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# Wilderness Food Storage in Yosemite: Using the Theory of Planned Behavior to Understand Backpacker Canister Use

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*Bear-resistant food storage canisters have gained widespread acceptance by backpackers as the most convenient and effective means of avoiding conflict with black bears in Sierra Nevada wilderness areas. Bear incidents, however, continue in the Yosemite Wilderness. Beginning in 2004, Yosemite backpackers were required to store their food in approved bear-resistant food storage canisters when camped within seven air miles of a road and anywhere above 9,600 feet; this constitutes a large majority of the park's wilderness. In 2005 we evaluated backpackers' use of canisters for food storage. Trailhead and Internet-based surveys were used to identify wilderness visitors' beliefs, attitudes, subjective norms, perceived control, and intentions regarding use of food storage canisters. We used the Theory of Planned Behavior to explain intended use of food storage canisters in the Yosemite Wilderness and found that models containing measures of attitudes and subjective norm explained 38 to 43% of backpackers' intentions to use canisters.*

**Keywords** Theory of Planned Behavior, wilderness food storage, human–black bear conflict

## Introduction

Alteration of the natural behavior of black bears through habituation to human food sources is the major recreational impact humans have on bears, and is well documented in parks and protected areas throughout North America (Hammitt & Cole, 1998). Human food is the basis for nearly all conflicts between humans and black bears that take place in native bear habitat (Graber, 1981). While studying the interactions of bears and humans in the Yosemite wilderness, Graber (1986) and Dalle-Molle, Coffey, and Werner (1986) offered an innovative strategy to alleviate bear–human conflict: a bear-resistant food canister that could be carried by backpackers. Although a novel idea in the 1980s, canisters have gradually supplanted the use of metal lockers, food hanging poles, and tree cables to become the preferred method of food storage for Yosemite backpackers (Koy & Anaya, 2002). Even with widespread and voluntary use of canisters, however, a low enough level of food availability to discourage food seeking behavior in bears has not been realized and

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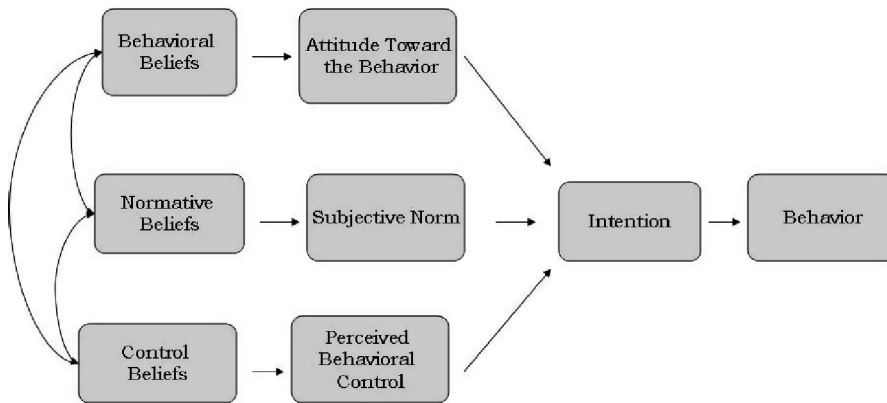
incidents continue (Mazur, 2008). Van Wagtendonk (2003) suggested that the establishment of a canister requirement may be needed, and the following year Yosemite National Park enacted such a regulation. Starting in April 2004, canister use was made mandatory in all wilderness areas within seven air miles of park roadways and anywhere above 9,600 feet. This regulatory action also removed counterbalance food hanging as a legal means of food storage where canisters are required. Metal food storage lockers at six of the park's most heavily visited backcountry destinations exempt these locations from the canister requirement. This study evaluated visitor use of canisters under the new regulation, and provided insight into the attitudes, beliefs, and behaviors of Yosemite wilderness visitors relative to canister use.

Prior to the enactment of this requirement, the National Park Service (NPS) estimated that as many as 80% of visitors camping overnight in the Yosemite Wilderness were voluntarily using canisters (NPS, 2002). The Yosemite canister program owns and maintains over 1,000 canisters. Each canister circulates an average of eight times a year, and in 2002 the NPS calculated that one canister was rented for every 1.5 wilderness permits issued (Koy & Anaya, 2002). This suggests that 67% of backpackers who visited the Yosemite Wilderness opted to carry rental canisters in 2002. When privately owned canisters and canisters rented from facilities outside Yosemite are included in these statistics, the actual rate of canister use would presumably be higher. According to an independent study conducted the same year, over 80% of wilderness users surveyed supported mandatory canister use in Yosemite (Newman, Manning, & Dennis, 2005).

## Conceptual Framework

The Theory of Planned Behavior (Ajzen, 2002a) offers one explanation for how beliefs, attitudes, and norms guide behavior. A person's behavioral intention is the cornerstone of the Theory of Planned Behavior, which assumes that "humans are reasoning animals who systematically utilize or process the information available to them" (Fishbein & Manfredo, 1992, p. 30). The model explains the relationships among an individual's beliefs, attitudes, intentions, and behavior. Understanding an individual's attitude toward a behavior and the associated subjective norm (social pressure) regarding the behavior makes it possible to predict a person's intention to perform the behavior in question. Preludes to attitude formation include the influences of behavioral beliefs and outcome evaluations (positive or negative). The inclusion of perceived behavioral control updated the Theory of Reasoned Action (Ajzen & Fishbein, 1980) into the Theory of Planned Behavior (Ajzen, 2002a; Figure 1). The perceived behavioral control component acknowledges the importance of voluntary action and ability on the process of translating intention into behavior.

Previous investigations using the Theory of Planned Behavior (TPB) have demonstrated varying degrees of predictive ability in explaining attitudes toward a targeted behavior and intentions to perform that behavior, for example exercise (Norman & Smith, 1995), pedestrian behavior (Evans & Norman, 1998), hunting (Hrubes, Ajzen, & Daigle, 2001), attendance at extension programs (Clark-Richardson, 2003), attendance at sporting events (Cunningham & Kwon, 2003), recycling (Kraft, Rise, Røysamb, & Sutton, 2005), and use of a park-and-ride facility (de Groot & Steg, 2007). Ajzen and Driver (1992) used the TPB to examine outdoor leisure intentions and behaviors and found that 50 to 86% of the variance in the intentions of college students to engage in outdoor recreation activities could be predicted from attitudes toward the behaviors, subjective norms, and perceptions of behavioral control. Norman and Smith (1995) were able to explain 38% of the variance



**Figure 1.** The Theory of Planned Behavior (from Ajzen, 2002a).

in exercise frequency using the TPB, while Evans and Norman (1998) used TPB to explain between 39 and 52% of variance in pedestrians' intentions to perform dangerous road crossing behaviors. Hrubec et al. (2001) found that attitudes, subjective norms, and perceived behavioral control explained 93% of the variance in hunting intentions. Kraft et al. (2005) determined that TPB components explained 51% of the variance in recycling intentions. Attitudes, subjective norms, and perceived behavioral control also explained 29 to 47% of the variance in people's intentions to use a park-and-ride facility in the Netherlands (de Groot & Steg, 2007).

We used the Theory of Planned Behavior to evaluate backpackers' beliefs, attitudes, subjective norms, perceived control, and behavioral intentions relative to food storage canister use in the Yosemite Wilderness. By examining attitudes toward canister use, subjective norms (the collective influence exerted by normative peer groups), and perceived behavioral control, as well as the beliefs underlying these, we sought to predict the level of canister use in areas where they are not required, as well as where their use is mandatory. We posit that a favorable attitude toward food storage, coupled with social pressure from others (subjective norm), and a rental system that makes canisters easy to obtain and use (behavioral control) will explain (at least in part) backpackers' intentions to carry and use a canister during wilderness trips in Yosemite.

## Methods

### *Study Area*

Yosemite National Park encompasses 747,959 acres on the western slope of the Sierra Nevada Mountains in central California. Elevations range from 1,500 feet on the western boundary to 14,000 feet along the Sierra crest. Ninety-four percent (94%) of the park is officially designated as wilderness. Overnight use averaged 117,000 visitor use nights per year between 1990 and 1999 (Boyers, Fincher, & van Wagtenonk, 2000), and approximately 80,000 people for 145,000 user nights in 2003 (NPS, 2004), making the Yosemite Wilderness one of the nation's most heavily used wildernesses. The roughly 700,000 acre wilderness area is divided into travel zones based on watershed drainages. Visitor use is predominately concentrated in 10 of the 53 zones, each of which is within one day's travel of the trailheads (Keay & van Wagtenonk, 1983). Recreational use is thus concentrated

in favored locations where backpackers camp in relatively high numbers (van Wagten-dock & Coho, 1986). Bear incidents are more prevalent in these high use areas of the Yosemite wilderness (Hastings & Gilbert, 1987; Keay & van Wagten-dock, 1983), which has led to a change in black bear distribution within the park (Graber, 1981). In the early 1900s, bears were rarely encountered above 8,200 feet elevation (Grinnel & Storer, 1924), which encompasses a majority of the Yosemite wilderness. Bears are now commonly seen at elevations up to 11,500 feet in the park, because of the presence of humans and their food (Graber, 1981). This has led to many bears being conditioned to backpackers' food, and the necessity for park strategies to offset human use and its impact on black bears.

One such strategy is a trailhead quota system for rationing use during the park's summer months. Wilderness permits are required for overnight use in all travel zones. A second strategy, and the focus of this research, requires the use of bear resistant food storage canisters in all areas within seven air miles of park roads (due to higher density of recreationists), and anywhere above 9,600 feet (approximately 85% of the park, due to a lack of trees from which to hang food). This strategy has been employed in a number of other locations (see Mazur, 2008).

### ***Sampling and Data Collection***

A sample of 924 individuals was selected from the population of adult wilderness users who used Yosemite trailheads in 2005. Surveys were administered at 36 randomly selected wilderness trailheads and backpacker campgrounds ranging from 3,500 feet to 9,600 feet in elevation in Yosemite National Park between May and October 2005. Approximately half of the trailheads were considered major wilderness portals; the remaining trailheads were seasonally or less frequently used. Study participants were given the option of completing a survey at the trailhead or over the Internet following their trip.

### ***Variable Measurement***

The questionnaire utilized TPB modeling (Ajzen, 2002b) to measure behavioral, normative, and control beliefs that may influence wilderness food storage behavior, three direct predictors of behavioral intention (attitudes, subjective norms, perceived behavioral control), and behavioral intention.

Behavioral beliefs were identified during pre-testing in Yosemite National Park. Behavioral beliefs were measured with the following four items: (a) "How important is it to me that bears don't get human food? (b) How important is it to me that bears are wild? (c) How important is it to me that I am safe when camping around bears? and (d) How important is it that other people who camp near me are safe from bears?" Response format was a 7-point scale ranging from *not at all important* (1) to *extremely important* (7). Four measures of attitude toward the behavior were assessed by asking respondents to evaluate personal canister use while camping in the Yosemite wilderness using a 7-point scale with endpoints labeled *disagreeable* (1) to *agreeable* (7), *difficult* (1) to *easy* (7), *bad* (1) to *good* (7), and *worthless* (1) to *valuable* (7). These scores were summed to form an aggregate measure of attitude toward the behavior.

To measure normative beliefs (i.e., how much social pressure to use bear-resistant food storage canisters participants feel), we identified four groups that may influence a backpacker's decision to carry and use a canister: family/friends, camping partners, the National Park Service, and other people camping nearby. Four normative belief items were formulated: (a) "Most people who are important to me think that I should carry a

food storage canister; (b) Other people camped near me think I should carry a food storage canister; (c) Other members of my backpacking group think I should carry a food storage canister; and (d) The National Park Service thinks that I should carry a food storage canister.” Response format was a 7-point scale ranging from *not at all important* (1) to *extremely important* (7). A measure of subjective norm was assessed by asking respondents how often camping friends of theirs carry and use food storage canisters when they travel in the Yosemite wilderness. Response format was a 5-point scale ranging from *never* (1) to *always* (5).

We identified six control factors relevant to a backpacker’s perceived ability to effectively carry out an intention to use a food storage canister while backpacking in Yosemite. For example, some backpackers may feel that it is difficult to rent or return a canister, that the canister rental fee is too high, that they will be unable to fit a canister in their pack, or that canisters are too heavy to carry. To assess control beliefs, respondents were asked to respond to the following items: (a) “Food storage canisters are expensive to obtain; (b) Food canisters are too small to hold enough food; (c) Food canisters are easy to rent in Yosemite National Park; (d) Food canisters are difficult to return in Yosemite National Park; (e) Food canisters are too heavy to carry; and (f) Food canisters are difficult to fit in or on a backpack.” Response format was a 7-point scale ranging from *strongly disagree* (1) to *strongly agree* (7). Perceived behavioral control was assessed by asking respondents the extent to which they felt the use of a canister was their choice to make, also measured on the same 7-point scale.

To measure behavioral intentions, participants were asked to respond to two items: (a) “Even in areas where they aren’t required, I will use a food canister on future trips in the Yosemite wilderness; and (b) Where they are required, I will use a food canister on future trips in the Yosemite wilderness.” Response format was a 7-point scale ranging from *strongly disagree* (1) to *strongly agree* (7).

### Data Analysis

Skewness and kurtosis ratios indicated that not all of the data met normality assumptions. Many of the variables were skewed and had to be corrected with data transformations (reflected square root or reflected inverse) to restore normality to the data (Tabachnick & Fidell, 2007).

A regression analysis was done separately for each of the two dependent (behavioral intentions) variables. Six independent variables were tested: behavioral beliefs, attitude toward the behavior, normative beliefs, subjective norm, control beliefs, and perceived behavioral control ( $p < .05$ ).

### Results

Three hundred and sixty questionnaires were completed by backpackers at trailheads immediately following a wilderness trip. An additional 208 surveys were completed over the Internet by those who volunteered their e-mail address at park trailheads. The response rate was 62% for the on-site and 60% for the Internet survey (overall = 61%).

Male respondents represented a significantly greater proportion of the survey sample (71%) than women. Sixty-two percent (62%) were California residents, whereas 29% were from other American states and 9% were foreign visitors. The median age of respondents was 36 years, with a range of 18 to 79 (minors were excluded from the survey). Fifty-nine percent (59%) had been on at least one previous wilderness trip in Yosemite

National Park, and 49% planned their trip more than 6 months in advance. Sixty-five percent (65%) took their first trip when food hanging was legal, 18% had previous run-ins with bears, and 25% were new to using canisters.

Of the 568 respondents, 87% reported using a canister on their trip. Of the canister users, 62% reported that they were able to achieve full compliance by fitting all their food, trash, and toiletries into their canisters on every night of their trip. Thirty-one percent (31%) had to leave items out of their canister on some nights of their trip. The remaining 7% had excess items most or all nights of their trip.

When queried about what was done with items that did not fit in their canisters, only 18% used legal alternatives to storing their food; 12% reported using a food storage locker and 6% counterbalanced their food from a tree limb. The remaining non-compliant canister users hung (but did not counterbalance) food, trash, or toiletries in a tree (27%), left food, trash, and/or toiletries sitting out (27%), buried, hid, suspended over cliff, sunk underwater, or covered in rocks (15%), kept in tent (7%), or kept in pack (5%).

Wilderness users who opted not to carry canisters cited four general reasons for their decision. Forty-three percent (43%) limited their trip to destinations with food storage lockers so they could legally avoid using canisters. Perceived behavioral control issues of inconvenience, weight, bulk, expense, and size were listed by 38% as reasons for not using a canister. Seventeen percent (17%) thought they could get by without one or did not expect to encounter bears. Only one respondent admitted that pure negligence prevented them from taking a canister.

TPB Analyses

*Behavioral Beliefs.* A behavioral belief score was calculated for each respondent by multiplying behavioral belief strength (1 to 7 scale) by its corresponding outcome evaluation (1 to 7 scale) (Table 1). An aggregate score was calculated by summing the resulting four scores. The composite scores ranged from 4, indicating the respondent was strongly

Table 1  
Behavioral belief scores (belief strength × outcome evaluation)

Behavioral belief strength	Outcome evaluation	$\bar{x}$ behavioral belief score
How important is it that bears and other wildlife don't get human food?	Use of a food storage canister will keep bears and other wildlife from getting human food.	42.4 (8.5)
How important is it that other people who camp nearby are safe from bears?	Use of a food storage canister will keep other park visitors safer from bears.	37.4 (11.7)
How important is it that bears are wild?	Use of a bear-resistant food storage canister will help keep bears and other animals wild.	41.3 (9.9)
How important is it that you are safe when camping around bears?	Use of a canister will keep me and other members of my group safe from bears.	40.0 (10.2)

Standard deviations in parentheses.

**Table 2**  
Summary of descriptive statistics for independent and dependent variables  
used in regression analyses

Variable	Sample size	Minimum	Maximum	Mean	Standard deviation
Behavioral beliefs	514	18	196	161.2	32.1
Attitude toward the behavior	464	5	28	24.1	4.2
Normative beliefs	423	13	196	104.9	41.9
Subjective norm	367	1	5	4.4	0.9
Control beliefs	228	36	294	175.1	51.5
Perceived behavioral control	527	1	7	2.7	1.8
Behavioral intention (where canisters <i>are</i> required)	537	1	7	6.5	1.1
Behavioral intention (where canisters <i>not</i> required)	532	1	7	5.0	1.9

against using bear-resistant food canisters for food storage, to 196, indicating the respondent was strongly in favor of using bear-resistant food canisters for food storage. A score of 64 means that overall the respondent has neutral beliefs about food storage canisters. The mean composite score for behavioral beliefs was 161.2, suggesting very favorable beliefs about using canisters for food storage (see Table 2 for a summary of descriptive statistics for all variables).

*Attitudes.* On a 7-point scale, with a larger number representing a more favorable attitude toward canister use, mean responses for the four attitude measures were: agreeability of using a canister = 6.0, ease of use = 5.0, goodness of use = 6.4, and value of use = 6.3, and a mean aggregate score (on a scale ranging from 4 to 28) of 24.1. Pearson correlations among the four measures of attitude toward the behavior were calculated. Three of the measures correlated well with one another ( $r = .61$  to  $.69$ ) for the disagreeable–agreeable, bad–good, and worthless–valuable items. Only the difficult–easy item showed a lower correlation with the other items ( $r = .38$  to  $.41$ ).

*Normative Beliefs.* A normative belief score was calculated for each respondent by multiplying normative belief strength (1 to 7 scale) by its corresponding motivation to comply (1 to 7 scale) (Table 3). An aggregate score was calculated by summing the resulting four scores. Composite scores ranged from 4, indicating the respondent experiences social pressure *not* to use a bear-resistant food canister for food storage, to 196, indicating the respondent experiences strong social pressure to use a canister. A score of 64 means that overall the respondent experiences no social pressure in either direction regarding the use of food canisters. The mean composite score for subjective norm was 104.9, suggesting that respondents experienced a moderately high degree of social pressure to use canisters for food storage.

*Subjective Norm.* A measure of subjective norm regarding canister use was measured by asking respondents how often camping friends of theirs use canisters when they travel in the Yosemite wilderness. Just over 40% reported that their friends “always” use canisters,



**Table 3**  
Normative belief scores (belief strength  $\times$  motivation to comply)

Normative belief strength	Motivation to comply	$\bar{x}$ normative belief score
Other visitors camped near me think I should carry a food storage canister.	How important is it that you do what people who are camping near you think you should do?	19.2 (13.1)
Other members of my backpacking group think I should use a food storage canister.	How important is it to you that you do what members in your backpacking group think you should do?	26.0 (14.0)
People who are important to me think that I should use a food storage canister.	How important is it to you that you do what people whose opinions you value think you should do?	25.5 (12.8)
The Park Service thinks that I should use a food storage canister.	How important is it to you that you do what the National Park Service thinks you should do?	35.3 (11.8)

Standard deviations in parentheses.

20% said “most of the time,” 4% said “sometimes,” 3% said “rarely,” and 1% said “never”; 32% did not know how often their friends carried canisters.

*Control Beliefs.* A control belief score was calculated for each respondent by multiplying each control belief strength (1 to 7 scale) by its corresponding belief power (1 to 7 scale) (Table 4). An aggregate score was calculated by summing the resulting six scores. Composite scores ranged from 6, indicating that the respondent does not feel he or she has the ability to use a bear-resistant canister for food storage, to 294, indicating complete ability to use a food storage canister. A score of 96 means that overall the respondent has neutral beliefs about his ability to use a bear-resistant canister for food storage. The mean composite score for perceived control beliefs was 175.1, suggesting that respondents feel a fairly high degree of ability to use bear-resistant food canisters.

*Perceived Behavioral Control.* A measure of perceived behavioral control regarding canister use was measured by asking respondents how much they feel they can choose whether or not to use a food canister when they camp in the Yosemite Wilderness. Nearly 72% disagreed (somewhat to strongly), whereas only 18% agreed (somewhat to strongly) that the choice is theirs.

*Behavioral Intention.* Using multiple regression we predicted the likelihood of future canister use in areas where canisters are required, and also in areas where they are not required. Attitude toward the behavior ( $\beta = .499$ ), together with subjective norm ( $\beta = .270$ ) predicted backpackers' intentions to use bear-proof food canisters in areas of the Yosemite wilderness where they *are* required ( $R^2 = .435$ ,  $F(2,107) = 41.1$ ,  $p < .001$ ) (Table 5). Inclusion of subjective norm increased the  $R^2$  by .06. Perceived behavioral control did not add significantly to the model, nor did the underlying belief constructs.

**Table 4**  
Control belief scores (belief strength  $\times$  belief power)

Control belief strength	Control belief power	$\bar{x}$ control belief score
Food storage canisters are expensive to obtain. <sup>1</sup>	How important is it that food storage canisters are inexpensive to obtain?	24.2 (14.3)
Food storage canisters are too small to hold enough food. <sup>1</sup>	How important is it that your food storage canister is big enough to hold all your food?	25.7 (12.6)
Food storage canisters are easy to rent in Yosemite National Park.	How important is it that canisters can be conveniently rented?	34.9 (13.6)
Food canisters are difficult to return in Yosemite National Park. <sup>1</sup>	How important is it that canisters can be conveniently returned?	35.4 (12.9)
Food storage canisters are too heavy to carry. <sup>1</sup>	How important is it that food storage canisters are lightweight?	25.4 (12.4)
Food storage canisters are difficult to fit in or on a backpack. <sup>1</sup>	How important is it that canisters take up little space in your backpack?	20.2 (11.3)

<sup>1</sup>Scoring reversed so that higher scores reflect more favorable beliefs.  
Standard deviations in parentheses.

**Table 5**  
Results of hierarchical regression analysis predicting backpackers' intentions to use bear-proof food canisters in areas of the Yosemite wilderness where they *are* required ( $n = 110$ )

Variable	$B$	$SE\ B$	$\beta$	$R^2$
Step 1				
Attitude toward the behavior	.032	.004	.612*	.375
Step 2				
Attitude toward the behavior	.026	.004	.499*	
Subjective norm	.082	.024	.270*	.435 <sup>a</sup>

$B$  = unstandardized regression coefficients,  $\beta$  = standardized regression coefficients.

\*Significant at  $p < .001$ .

<sup>a</sup>Significant increase in  $R^2$  ( $p < .001$ ).

Attitude toward the behavior ( $\beta = .616$ ) alone predicted backpackers' intentions to use bear-proof food canisters in areas of the Yosemite wilderness where they *are not* required ( $R^2 = .379$ ,  $F(1,108) = 65.9$ ,  $p < .001$ ) (Table 6). Subjective norm, perceived behavioral control, and the underlying belief constructs did not add significantly to the model.

## Discussion

The Theory of Planned Behavior afforded a statistically significant prediction of intended canister use in Yosemite National Park. Attitudes toward wilderness food storage and

**Table 6**

Results of hierarchical regression analysis predicting backpackers' intentions to use bear-proof food canisters in areas of the Yosemite wilderness where they are *not* required ( $n = 110$ )

Variable	<i>B</i>	SE <i>B</i>	$\beta$	$R^2$
Step 1				
Attitude toward the behavior	.080	.010	.616*	.379

*B* = unstandardized regression coefficients,  $\beta$  = standardized regression coefficients.

\*Significant at  $p < .001$ .

subjective norm (where canisters are required) were determinants of behavioral intentions. These predictors were able to explain 43% of the variance in backpackers' intentions to use canisters where they are required, and 38% of the variance in backpackers' intentions to use canisters where they are not required.

Of the variables used to explain future canister use in Yosemite National Park, attitude toward the behavior was the best predictor. Other Theory of Planned Behavior/Reasoned Action investigations have also found attitudes (or sometimes their underlying behavioral beliefs) to be the strongest predictor of intentions (Bright, Manfredo, Fishbein, & Bath, 1993; Galper, 1995; Hrubec et al., 2001). Because backpackers with more positive attitudes about food storage and bears are more likely to use canisters, the park should continue to foster positive attitudes not only toward canisters but also toward bears to reinforce people's use of food storage canisters.

Although, according to the TPB model, behavioral beliefs do not directly influence intentions to perform a behavior, they are believed to provide the cognitive and affective foundations of attitudes toward the behavior. It should be comforting to park managers that respondents scored very highly on the behavioral belief items, indicating a favorable belief structure toward bears and food storage canister use. The park's campaign that promotes the slogan "a wild bear is a beautiful sight to see" is a good example of an interpretive effort to foster favorable beliefs about bears and, in turn, proper food storage. To reinforce the behavioral belief that Yosemite bears should be wild (and that visitors should take steps to ensure human food is unavailable to bears), NPS wildlife managers should consider, whenever possible, not placing obvious identification markers such as ear tags on bears they are managing in wilderness.

Social norms have been used to explain behavior (Ajzen & Fishbein, 1980; Basman, Manfredo, Barro, Vaske, & Watson, 1996; Manfredo, Fishbein, Haas, & Watson, 1990; Young & Kent, 1985), and subjective norm did add somewhat to our prediction of canister use where they are required in Yosemite. As suggested by the Theory of Planned Behavior, respondents were more likely to say that they intended to use a canister on future trips if they reported that their camping friends also used canisters, but curiously this held true only where canisters are already required. Where canister use is voluntary, subjective norm did not help explain canister use. This is somewhat surprising given the extent to which Yosemite backpackers recognize that their safety around bears depends to some degree on the proper food storage behavior of others.

Underlying the subjective norm are normative beliefs. The normative belief scores indicated that backpackers felt some pressure to use canisters, especially from the National Park Service. This is consistent with Lackey and Ham's (2003) findings about

food storage behavior in Yosemite National Park drive-in campgrounds. Their respondents listed “park personnel,” among the social referents who would approve of proper food storage behavior.

One recommendation to strengthen the influence of the subjective norm regarding wilderness food storage would be for the National Park Service to increase enforcement of the wilderness food storage requirement, much as enforcement of frontcountry food storage regulations has been increased in recent years. Warnings or citations should be issued to visitors found violating the park’s wilderness food storage regulations, including common practices such as hanging food in trees, hiding food under rocks, or leaving food unattended. Warnings should be issued to the many canister users who have overflow issues with their food, trash, or toiletries.

The third component of the Theory of Planned Behavior measures the influence of perceived behavioral control on behavioral intention. Ajzen (2002a) contends that one’s perceived control over performance of a behavior can account for considerable variance in intentions and actions. Galper (1995) demonstrated this when perceived behavioral control measures were added to his model, resulting in the attitude and perceived behavioral control components together predicting 67% of the variance (an increase of 22%) in athletes’ steroid use intentions. Additional studies support the influence of perceived behavioral control in predicting behavior (Ajzen & Driver, 1991; Evans & Norman, 1998; Hrubes et al., 2001; de Groot & Steg, 2007).

Perceived behavioral control, however, does not appear to significantly influence canister use intentions in the Yosemite Wilderness. Perceived control did not add to the prediction of either voluntary or required canister use in Yosemite. Our perceived control results may be attributed in part to a well-established canister rental program that has largely identified and alleviated obstacles that may impede backpackers from obtaining canisters. In Yosemite National Park, canisters are easily rented and returned for a \$5 fee. Likewise, an assortment of canister brands are now on the market in different sizes and weights to accommodate backpacker preferences and abilities, although the lowest scoring (least favorable) control belief item was related to the difficulty of fitting a canister in or on a backpack.

Finally, our research took place when canister use was required only in certain portions of the Yosemite Wilderness (albeit the majority of the area). Regulations now require the use of food storage canisters throughout the entire Yosemite Wilderness, with the only exception being the six High Sierra Camp destinations where metal food storage lockers are available.

## References

- Ajzen, I. (2002a). Perceived behavioral control, self-efficacy, locus of control, and the Theory of Planned Behavior. *Journal of Applied Social Psychology*, 32, 665–683.
- Ajzen, I. (2002b). Constructing a TpB Questionnaire: Conceptual and methodological considerations. Retrieved October 2004, from <http://www-unix.oit.umass.edu/~ajzen/tpb.html>
- Ajzen, I., & Driver, B. (1991). Prediction of leisure participation from behavioral, normative, and control beliefs: An application of the Theory of Planned Behavior. *Leisure Sciences*, 13, 185–204.
- Ajzen, I., & Driver, B. (1992). Application of the Theory of Planned Behavior to leisure choice. *Journal of Leisure Research*, 24, 207–224.
- Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*. Englewood Cliffs, NJ: Prentice Hall.

- Basman, C., Manfredo, M., Barro, S., Vaske, J., & Watson, A. (1996). Norm accessibility: An exploratory study of backcountry and frontcountry recreational norms. *Leisure Sciences*, 18, 177–191.
- Boyers, L., Fincher, M., & van Wagtenonk, J. (2000). Twenty-eight years of wilderness campsite monitoring in Yosemite National Park. In D. Cole, S. McCool, W. Borrie, & J. O'Loughlin (comps.), *Wilderness science in a time of change conference: Vol. 5. Wilderness ecosystems, threats, and management* (pp. 105–109). RMRS-P-15-VOL-5. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.
- Bright, A., Manfredo, M., Fishbein, M., & Bath, A. (1993). Application of the Theory of Reasoned Action to the National Park Service's controlled burn policy. *Journal of Leisure Research*, 25, 263–280.
- Clark-Richardson, A. (2003). *The Theory of Planned Behavior in predicting attendance at environmental horticulture extension programs*. Unpublished master's thesis. University of Florida—Gainesville.
- Cunningham, G., & Kwon, H. (2003). The Theory of Planned Behavior and intentions to attend a sporting event. *Sport Management Review*, 6, 127–145.
- Dalle-Molle, J., Coffey, M., & Werner, H. (1986). Evaluation of bear-resistant food containers for backpackers. In R. Lucas (comp.), *Proceedings—National Wilderness Research Conference* (pp. 209–214). Gen. Tech. Rep. INT-212. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station.
- De Groot, J. & Steg, L. (2007). General beliefs and the Theory of Planned Behavior: The role of environmental concerns in the TPB. *Journal of Applied Social Psychology*, 37, 1817–1836.
- Evans, D., & Norman, P. (1998). Understanding pedestrians' road crossing decisions: An application of the Theory of Planned Behavior. *Health Education Research*, 13, 481–489.
- Fishbein, M., & Manfredo, M. (1992). A theory of behavior change. In M. Manfredo (Ed.), *Influencing human behavior* (pp. 29–50). Champaign, IL: Sagamore Press.
- Galper, D. (1995). *Understanding the motivation to use anabolic steroids: An application of the Theory of Reasoned Action*. Unpublished master's thesis. Virginia Polytechnic Institute and State University—Blacksburg.
- Graber, D. (1981). *Ecology and management of black bears in Yosemite National Park*. (Tech. Rep. No. 5). University of California—Davis.
- Graber, D. (1986). Conflicts between wilderness users and black bears in the Sierra Nevada national parks. In R. Lucas (comp.), *Proceedings—National Wilderness Research Conference* (pp. 197–202). Gen. Tech. Rep. INT-212. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station.
- Grinnel, J., & Storer, T. (1924). *Animal life in the Yosemite*. Berkeley: University of California Press.
- Hammitt, W., & Cole, D. (1998). *Wildland recreation: Ecology and management* (2nd ed.). New York: John Wiley & Sons, Inc.
- Hastings, B., & Gilbert, B. (1987). Extent of human–bear interactions in the backcountry of Yosemite National Park. *California Fish and Game*, 73, 188–191.
- Hrubes, D., Ajzen, I., & Daigle, J. (2001). Predicting hunting intentions and behavior: An application of the Theory of Planned Behavior. *Leisure Sciences*, 23, 165–178.
- Keay, J., & van Wagtenonk, J. (1983). Effect of backcountry use levels on incidents with black bears. In E. C. Meslow (Ed.), *International Conference on Bear Research and Management*, 5, 307–311.
- Koy, G., & Anaya, C. (2002). *May 1–September 15 bear canister analysis*. Yosemite National Park, CA.
- Kraft, P., Rise, J., Røysamb, E., & Sutton, S. (2005). Perceived difficulty in the Theory of Planned Behaviour: Perceived behavioural control or affective attitude? *British Journal of Social Psychology*, 44, 479–496.
- Lackey, B., & Ham, S. (2003). Contextual analysis of interpretation focused on human–black bear conflicts in Yosemite National Park. *Applied Environmental Education and Interpretation*, 2, 11–21.
- Manfredo, M., Fishbein, M., Haas, G., & Watson, A. (1990). Attitudes toward prescribed fire policies. *Journal of Forestry*, 88, 19–23.
- Mazur, R. (2008). Backpacker use of bear-resistant canisters and lockers at Sequoia and Kings Canyon National Parks. *Ursus*, 19, 53–58.

- National Park Service. (2002). Human–bear management plan. Yosemite National Park, CA.
- National Park Service. (2004). Black bear incident summary report. Yosemite National Park, CA.
- Newman P., Manning R., & Dennis, D. (2005). Informing social carrying capacity decision making in Yosemite National Park, using stated choice modeling. *Journal of Parks and Recreation Administration*, 21, 43–56.
- Norman, P., & Smith, L. (1995). The Theory of Planned Behavior and exercise: An investigation into the role of prior behavior, behavioral intentions and attitude variability. *European Journal of Social Psychology*, 25, 403–415.
- Tabachnick, B., & Fidell, L. (2007). *Using multivariate statistics* (5th ed.). Boston: Allyn and Bacon.
- van Wagtenonk, J., & Coho, P. (1986). Trailhead quotas, rationing use to keep wilderness wild. *Journal of Forestry*, 84, 22–24.
- van Wagtenonk, J. (2003). Role of science in sustainable management of Yosemite wilderness. In A. Watson and J. Sproull (comps.), *Science and stewardship to protect and sustain wilderness values: Seventh World Wilderness Congress symposium* (pp. 225–230). RMRS-P-27. Ogden UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.
- Young, R., & Kent, A. (1985). Using the Theory of Reasoned Action to improve the understanding of recreation behavior. *Journal of Leisure Research*, 17, 90–106.