB (Table 3). Results showed that respondents were very likely to engage in conservation lifestyle behaviors ($M = 4.42$, $SD = 0.63$), with recycling (94.0% participation often or very often), energy/water conservation (88.9%), and green purchasing (81.5%) all representing common practices among rural participants. In fact, more than 99% of respondents indicated they had participated at least once in all of these activities.

Participation rates for behavior items in the land stewardship ($M = 2.82$, $SD = 0.88$), social environmentalism ($M = 2.36$, $SD = 0.91$), and environmental citizenship ($M = 2.39$, $SD = 1.00$) domains were significantly lower and much more variable, with means falling between the "2 = Rarely" and "3 = Sometimes" options on the participation frequency scale (Table 3). The number of respondents reporting "often" or "very often" participation for the specific items on the social environmentalism subscale ranged from 9.2% (participating as active member in an environmental group) to 27.5% (talking to others about environmental issues). Similarly, the number of respondents reporting "often" or "very often" participation for the specific items on the environmental citizenship subscale ranged from 9.9% (writing a letter in response to an environmental issue) to 38.7% (voting to support a pro-environmental policy). Frequencies were comparable for two of three land stewardship items. However, private land habitat enhancement was a notable exception, with 71.8% of respondents

reported doing this often or very often.

Results of the CFA and associated goodness-of-fit indices supported the hypothesis that, of the five models tested, the four-factor model of PEB offered the best fit for the observed covariance structure. Significant differences in discriminant validity were observed between the 4-factor model and all other models on most metrics (Table 4), with the 1-factor and 2-factor models of PEB demonstrating the worst fit for the data. Although χ^2 values indicated that the measurement model did not reproduce the observed covariances exceptionally well [χ^2 (59, $n = 1082$) = 387.7, $p < 0.001$], stand-alone (SRMR = 0.05, RMSEA = 0.07) and incremental (CFI = 0.94) fit indexes indicated adequate fit. Modification indexes suggested that fit could be improved by adding covariance paths between the errors associated with items in each of the behavior domains (e.g., "participate in an environmental group" and "work with others to address environmental issues," or "wrote a letter in response to an environmental issue" and "signed a petition about an environmental issue"). These links are not surprising given the similar nature of the respective actions and item wording on the survey (i.e., measurement error). Nevertheless, we chose not to add any speculative parameters based on modification indexes because such alterations often result in models that do not accurately represent the true data structure (MacCallum, 1986).

Using the best-fitting model, we examined the convergent validity of the specific PEB constructs by comparing standardized path loading coefficients (λ). Each of the path loadings was ≥ 0.49 and all values were statistically significant, supporting the theory that each item was a relatively good measure of the specified factor (Fig. 1). Error variances for the observed variables ranged from 0.23 to 0.76, indicating substantial variability in the proportion of the variance in each behavior item that could be explained by the latent PEB constructs. Covariances between the latent constructs (ϕ) showed that relationships between all of the behavior domains were positive and statistically significant. The relationship between land stewardship, social environmentalism, and environmental citizenship was much stronger ($\phi \geq 0.719$) than the relationship between any of those domains and conservation lifestyle behaviors ($\phi \leq 0.346$). A summary of the standardized values of the significant paths and covariances among observed and latent variables in the four-factor measurement model appears in Fig. 1.

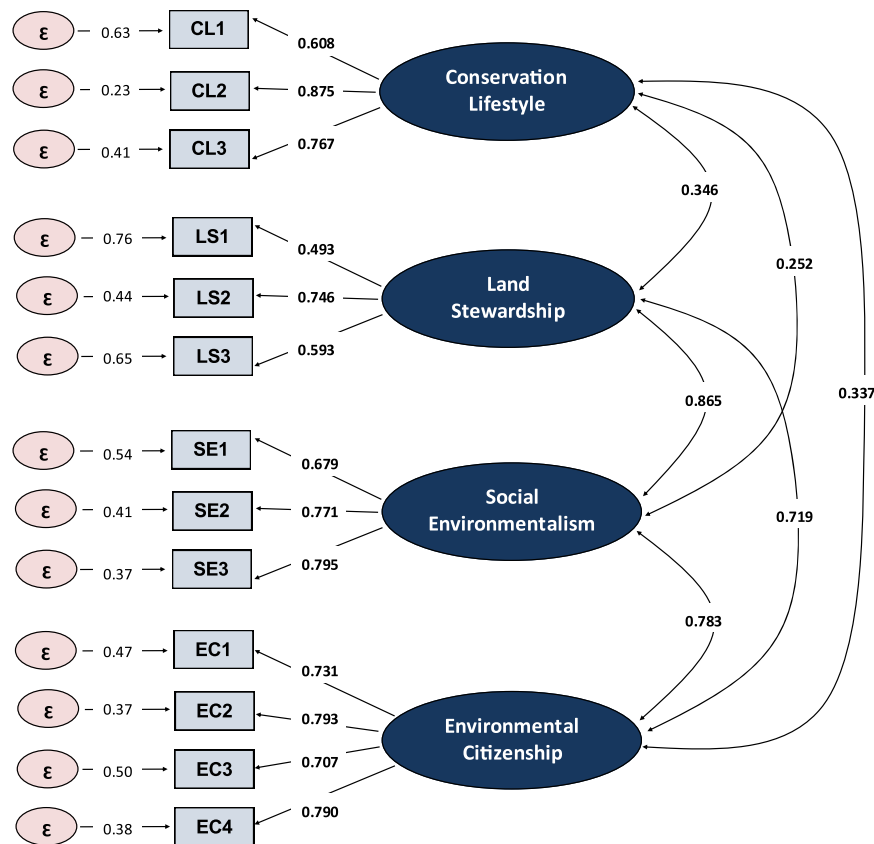
In a final test of validity, we ran a separate four-factor CFA model for each of the three sample groups and examined model fit using the multiple index approach. Model fit was adequate across all groups (Table 5), suggesting that the four-domain structure of PEB held for all participants. In fact, the behavior model exhibited the best fit for landowners who may or may not experience direct connections with the natural world via outdoor recreation. These patterns suggest a relatively high level of inter-group consistency and stability for the PEB model across diverse populations.

5. Discussion

Results of this study provide support for the hypothesis that PEB contains multiple domains that cannot (and should not) be measured using an aggregated or uni-dimensional scale. The four-dimensional structure of PEB that emerged from our analysis was created by participant input (i.e., interviews with rural residents) and supported by statistical models derived from this input (i.e., confirmatory factor analysis of survey data from a different rural sample). The use of semi-structured interviews to solicit participants' perceptions of activities that constitute "pro-environmental" behavior is a strategy that rarely appears in the literature, but one that can provide useful insights that facilitate conceptualization of PEB and the various ways in which it is expressed. In fact, similar participatory approaches focused on topics such as ecosystem

Table 4Confirmatory factor analysis model comparison based on chi-square difference (χ^2 D) tests and goodness of fit indexes.

Number of factors in Model	df for χ^2	χ^2	df for χ^2 D*	χ^2 D	AIC	RMSEA	SRMR	CFI
Four ^a	59	387.7	—	—	35741	0.072	0.047	0.943
Five ^b	61	413.3	2	25.6	35762	0.073	0.051	0.939
Three ^c	62	441.0	3	27.7	35788	0.075	0.050	0.934
Two ^d	64	728.0	5	340.3	36071	0.098	0.056	0.884
One ^e	65	1608.7	6	1221.0	36950	0.148	0.096	0.731

*All χ^2 D are significantly different than best-fitting (4-factor) model at $\alpha = 0.001$.^a 4 Factors (best-fitting model): Conservation Lifestyle, Land Stewardship, Social Environmentalism, Environmental Citizenship.^b 5 Factors: Conservation Lifestyle, Land Stewardship, Social Environmentalism, Environmental Citizenship, Single endogenous “place-based conservation actions” latent variable (combines Land Stewardship, Social Environmentalism, Environmental Citizenship).^c 3 Factors: Conservation Lifestyle, Environmental Citizenship, Other “place-based conservation actions” behaviors (combines Land Stewardship and Social Environmentalism).^d 2 Factors: Conservation Lifestyle, Place-based conservation actions (combines Land Stewardship, Social Environmentalism, and Environmental Citizenship).^e 1 Factor: All PEBs assumed to represent a single homogenous domain.**Fig. 1.** Confirmatory Factor Analysis results for best-fitting model highlighting distinct domains of pro-environmental behavior ($n = 1082$) [Model fit statistics: $\chi^2_{(59, N=1082)} = 387.7$, $p < 0.001$; RMSEA = 0.07; SRMR = 0.05; CFI = 0.94].

service valuation have already generated substantial interest among civic ecology scholars working to understand similar types of pro-environmental actions in urban settings (Krasny, Russ, Tidball, & Elmqvist, 2014). Other research also highlights the growing need to address the “expert-lay person gap” that persists

in PEB conceptualization and engagement, emphasizing integration of public perspectives to enhance local conservation outcomes (MacDonald et al. 2015).

When asked to identify actions that enhance the quality of the natural environment, many interviewees’ first inclination was to mention behaviors that occur on a regular basis – simple acts associated with a conservation-oriented lifestyle such as recycling or reusing products, conserving energy and water, or picking up trash. Given the powerful and long-standing impact of social norms on behaviors such as energy conservation (Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007) and littering (Cialdini, Reno, & Kallgren, 1990), this immediate response was not surprising. A similar suite of conservation lifestyle behaviors has been a particularly common focus of researchers, possibly because they are

Table 5

Comparison of fit statistics for 4-factor confirmatory factor analysis model of PEB within different survey sample groups.

Survey group	n	df for χ^2	χ^2	RMSEA	SRMR	CFI
Landowners	340	59	134.6	0.061	0.052	0.950
Hunters	205	59	103.3	0.061	0.057	0.944
Birders	537	59	239.4	0.075	0.053	0.939

universally recognized as PEB and feasibly can be performed by nearly all members of the general public. For instance, over 99% of our survey respondents had participated in the three conservation lifestyle behaviors at least once, and more than 80% participated “often” or “very often.” Most existing PEB instruments have targeted some combination of these lifestyle behaviors using either subjective activity-participation-frequency rating scales (typically ranging from 1 = Never to 5 = Always) (Gatersleben et al., 2002; Gosling & Williams, 2010; Mobley et al., 2009; Oreg & Katz-Gerro, 2006; Schultz et al., 2005) or a dichotomous “yes/no” participation option (Cottrell, 2003; van Riper & Kyle, 2014; Scott & Willits, 1994). As a result, their reliability and validity have been scrutinized through multiple iterations. Despite these advantageous attributes, researchers have noted that many commonly studied lifestyle behaviors actually generate trivial conservation impacts (Gatersleben et al., 2002; Steg & Vlek, 2009). Furthermore, because conservation lifestyle behaviors are often self-reported at increasingly high frequencies, lack of variability may generate a “ceiling effect” that obscures inference and interpretation (Chao & Lam, 2011; Dunlap, Van Liere, Mertig, & Jones, 2000). It therefore appears that although conservation lifestyle behaviors constitute a necessary component of any PEB scale, they alone are insufficient to characterize the full scope of pro-environmental actions.

When given more time to reflect on actions that might enhance environmental quality, interviewees began to move beyond general household actions and describe behaviors that typically occurred less frequently. These behaviors include actions categorized as social environmentalism and environmental citizenship. For example, active participation in environmental groups may be limited by the organization's meeting frequency, and voting to support pro-environmental policies is typically tied to annual election cycles. About 65–70% of survey respondents had participated at least once in these types of PEB, and less than 39% had participated in any of them “often” or “very often.”

Although few survey respondents regularly engaged in behaviors associated with social environmentalism, the value of these actions was acknowledged by a number of interviewees. Interviewees often described how, by socially engaging with and encouraging their peers, they were able to educate others about environmental issues. The benefits of informal information exchange have been noted by other authors studying PEB (Cottrell, 2003; Kaiser, 1998; Schultz et al., 2005; Vaske & Kobrin, 2001). Furthermore, persuasive communication and advocacy focused on social impacts have been recognized as important motivations for carrying out conservation-oriented behaviors (Cleveland, Kalamas, & Laroche, 2012; Hanss & Bohm, 2013), highlighting the value of social interaction. Interviewees also indicated another key form of social engagement: participation in environmental groups. Though the definition of (and conservation benefits associated with) an “environmental group” may differ drastically for different types of people, including birdwatchers (McFarlane & Boxall, 1996) and hunters (Green, Grijalva, & Kroll, 2004), our Phase 2 CFA model confirmed that environmental group membership (regardless of type) was generally linked to social environmentalism.

Environmental citizenship behaviors were also widely recognized, albeit infrequently practiced, by both Phase 1 and Phase 2 study participants. More than half of interview participants mentioned some form of environmental citizenship actions, but survey respondents' self-reported rates of regular (i.e., “often” or “very often”) participation were lower than 40% for voting, writing letters, or signing petitions to support environmental protection, and much lower (<10%) for donating money to pro-environmental causes. Low rates of participation in environmental citizenship behaviors are relatively common in the PEB literature (Cottrell, 2003; Oreg & Katz-Gerro, 2006; Stern, 2000), likely because these

actions require substantial effort and resource investment on behalf of the participants. Because of the unique levels of impact and markedly different levels of participation associated with both the social environmentalism and environmental citizenship categories, our data suggest these actions should be considered independently of conservation lifestyle behaviors. Some researchers have attempted to address this discrepancy by developing separate scales to measure PEBs that potentially occur at different rates and intervals (Huddart-Kennedy et al., 2009). Similar approaches may be necessary to discern differences among PEB domains in future investigations.

The fourth key PEB domain identified in this study, land stewardship, is conspicuously absent from most existing PEB scales (Huddart-Kennedy et al., 2009; van Riper & Kyle, 2014). However, participants in this study appeared to be keenly aware of the conservation value derived from land stewardship actions. Over 80% of interviewees discussed at least one ecosystem-level stewardship action in the conversation about enhancing environmental quality, and about one out of every three interviewees talked about habitat management on private land, habitat management on public land, and the benefits accrued from wildlife advocacy. Behavior participation rates reported in Phase 2 underscored the importance of these actions. For instance, over 70% of survey respondents reported participating “often” or “very often” in habitat enhancement on their own private land, and more than 60% of participants indicated they had participated at least once in voluntary public-land-habitat enhancement or data collection for some type of environmental inventory (e.g., bird counts). The need to account for similar types of stewardship that benefits ecosystems on both private (Gosling & Williams, 2010; Raymond & Brown, 2011) and public land (Buta, Holland, & Kaplanidou, 2014; Halpenny, 2010; van Riper & Kyle, 2014) has become increasingly evident, and the addition of land stewardship items to PEB scales represents an important step in this process.

Inclusion of items within the land stewardship domain may contribute to systematic investigations exploring differences in PEB engagement between urban and rural residents (Arcury & Christianson, 1993; Huddart-Kennedy et al., 2009; Tarrant & Cordell, 1997). Though recently documented high approval rates for land conservation ballot measures across geographical contexts suggest widespread public support for pro-environmental agendas (Banzhaf, Oates, & Sanchirico, 2010), other evidence suggests that rural residents may place a higher priority on the natural environment and stewardship behavior than their urban-dwelling counterparts (Berenguer, Corraliza, & Martin, 2005; Huddart-Kennedy et al., 2009). These differences may simply be an artifact of opportunity (e.g., few urban residents have access to substantial parcels of land or significant populations of wildlife) (Huddart-Kennedy et al., 2009). However, other explanations center on the unique environmental place meanings and sense of place that often emerges in rural settings (Stedman, 2003). Research has demonstrated that attachment to place matters when expressing pro-environmental views and behaviors (Halpenny, 2010; Hamilton et al., 2010). Other work has shown that positive experiences within nature are a significant predictor of PEB (Chawla, 2007; Cooper et al. 2015; Gosling & Williams, 2010; Larson, Whiting, & Green, 2011; Theodori, Luloff, & Willits, 1998; Zaradic, Pergams, & Kareiva, 2009). Given the rural nature of the sample in this study and the population's intimate connections with natural world via wildlife recreation, the unequivocal emergence of land stewardship as a key dimension of PEB might therefore be expected. Future research is needed to confirm the existence of land stewardship as a unique domain of PEB and explore the relationship between sense of place and ecosystem-level stewardship in other populations and research contexts.

5.1. Limitations and recommendations for future research

Future studies examining the dimensionality of PEB could be expanded to include a broader array of demographic groups (e.g., younger populations – most respondents in our sample were approaching retirement age), a sample population that more accurately reflects the general public (e.g., about two out of every three people in this rural sample were identified based on the nature-based recreation preferences), and a wider range of spatial scales (e.g., urban areas, other states – our study was confined to rural areas of upstate New York). A similar participant-driven approach to PEB conceptualization and measurement might yield a unique multi-dimensional structure in other settings where public appraisals of pro-environmental behaviors and their respective impacts differ, particularly when the impacts are global (this study focused primarily on local conservation outcomes). Additional studies that explicitly incorporate observed (through systematic expert analysis) and/or perceived (through participant input) environmental impact assessments of specific behaviors could help to validate and potentially prioritize certain domains of PEB across diverse research contexts (Steg & Vlek, 2009). Future research might also reveal additional behavior items that could be added to each subscale (and particularly the novel land stewardship subscale), thereby increasing the reliability and broader utility of PEB instruments.

Although this study sought to refine understanding of the multi-dimensional structure of PEB, we did not attempt to investigate the wide range of socio-demographic and cognitive variables (e.g., environmental values and beliefs, social norms) that are associated with behavioral expression (Ajzen & Albarracín, 2007; De Young, 2000; Milfont et al., 2010; Stern, 2000; Theodori & Luloff, 2002; Vaske, Donnelly, Williams, & Jonker, 2001). Future inquiries could examine how each PEB domain is differentially affected by a variety of potential antecedents. It is also important to note the limitations of self-reported behavior scales. Concerns centered on potentially overstated participation influenced by social desirability bias and weak correlations with observed behavior frequencies (Chao & Lam, 2011; Corral-Verdugo, 1997) have led some to consider alternative measurement strategies including overt outcomes like meter-based household energy use (Gatersleben et al., 2002) or direct observation focused on various PEBs such as recycling or reuse of plastic bags (Corral-Verdugo, 1997; Lam & Chen, 2006). These approaches, however, require significantly more effort than self-reported surveys and might struggle to capture behaviors that fall outside of the conservation lifestyle behavior domain. Finally, considering high levels of engagement in conservation lifestyle behaviors and the comparatively low reported participation rates associated with social environmentalism, environmental citizenship, and land stewardship behaviors in our rural sample, there appears to be an opportunity to study, promote, and encourage these particular types of PEB through targeted intervention programs (De Young, 1993; Heimlich & Ardoin, 2008; Steg & Vlek, 2009).

6. Conclusion

This study revealed that research focused exclusively on conservation lifestyle or private-sphere consumer behaviors, a common theme in many studies of PEB (Poortinga et al., 2004; Stern, 2000; Steg & Vlek, 2009), may fail to capture adequately the range of variation and diversity associated with pro-environmental actions. Other behavioral domains such as social environmentalism, environmental citizenship, and land stewardship should be considered to effectively assess the full scope of potential conservation-oriented actions. Researchers attempting to

characterize PEB and the factors that influence PEB should carefully consider these distinct domains and their unique conservation implications.

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