RESEARCH ARTICLE

Identifying women's attitudes and barriers to participating in a proposed community-based conservation group in western Belize

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Received: 6 April 2017 / Revised: 26 June 2017 / Accepted: 20 October 2017 / Published online: 10 November 2017

Abstract With mounting research showing the many benefits of having women involved in community-based conservation (CBC) efforts, we wanted to identify and measure the attitudes and barriers to women participating in a CBC program in western Belize. We surveyed 500 women in communities surrounding the Vaca Forest Reserve to measure their interest in, attitudes toward, and possible barriers to participating in a CBC program. We assessed women's intent to participate in CBC activities using the Theory of Planned Behavior to identify the attitudinal, normative, and behavioral control constructs that best predict their intentions to participate. Women indicated positive attitudes toward participating in a CBC program, while perceived behavioral controls had the largest influence on their intent to participate. Understanding the importance of and influence of these constructs on women's participation will help us and other conservation scientists work with women to collaboratively design effective conservation programs.

Keywords Belize · Community-based conservation · Structural equation model · Theory of planned behavior

INTRODUCTION

Increased greenhouse gas emissions, habitat loss, and species extirpations resulting from deforestation and forest degradation remain critical conservation issues globally (Board 2005). The Paris Climate Agreement contains many provisions about reducing emissions from deforestation

and forest degradation and recognizes the need to involve more communities in addressing and responding to climate change (UNFCCC 2015). One method to accomplish this is community-based conservation (CBC), a people-centered approach to conservation that attempts to link development and conservation goals (Berkes 2004). This approach has been employed globally to reduce forest degradation by empowering natural resource-dependent communities to sustainably manage forest resources (Brown 2002; Porter-Bolland et al. 2012). However, there needs to be more successful CBC programs to better address current global issues.

For CBC programs to be successful, forest resource management needs to shift from central governments to local communities. Brown (2002) states “experience has shown that traditional, top-down exclusionary approaches to protected areas are often not effective in reaching conservation objectives”. Historically, community development was seen as the cause of environmental degradation, not as a possible solution (Brown 2002). However, scientists are beginning to document the benefits that may come from local community involvement in management practices, shifting conservation efforts from top-down or command-and-control forms of management to including local communities (Berkes 2004). Furthermore, command-and-control management styles often alienate local communities, do not further social equity, and may actually harm the poor rural communities that live in the vicinity (Wells 1992). Recently, a goal to “ensure responsive, inclusive, participatory, and representative decision-making at all levels” was one of the policies supported by leaders attending the UN Sustainable Development Summit 2015 (UNFCCC 2015), providing more evidence of the needed shift from government to local management.

Electronic supplementary material The online version of this article (<https://doi.org/10.1007/s13280-017-0986-7>) contains supplementary material, which is available to authorized users.

There have been notable successes in CBC programs globally (Prasad Timsina 2003; Pagdee et al. 2006; Adhikari et al. 2007; Agarwal 2009; Baral and Stern 2011). For example, in a meta-analysis of community-managed forests and forest-protected areas in the tropics, Porter-Bolland et al. (2012) found community-managed forests to have less annual deforestation rates than government-managed protected areas. A review of 153 community-based groups in Bangladesh found these programs improved the productivity of the natural resources harvested by these groups (Thompson 2013). Still, some CBC efforts have been criticized because they were designed with little *a priori* data or input from the target population (Songorwa 1999; Brown 2002). By omitting formative studies and excluding local communities in program development and decision making, many CBC programs have relied on trial and error, resulting in an inefficient use of limited resources (Songorwa 1999; Campbell and Vainio-Mattila 2003).

Current evaluative research on CBC programs has largely been summative, often occurring after the program has been implemented. They are generally employed to assess program outcomes, participation, and people's attitudes toward an existing program (Baral and Stern 2011; Porter-Bolland et al. 2012; Soe and Sato 2012). In these summative evaluations, the authors outline barriers to program implementation and suggest improvements to increase CBC program impacts. We believe that some of the barriers and failures of CBC programs can be anticipated and overcome by conducting an initial analysis of the communities' attitudes and barriers to participation as a formative evaluation. Formative assessments are used as a standard practice in many industries, notably education, because it helps guide program creation and has been shown to increase student and program success (Keeley 2015). Therefore, we consider formative evaluations necessary to increase program efficiency and ultimately increase its impacts.

Involving women is another method researchers have found to increase CBC success, however there is a noted lack of women's participation in CBC efforts (Schmink 1999; Westermann et al. 2005; Agarwal 2009). Studies examining CBC programs that involve women have reported better program outcomes, such as improved rule compliance and forest protection (Agarwal 2009), better collaboration, solidarity, and conflict resolution due to them building "more relational social capital than men" (Westermann et al. 2005). Schmink (1999) indicated women may be more observant of the entire ecosystem, instead of focusing on only one aspect of it at a time, due to their many activities in their household that may include food procurement and preparation, and firewood collection. Agarwal (2009) found that community forest groups involving women showed greater improvement in forest

conditions on all indicators, with a 57% higher probability of improvement when the groups had two or more women involved. Women also had strong feelings of forest stewardship and watched for and reported illegal activity while performing their daily work. Therefore, including women in more programs could increase their effectiveness.

In order to increase the effectiveness of local conservation efforts, our research objective was to predict local women's intent to participate in a proposed CBC program and to identify their attitudes toward the group and any barriers to their participation. This was accomplished by conducting a formative exploratory study using the Theory of Planned Behavior (TPB) (Ajzen 1991) to identify the attitudes, norms, and barriers to women's participation in a proposed CBC program to sustainably use and protect the local rainforest.

MATERIALS AND METHODS

Theoretical framework

The Theory of Planned Behavior (TPB) is a social psychological theory that links beliefs to intent to perform a behavior (Ajzen 1985). Ajzen (1985) hypothesized that in order to predict intentions to perform a behavior, you must determine the explanatory variables of attitude, subjective norm, and perceived behavioral control (PBC) of performing the behavior (Fig. 1). The TPB has been used successfully to predict intent to perform a wide range of behaviors and specifically conservation-related behaviors such as, landowners participation in conservation easements (Brain et al. 2014), hunter behavior (Hrubec et al. 2001), rancher conservation activities (Willcox et al. 2012), and general conservation and environmental behaviors (Kaiser et al. 2005; Oreg and Katz-Gerro 2006). We chose the TPB because of its strong predictive ability in conservation behavior research and the inclusion of the PBC construct. We wanted to include this construct to determine if there were any aspects of participation that the women perceived as being beyond their control. Anecdotal evidence shows women have positive attitudes toward conservation, but there are likely some unknown barriers to their participation in conservation groups and activities. By considering women's PBC, a program can be better designed and implemented to minimize barriers and increase participation.

We chose to use indirect measures for attitude, subjective norm, and PBC to provide detailed information from the predictor variables that can be applied in the CBC program design (Fishbein and Ajzen 2011). As opposed to using one-question direct measures, we chose indirect measures to obtain more details about the three variables in

Fig. 1 The Theory of Planned Behavior

order to better assist practitioners in the creation of an actual CBC group. The first explanatory variable, attitude, is defined by Fishbein and Ajzen (2011) to be an individual's "tendency to respond with some degree of favorableness or unfavorableness to a psychological object." Two components are used to indirectly measure attitudes toward the behavior: behavioral belief (a person's beliefs about the behavior) and outcome evaluation (their evaluation of the outcomes of performing the behavior). Multiplied together, these two measures result in an overall attitude score. Each attitude question's score is then added together for the overall attitude score. This construct is expressed as

$$A = \sum b_i e_i$$

where A is the "overall" attitude score (creating a scale of 1–25); b_i is the strength of the belief that the behavior has a certain characteristic (behavioral belief) and e_i is the evaluation of the relative importance of that characteristic to the respondent (outcome evaluation).

The second TPB explanatory variable, subjective norm, is defined as an individual's perception about whether or not the people who are important to them expect them to perform or not perform a behavior. This construct also has two components: normative belief and motivation to comply. Subjective norms are indirectly measured by asking which groups a person thinks would want them to perform a behavior (normative belief), followed by a paired

question to measure their motivation to comply with that groups beliefs. These two components are calculated similarly to attitudes by multiplying the two components together to get the respondents overall subjective norm score.

The final explanatory variable, PBC, is the measure of the person's perception of the degree of control they have over the performance of a behavior. This variable can be indirectly measured by two components: control belief (what a person believes the barriers are to performing a behavior), and perceived power of control (the extent they believe those barriers are under their control). Perceived behavioral control is calculated similarly to the above attitudinal equation. Fishbein and Ajzen (2011) contend that a person's perception of their control over performing a behavior serves as a proxy for actual control.

Study area and participants

Belize is 63% forested and accounts for the greatest percentage of forest cover in the Mesoamerican Region (ChartsBin 2011). Between 1990 and 2010, Belize lost 12.2%, or approximately 193 000 hectares of its forests, mostly from illegal logging (FAO 2011; Arevalo and Chan 2012). Additionally, Belize's population density (15 people/km²) is relatively small compared to neighboring Central American countries such as Guatemala (149 people/km²), where forests are highly degraded. The

population-to-land ratio in Belize suggests there is opportunity for proactive, rather than restorative forest conservation efforts.

The Vaca Forest Reserve is in the Cayo District of western Belize and was established in 1991 to “to maintain adequate stock of renewable natural resources for sustainable use by the local communities and to contribute to the national economy” (Manzanero and Melendez 2013). It is a 14 448 hectare protected area situated within the Chiquibul forest, which stores a large amount of carbon, contains mineral deposits, large stocks of valuable mahogany (*Swietenia macrophylla*) and Spanish cedar (*Cedrela mexicana*) timber, and provides clean water for Belize and Guatemala (Cho 2011). The Chiquibul forest, along with neighboring protected areas, comprises one of the largest continuous tracts of tropical forests in Central America (Bridgewater et al. 2006). These forests are also part of the Chiquibul–Maya Mountains Key Biodiversity Area, which is a priority conservation area recognized by Conservation International (Arevalo and Chan 2012). Despite this distinction, as of 2012, a total of almost six million board feet of lumber has been illegally harvested from the Chiquibul forest, damaging 92,316 trees. This has resulted in a loss of almost 9.5 million dollars and destroyed substantial wildlife habitat (Arevalo and Chan 2012).

There is currently a small CBC program, Friends of the Vaca Forest Reserve (FVFR), working in the Vaca with farmers and in the surrounding villages where the farmers live. It comprises 24, mostly male, farmers who participate in apiculture, agro-ecological methods of farming, reforestation, composting, and other soil conservation techniques adjacent to and within the Vaca. These farmers typically live in the nearby villages and travel daily or weekly to their farming plots. However, all local residents are reliant on the forest’s ecosystem services such as nuts, seeds, lumber, farmed crops and livestock, and clean water and air. Long-term goals of FVFR include empowering communities to manage natural and cultural resources, reducing poverty, and reforestation (Manzanero and Melendez 2013). This access to and sustainable use of the Vaca has resulted in FVFR participants increasing forest stewardship by monitoring and reporting poaching activities. A local nongovernmental organization, Friends for Conservation and Development, works with farmers in the VACA and in the surrounding villages where the farmers live to increase forest conservation and conservation awareness. The leader of this group recognized the need to increase women’s participation, as their main role in the forest usually only involves accompanying their husbands to cook for them during planting and harvest time; however, there are a couple women who do participate in FVFR (Kaeser et al. 2016). His desire is to improve the effectiveness of conservation efforts and environmental

awareness around the Vaca and approached us to assist them in designing a CBC program to specifically include women, as women have been found to be the way knowledge is transferred in this area and are highly respected and looked up to in the family unit (Kaeser et al. 2016).

Survey development

We designed a survey from the results of an elicitation study (Kaeser et al. 2016) that was completed following the TPB guidelines (Ajzen 1985). We conducted the elicitation study by interviewing 47 local key informants: police, mayors, educators, religious leaders, current CBC participants, nongovernmental organization leaders, resort personnel, government agencies, and women. Results determined common beliefs held by the target population about attitudes, norms, and behavioral controls that might influence women’s ability to participate. The final survey was reviewed by two researchers familiar with the TPB and by two native Belizeans experienced in surveying the target population, and revisions were made as needed. The survey contained 24 questions, 11 of which were matrix style with multiple parts (See Appendix S1 for full survey). We translated our survey into Spanish and then tested the English and Spanish versions with eight bilingual community members to check for content validity and understanding.

Survey administration

We collected surveys in the town of Benque Viejo Del Carmen (total pop. = 6 140; women = 3 091), and the two villages of San Jose Succotz (total pop. = 2 322; women = 1 180) and Arenal (total pop. = 612; women = 292) (SIB 2014). We chose these communities because they are adjacent the Vaca. We administered surveys to women in the language of their choosing, English or Spanish, over a four-week period in May and June 2015 using three iPads and three Android tablets with iSurvey and droidSurvey apps. Although some of the research areas were remote, the use and familiarity with tablets and other technology was widespread enough for us to feel comfortable using this method. Additionally, as the surveys were read to the participants we felt that the administering device would not have an effect on the results. We collected surveys between 8:30am and 11:30am and returned in the afternoon and evening between 3:30 pm and 7:30 pm to avoid times when women would be busy preparing food for their families.

We surveyed one woman over the age of 18 at each residence, if a woman was available, due to the likelihood that women within the same household may hold similar

views about the topic. We attempted to visit all houses in each community, although we may have omitted some due to a lack of current and detailed street maps.

After we collected a few surveys, we determined self-administered surveys were impractical and taking a long time (> 30 min), likely due to low literacy. Education levels and literacy rates in the area are quite low, with 62% of women, ages 14 and older only completing eighth grade or less (SIB 2014). Therefore, after women completed 11 self-administered surveys, we administered the remaining by reading questions to women and recording their answers. Researcher-administered surveys have been previously employed here as a means to increase comprehension, reduce respondent fatigue, and ultimately improve data quality (Panti, pers. Comm.). Researchers fielded questions from respondents as necessary to clarify any survey questions. All field assistants were trained on how to answer respondent questions about the survey. We compared the 11 self-administered surveys to the researcher-administered surveys on all TPB responses using one-way ANOVAs. Finding no differences, the 11 surveys were included in our sample. Of the women who were home and were asked to complete the survey, we had four women refuse, resulting in a less than 1% refusal rate.

Data analysis

We conducted all analyses in STATA 13.1. We used Cronbach's Alpha to assess internal reliability of the dependent and independent variables measuring the latent constructs (Kline 2011). Confirmatory factor analysis was used to measure the observed variables convergent and discriminant validity within and among our four constructs (Garson 2015).

We employed Structural Equation Modeling (SEM) with maximum likelihood estimation to determine relationships between behavioral intent questions (response variable) and the calculated indirect measures of attitude, subjective norm, and PBC (explanatory variables). We chose SEM to compare the TPB model to empirical data, as it can analyze data even if multicollinearity exists, and is a more flexible tool than regression as SEM can consider multiple equations at once, i.e., covariances and direct relationships (Garson 2015; Nachtigall et al. 2003). One of its main benefits is that from observed variables it can determine or measure latent variables, the factors underlying the observed variables, unlike regressions which can only model observed variables (Nachtigall et al. 2003). This is important for our analysis because only indirect measures were used to determine the three constructs. Structural equation models can also be used as a confirmatory factor analysis, in that an acceptable goodness-of-fit can serve as evidence that indirect, but observable,

measures were successfully used to determine the latent variables (Nachtigall et al. 2003).

Fourteen cases were dropped before the analysis due to missing data for all questions relating to at least one of the three constructs. We imputed overall construct means for missing data on construct question pairs, using the respondent's mean from the remaining answered questions for that construct. For example, if a respondent did not have a significant other, the normative belief question "My husband/boyfriend would approve of my participation in a women's conservation group" and its paired motivation to comply question were legitimately skipped. Therefore, the overall subjective norm mean for that respondent was imputed and used in place of the missing data. This method ensures the subjective norm mean for each respondent is maintained and STATA 13.1 does not remove all of this respondent's data from the model. All field assistants were told to skip questions when they did not apply to the respondent instead of answering neutral. This was done to assure that responses were not skewed toward neutral by respondents who could not respond to a question.

RESULTS

Demographics

All respondents were women with 52% residing in Benque Viejo, 40% in San Jose Succutz, and 8% in the small village of Arenal. The average age of the respondents was 36, with 62% having what they consider a job. The education level of the respondents was low, with 51% completing school through the 8th grade or less. The majority of women (69%) were married or in a common law relationship.

To assess our sample's representativeness of the larger population in our study area, we compared our sample's age to the 2010 Belize census for the Cayo District (the study area) and our sample's education level to the entire country (local statistics were not available for education) (SIB 2014). Our sample was not different in most age categories, with the exception that we had 4% more in the 30–34 age range ($p = 0.011$; $z = 2.52$). Proportions of women completing most education levels in our sample did not differ from the Belize census, apart from secondary school completion, where our sample contained 10% more than in the general population ($p = 0.000$; $z = 5.55$). We were not able to perform other demographic comparisons due to the lack of comparable census data. Therefore, our sample is largely representative of the comparable population demographics except for the two caveats described above.

TBP construct analysis

Confirmatory factor analysis indicated strong convergent and discriminant validity between behavioral intent, attitude, subjective norm, and PBC, with all these variables loading on different factors.

Behavioral intent

Cronbach's Alpha for the four behavioral intent questions was high ($\alpha = 0.8553$), indicating adequate convergent validity and reliability. Overall intent to participate in the four proposed activities given in Table 1 ranged from 2.13 to 2.57, with intent averaging 2.36 on a 1–5 scale with 1 = very likely, 2 = likely, 3 = neutral, 4 = unlikely, and 5 = very unlikely (Table 1). This demonstrates that the average respondent is “likely” to participate in all CBC group activities. The SEM analysis showed all path weights to be above the 0.6 minimum and therefore all were included in the model (Garson 2015).

Attitude

The six attitude question scores exhibited a high Cronbach's Alpha ($\alpha = 0.8875$), indicating adequate convergent validity and reliability. All outcome evaluation and attitudinal strength question means denoted respondents had very favorable attitudes toward participating in the proposed CBC program, with outcome evaluation and attitude strength means ranging from 1.27 to 1.50 on a 1–5 scale. Overall Attitude means ranged from 1.75 to 2.37 with a global attitude mean of 1.97 on a scale of 1–25, with lower numbers indicating more favorable attitudes (Table 2). This low global attitude mean demonstrated that the respondents hold very positive attitudes toward participating in the proposed CBC program and believed that

participating would provide them benefits that are important to them. All path weights were above 0.6.

Subjective norm

All subjective norm questions also factored together and had a high Cronbach's Alpha ($\alpha = 0.8837$), indicating adequate convergent validity and reliability. Respondents indicated strong subjective norms to participate with normative belief and motivation to comply question means ranging from 1.86 to 2.33 on a scale from 1 to 5. Overall subjective norm means ranged from 3.97 to 5.20 on a 1–25 scale with a global mean of 4.59, with lower scores indicating more positive subjective norm scores (Table 3). This indicates respondents believed the normative groups that are important to them would be in favor of their participation. All path weights were above 0.6, therefore all norms were included in the SEM analysis.

Perceived behavioral control

Perceived behavioral control questions exhibited a high Cronbach's Alpha ($\alpha = 0.8353$), indicating adequate convergent validity and reliability. Individual control belief and control power question means ranged from 1.5 to 2.89 on a 1–5 scale. Overall individual PBC means ranged from 2.67 to 4.53, on a 1–25 scale (Table 4), with lower means indicating participants feel more in control of performing the behavior. The global PBC mean was 3.47 on a 1–25 scale, indicating that participants feel they are in control of participating in a CBC program.

The observed variable that addressed the need to make money in order to participate had a path weight below the required 0.6. However, this variable was included in the model due to its importance for the application of this research and when removed the R^2 value for the dependent variable (intent) was not increased.

Table 1 Women's behavioral intent questions, means, and standard errors about participating in a conservation program in western Belize, 2015. ($n = 486$)

Statement	$\bar{x}$	SE
How likely is it that you would participate in the following activities? ^a		
Attending conservation group meetings	2.53	0.058
Going on conservation group outings into the forest to collect resources	2.57	0.063
Making forest resources into something that can be sold at market	2.13	0.056
Selling a processed forest product at a market	2.22	0.057

^a Intent questions. Ordered responses: 1 = very likely, 2 = likely, 3 = neutral, 4 = unlikely, 5 = very unlikely

Structural equation model analysis

The test for goodness-of-fit was acceptable (Hooper et al. 2008) with RMSEA = 0.079, CFI = 0.903, and SRMR = 0.050, suggesting that the relationship between the observed and latent variables is supported and that the specified model cannot be disconfirmed (Nachtigall et al. 2003). All regression path p values were significant, signifying that none need to be removed to improve the model (Garson 2015). Behavioral intent had an R^2 value of 0.21, explaining 21% of the variance of the dependent variables. The SEM model's standardized results show that the relationship between PBC and behavioral intent has the largest effect size ($\beta = 0.27$, $p = 0.000$) (Fig. 2), with

Table 2 Women's attitudinal questions, means, and standard errors about participating in a conservation program in western Belize, 2015. ($n = 486$)

Statement	$\bar{x}^c$	SE	Calculated Attitude Scores	
			$\bar{x}^d$	SE
How likely is it that participating in a women’s conservation group would provide you with the following benefits? ^a				
1. Providing opportunities to meet and get to know other people	1.31	0.026	2.02	0.077
2. Learning more about the forest and conservation	1.27	0.023	1.75	0.058
3. Providing an additional source of income	1.45	0.032	2.37	0.098
4. Helping you inform others about conservation	1.33	0.025	1.94	0.071
5. Helping the forest and the environment	1.32	0.025	1.83	0.064
6. Reducing deforestation in Belize forests	1.37	0.032	1.88	0.079
How important are the following to you? ^b				
1. Having opportunities to meet and get to know other people	1.46	0.034		
2. Learning more about the forest and conservation	1.32	0.027		
3. Having an additional source of income	1.50	0.035		
4. Informing others about conservation	1.36	0.028		
5. Helping the forest and the environment	1.31	0.027		
6. Reducing deforestation in Belize forests	1.29	0.027		

^a Outcome evaluation questions. Ordered responses: 1 = very likely, 2 = likely, 3 = neutral, 4 = unlikely, 5 = very unlikely

^b Attitudinal strength questions. Ordered responses: 1 = very important, 2 = important, 3 = neutral, 4 = unimportant, 5 = very unimportant

^c Raw question means without any imputations (with missing data)

^d Calculated attitude score (outcome evaluations^a $\times$ attitudinal strength^b) with imputed means, used in SEM model

Table 3 Women's subjective norm questions, means, and standard errors about participating in a conservation program in western Belize, 2015. ($n = 486$)

Statement	$\bar{x}^c$	SE	Calculated Subjective Norm Scores	
			$\bar{x}^d$	SE
Who would approve of/disapprove of your participation in a women’s conservation group? ^a				
1. My community leaders	2.14	0.040	5.20	0.179
2. My husband/boyfriend	2.17	0.042	4.54	0.153
3. My friends, relatives, and others important to me	1.95	0.038	3.97	0.133
4. The religious or spiritual leaders in the area	2.16	0.041	5.18	0.176
5. Friends for Conservation and Development	1.91	0.036	4.34	0.142
6. Other community groups (for example: women’s groups or the House of Culture)	1.86	0.034	4.31	0.149
How important are the following people’s opinions to you? ^b				
1. My community leaders	2.33	0.058		
2. My husband/boyfriend	2.00	0.050		
3. My friends, relatives, and others important to me	1.94	0.047		
4. The religious or spiritual leaders in the area	2.32	0.056		
5. Friends for Conservation and Development	2.07	0.050		
6. Other community groups (for example: women’s groups or the House of Culture)	2.15	0.050		

^a Normative belief questions. Ordered responses: 1 = strongly approve, 2 = approve, 3 = neutral, 4 = disapprove, 5 = strongly disapprove

^b Motivation to comply questions. Ordered responses: 1 = very important, 2 = important, 3 = neutral, 4 = unimportant, 5 = very unimportant

^c Raw question means without any imputations (with missing data)

^d Calculated subjective norm score (normative belief^a $\times$ motivation to comply^b) with imputed means. Used in SEM model

attitude having the next largest effect size ($\beta = 0.18$, $p = 0.003$), and subjective norm having the smallest effect size ($\beta = 0.11$, $p = 0.032$). All observed variable loadings

were significant at the 0.001 level and all constructs were found to have significant covariance, with attitude and PBC having the largest covariance at $\beta = 0.6$ ($p = 0.000$).

Table 4 Women's perceived behavioral control questions, means, and standard errors about participating in a conservation program in western Belize, 2015. ($n = 486$)

Statement	$\bar{x}^c$	SE	Calculated PBC Scores	
			$\bar{x}^d$	SE
There are things that would influence a women's ability to participate in a women's conservation group. Please tell me how much you agree with the following statements ^a				
1. Having time to participate in a women's conservation group would influence her ability to participate	1.50	0.035	3.65	0.141
2. A women's comfort level while in the forest would influence her ability to participate	1.60	0.038	3.17	0.122
3. A women's access to childcare would influence her ability to participate	1.63	0.038	3.88	0.125
4. The potential to make money would influence her ability to participate	1.55	0.037	4.53	0.157
5. A women's interest in the local forest and conservation would influence her ability to participate	1.52	0.032	2.92	0.107
6. A women's current knowledge about the forest and conservation would influence her ability to participate	1.47	0.032	2.67	0.103
How much do you agree or disagree with the following statements? ^b				
1. I have time to participate in a women's conservation group	2.33	0.055		
2. I would feel comfortable going into the forest to collect things	1.92	0.051		
3. My children would be taken care of while I am participating in a women's conservation group	2.41	0.055		
4. I would need to make money from my participation in a women's conservation group	2.89	0.059		
5. My interest in the local forest and conservation makes me want to participate in a women's conservation group	1.79	0.036		
6. I would need more knowledge about the forest and conservation to participate in a women's conservation group	1.69	0.038		

^a Control belief questions. Ordered responses: 1 = strongly agree, 2 = agree, 3 = neutral, 4 = disagree, 5 = strongly disagree

^b Control power questions. Ordered responses: 1 = strongly agree, 2 = agree, 3 = neutral, 4 = disagree, 5 = strongly disagree

^c Raw question means without any imputations (with missing data)

^d Calculated perceived behavioral control score (control belief^a $\times$ control power^b) with imputed means. Used in SEM model

DISCUSSION

The acceptable goodness-of-fit statistics serve as evidence that the use of indirect observed variables can determine the latent variables of attitude, subjective norm, and PBC. The SEM analyses indicated that these empirical data fit well with the TPB model to predict women's intent to participate in a CBC program. In agreement with the TPB, attitudes, subjective norms, and PBC were found to be determinants of behavioral intent. Although there was covariance between the three constructs (attitude, subjective norm, and PBC), they clearly represent different concepts to the respondents as indicated by our factor analysis. The covariance between attitude and PBC was $\beta = 0.6$, suggesting that either the women's attitudes are effecting their perceived control or that the PBCs are affecting their attitudes. We believe our low R^2 value (0.21) for the dependent variable was due to using a suite of behavioral intent questions instead of one specific behavior and using indirect measures instead of direct measures for the three constructs. We feel the sacrifice of a high R^2 value was justified by the increase in practicality of our results. The TPB authors state that very specific behavioral intent response variables increase the model's predictive power (Fishbein and Ajzen 2011). However, for general behaviors

such as ours regarding participation in a proposed CBC program, suites of response variables have been successfully employed to predict intentions, but typically yield lower R^2 values than specific, individual behavioral intent variables (Kaiser et al. 2005). We recognized that obtaining a lower R^2 value in order to increase the applicability of our research by measuring a suite of variables was an acceptable tradeoff. Additionally, we inferred the three constructs (attitude, subjective norm, and PBC) from indirect measures instead of using semantic differentials. Referring to using indirect measures instead of semantic differentials, Fishbein and Ajzen (2011) note that "many investigators prefer more complicated techniques developed earlier because these techniques can provide interesting information about the content of the attitude domain that is not available with the semantic differential." Additionally, researchers have obtained high R^2 values using only indirect measures (Rossi and Armstrong 1999; Willcox et al. 2012; Brain et al. 2014).

Examining the behavioral intent activities individually, converting forest resources into products that could be sold at a local market was the activity in which women were most likely to participate. This is likely linked to the result that women perceive they have less control over the amount of time they have to participate than some of the

Fig. 2 Full SEM model using the TPB regarding women's participation in a conservation program in western Belize, 2015 ($n = 486$)

other barriers. Making marketable products can be done at home and at their own pace, potentially alleviating the 'time' PBC. Similarly, the least likely behavioral intent

activity was going into the forest to collect resources. Again, this may relate to the 'time' PBC. Going into the forest would take at least an hour of travel and many hours

to collect resources each trip. Therefore, as we collaboratively design specific program activities, time constraints need to be strongly considered and mechanisms designed to either free up time or focus on activities that can be done concurrently with daily activities.

Our results are similar to those of Kaiser et al. (2005) in a study that used the TPB to explain general conservation behavior. They also determined that PBC had the greatest effect on behavioral intent. However, this result is uncommon in TPB studies of conservation behavior. Generally, in most TPB studies, attitude has the largest effect on intent, followed by subjective norm (Ajzen 1991). Some studies have found that PBC did not have a significant effect on intent, which was explained by the target behavior being largely under a person's volitional control (Hrubes et al. 2001; Willcox et al. 2012). Ajzen (1988) added the variable of PBC to the Theory of Reasoned Action model, which only contains the constructs of attitude and subjective norm (Fishbein and Ajzen 1975), in order to enable the prediction of behaviors that are non-volitional, or those not considered to be under a person's own control (Kurland 1995). Therefore, it is possible in our population there are behavioral aspects of participating in a CBC program that the women believe are out of their control. For example, possessing the required knowledge about conservation and the forest and having the time required to participate are not things that the women may perceive as being under their control. It would take specialized education to increase forest knowledge, which they cannot easily access without outside support. Moreover, a dramatic lifestyle change would have to occur to increase available time. Women in this area are not well educated and have many household and familial tasks (SIB 2014; pers. obs.). This is supported by the evidence that women 'strongly agree' that having knowledge about the forest and conservation would influence their ability to participate.

Regardless of the finding that PBC had the greatest effect, women's attitudes toward participation were very positive. The possibility of learning more about the forest and conservation was very important to them and they believe that this would occur if they participated in a conservation group. Therefore, any CBC program implemented should focus on conservation education and local forest resources and their importance. Increasing women's knowledge about conservation and the forest should give them more confidence about their ability to participate. Learning more about the importance of conservation may increase their interest in the forest and conservation, decreasing another possible barrier to participation as identified in the PBC analysis. Additionally, it may be beneficial to train them in effective knowledge transfer strategies and provide opportunities for them to incorporate their family and friends into group conservation activities,

furthering the reach of the program by harnessing these positive attitudes. Offering ways for family and friends to participate in group activities could also work to free some of the women's time by having their dependents with them instead of relying on child care. Planning activities at a time of the day when the women are more likely to be free, such as during school hours, would help them to be able to participate as well.

An unexpected finding was that the least positive attitude to participation was potential financial gain. It was still important (2.37 on a scale of 1–25, with low numbers representing more positive attitudes), but ranked last in the individual attitude scores. However, this is similar to results from another study we conducted in that area (Kaiser et al. 2016). In this, women did not express a great desire to gain an income from participation in a conservation group, but would rather have the opportunity to increase their conservation knowledge. A lower emphasis on financial gain also concurs with Berkes' (2004) finding that indicates social benefits are often more important in rural communities in developing areas than economic benefits. Our PBC questions also showed similar results with regard to income. Women agreed that the potential to make money would influence their ability to participate, however, the mean for the question "I would need to make money from my participation" was 2.89, almost neutral. Therefore, a good portion of women surveyed did not indicate they would need to make money in order to participate. This result is contrary to findings that people are more likely to change their behavior if they perceive a positive economic benefit from the change (Pannell et al. 2006; Corbeels et al. 2014). The benefits of education and increased conservation are more of a motivation for this particular population and these elements should be highlighted in program design and implementation.

This study provides evidence for the importance of program analyses prior to its implementation, rather than relying on trial and error and wasting time and project resources. These pre-implementation analyses can uncover unexpected cultural and logistical barriers to participation. For example, our results demonstrated that women do not need an income and their main motivations are education and transfer of knowledge to others. Without our *a priori* results, these motivations would not have been included in the program design and increasing personal income may have been unnecessarily highlighted, making it less palatable to potential participants. Additionally, we might not have realized that time was a barrier to participation. Therefore, we urge conservation practitioners to conduct *a priori* assessments of their target population before designing intervention programs in order to increase their chance for success.

Acknowledgements We would like to thank the WK McClure Scholarship for the Study of World Affairs and the Rainforest Alliance for financial support. Rafael Manzanero and other staff of Friends for Conservation and Development are thanked for their continued support along with Cayo Women for Conservation and the Program for Tropical Ecology and Conservation Science. We would like to acknowledge Arnoldo Melendez, Nasly Escobar, Nidia Panti, Hicela Panti, and the rest of the Panti family for research assistance.

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