



US National Park Service and concession staff perceptions regarding waste management in Yosemite, Grand Teton, and Denali National Parks

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ABSTRACT

Each year, over 45,000 metric tons of waste are generated in US national parks through a variety of means, including park operations, visitation, and other sources. In an effort to address these impacts, the National Park Service (NPS) has partnered with commercial and non-profit organizations to implement the Zero Landfill Initiative (ZLI). The goal of the ZLI is to realize a steady decrease in waste generated in parks, and an increase in materials being sent for recycling. Through this initiative and aligning research, efforts to mitigate waste and recycling issues with visitors is underway; however, to date there have been no attempts to understand the perspectives of those individuals who manage these parks on a daily basis. This study explored Theory of Planned Behavior-based constructs regarding disposal of waste and recycling using surveys with NPS employees and park concession staff in Yosemite, Grand Teton, and Denali National Parks. Results indicate that perceived difficulty and moral norms related to disposal of waste and recycling are significant drivers of self-reported behavior and intent with NPS and concession staff. Generally, concession staff perceptions align with the goals of ZLI more than those of NPS staff. This research adds to the limited understanding of land manager perceptions, and results provide justification for future messaging and trainings that could improve sustainable management of these and other NPS units in the future.

Keywords: Park Management; Visitor Use; Recycling; Waste Management; Communication; Human Behavior; Leave No Trace

INTRODUCTION

One of the most significant challenges to the long-term protection of US national parks is sustainable waste management (Przydatek 2019). In fact, each year more than 45,000 metric tons of waste is generated in US national parks through park operations, visitation, and

other sources (Varner 2016). In an effort to address waste-related impacts, the US National Park Service (NPS) has partnered with commercial and non-profit organizations to implement the Zero Landfill Initiative (ZLI). The goal of the ZLI is to steadily decrease waste generated in parks,

in part through actually recycling materials that can be recycled rather than disposing of them as waste. In general, there is a lack of empirical research regarding waste and recycling behaviors in a protected areas context. That which has taken place has focused on waste generation and management (Basnet 1993; Kaseva and Moirana 2009; Başak 2007; Canepa et al. 2012; Grazhdini 2016) and visitor behaviors regarding litter (Brown et al. 2010) and the disposal of waste and recyclables (Miller et al. 2019; Mateer et al. 2020; Taff et al. 2022). However, there is a significant gap in understanding the perceptions and behaviors of NPS staff and concession (Pitas 2020) operators—those individuals that manage these parks on a daily basis—toward waste and recycling in parks. The purpose of this paper is to address this gap by exploring employees' perceptions regarding the disposal of waste and recycling materials in Yosemite (YOSE), Grand Teton (GRTE), and Denali (DENA) National Parks.

LITERATURE REVIEW

Zero Landfill Initiative

While litter is certainly a prevalent issue in many parks and protected areas, the goal of the ZLI is to instead decrease waste generated in parks. Three iconic parks (YOSE, GRTE, and DENA) were selected by NPS and the program collaborators as the ZLI pilot parks, which received enhanced waste and recycling infrastructure and staffing dedicated to the effort. In addition, several important behavioral components were thought to be pertinent to the success of ZLI. For example, the reduction of waste materials being brought into the park, only purchasing items onsite that can be reused or recycled, and properly sorting and disposing of waste from recyclables are key variables that would benefit the program, and ultimately the NPS units. It was unknown, however, how visitors or park and concession staff perceive these important behaviors. Recently visitor perceptions regarding waste and recyclable disposal (Miller et al. 2019) and actual observed behaviors (Mateer et al. 2020; Taff et al. 2022) at waste and recycling infrastructure were evaluated in the three ZLI pilot parks, but a lack of empirical research regarding the perceptions of those who manage the parks remains.

NPS and Concession Staff

For more than a century, NPS and the concessions that operate, and in many units co-manage, national park resources and facilities have promoted high-quality recreational experiences while attempting to preserve the natural resources (Coggins et al. 1996; Brymer et al. 2017; Hellmann 2017). Despite this history and the vital role that these employees play in the long-term sustainability of the parks, there is a lack of empirical research regarding NPS and park concession staff

perceptions and behaviors, generally. For example, the limited existing research has examined staff perceptions toward barriers to climate change adaptation (Casey and Becker 2019), views of challenges to long-term sustainability (Susan 2017), perceptions of increasing inclusivity and diversity in national parks (Schuett and Bowser 2006; Santucci et al. 2014), and differences in perspectives on sustainable ecotourism management between NPS staff and park concession staff (Dangi and Gribb 2018); but no research to date has examined NPS or park concession staff perceptions toward waste management. However, waste and recycling behaviors have been examined within the workplace context outside of the protected areas setting, which informed the theoretical framing applied to this study.

Theory of Planned Behavior and Recycling

For decades the Theory of Planned Behavior (TPB) has been applied in numerous studies to understand the factors that influence behavioral intentions and subsequent behaviors (Ajzen 1991). According to the TPB, behaviors arise from behavioral intentions, which refer to whether someone intends to perform certain behaviors. In turn, three perceptual elements predict behavioral intentions: attitudes, subjective norms, and perceived behavioral control. Attitudes are positive or negative evaluations of objects, such as how pleasant (positive attitude) or unpleasant (negative attitude) a certain behavior is. Subjective norms are similar to peer pressure in that they are measures of a person's perception about whether or not others think they should perform a certain behavior. For instance, a person may recycle something because others in a group think that they should. Perceived behavioral control is a measure of whether or not someone thinks they are able to perform a behavior. An example of perceived behavioral control is that someone may wish to recycle, but cannot find proper facilities to do so. Collectively, these three concepts are theorized to predict behavioral intentions, which in turn predict behavior.

The TPB has been applied to many waste-related studies to improve understanding, and ultimately efficacy regarding proper waste and recycling behavior. For example, the TPB has been used to examine household recycling behaviors (Tonglet et al. 2004; Strydom 2018) and to improve understanding of sports spectator recycling behaviors (McCullough 2013). Relevant to this study, the theory has been applied to understand how norms (Chan and Bishop 2013) and perceived behavioral control (Mahmud and Osman 2010) can influence recycling behaviors, albeit these studies were based in a university setting. The TPB has also been used to examine behaviors of employees within the workplace. For example, Greaves, Zibarras, and Stride (Greaves et al. 2013) found that the TPB variables

explained a significant amount of variance for three environmental behaviors specific to the workplace, one of which focused on recycling. Oke's (2015) review of more than 50 studies examining workplace waste and recycling attitudes and behaviors found that many of the studies used the TPB or perceptual elements that are part of the TPB (e.g., norms, attitudes, beliefs) to inform the research. Results indicated that the majority of studies took place in the US and used survey methodologies; important factors emerged such as general awareness, beliefs, and norms, as well as barriers related to perceived behavioral control (Oke 2015). These empirical studies informed this research.

The following research questions were examined in this study:

- R1. *What are NPS and park concession employees' attitudes, norms, self-reported behavior and intent towards proper disposal of waste and recycling?*
- R2. *What factors are significant predictors of behavioral intentions towards proper disposal of waste and recycling for NPS and park concession employees?*

METHODOLOGY

Research Design

Sampling of both NPS and park concession staff was completed using email contacts and online surveys. We applied an online sampling approach that used best practices to increase the response rate and sample size (Dillman et al. 2015). Employees were contacted by their employer (either NPS or concessioner) via email on three different occasions. Each email contained a link to the online survey embedded in the body of a recruitment/participation message; the body of these messages was adapted from Dillman et al. (2015). Sampling at both GRTE and DENA took place during July 2018, which was also the anticipated schedule for YOSE. However, due to a severe fire in YOSE that closed the entire park for an extended period of time, sampling was postponed until September 2018.

Study Sites: YOSE, GRTE, and DENA

Overall, 695 NPS employees at YOSE, 478 NPS employees at GRTE, and 302 NPS employees at DENA were contacted. At YOSE about 28% of contacts completed the survey, which resulted in a final sample size of 195 NPS employee respondents. Managers at Aramark, the main concessioner in YOSE, distributed the surveys to YOSE concessioner employees. Overall, 804 concessioner employees were contacted and asked to participate in the research. About 7% of contacts completed the survey, which resulted in a final sample size of 60 respondents for YOSE concessioner employees.

Overall, 478 NPS employees were contacted at GRTE and asked to participate in the research. About 55% of contacts completed the survey, which resulted in a final sample size of 266 respondents. Two concessioners at GRTE were enlisted to assist with the distribution of surveys to GRTE concessioner employees: Grand Teton Lodge Company and Signal Mountain Lodge. Because one survey link was used for all concessioner contacts, the response rate and sample sizes were pooled. Overall, 1,000 GRTE concessioner employees were contacted and asked to participate in the research. About 19% of contacts completed the survey, which resulted in a final sample size of 185 respondents.

Overall, 302 NPS DENA employees were contacted and asked to participate in the research. About 45% of contacts completed the survey, which resulted in a final sample size of 135 respondents. Doyon-Aramark, the main concessioner in DENA, assisted with the survey distribution to DENA concessioner employees. Overall, 250 concessioner employees were contacted and asked to participate in the research. About 40% of contacts completed the survey, which resulted in a final sample size of 101 respondents.

Survey Instrument

The survey instrument for the employee portion of this study was developed through a collaborative, iterative review process among the researchers, NPS staff, and park concessioners, and was largely informed by other park waste and recycling research (Greaves et al. 2013; Oke 2015; Miller et al. 2019; Taff et al. 2022). The design process was informed by the TPB (Ajzen 1991), and the survey instrument specifically focused on questions addressing perceptions regarding the reduction of waste materials being brought into the park, only purchasing items onsite that can be reused or recycled, and properly sorting and disposing waste from recyclables in their workplace, the parks. All respondents were 18 years of age or older, and all respondent information was completely anonymous.

Data Analyses

Summary statistics regarding NPS and concession staff employment status and organizational division are provided for contextual background, given the limited existing literature regarding NPS and concession staff. To address R1, a principal components analysis produced employee perceptual and behavioral waste and recycling factors that included multiple variables. These factors were labeled based on previous TBP and waste/recycling literature. Subsequently a multiple regression analysis was conducted to address R2, examining the influence of these factor on behavioral intentions.

RESULTS

Sample Demographics

A total of $n = 495$ NPS staff (response rate 33%), and $n = 427$ concessioner staff (response rate 19%) completed the online survey, for a combined sample of $n = 922$. Among all three parks, 61.9% of NPS staff in the sample reported having either permanent or term employment status (Table 1). Permanent/term respondents represented 32.1% of the overall concession employee sample. The proportion of permanent to seasonal staff among respondents was higher in YOSE than in GRTE or DENA. This was true for both NPS (70.4%) and concession (94.1%) employees.

Specific to NPS, respondents were relatively evenly distributed (18 to 22%) per division (i.e., *interpretation, visitor and resource protection, facilities management, science and resource management, business resources administration*); however, there was much smaller representation from the *superintendent's office* (5%) (Table 2). Specific to con-

cessioner staff, the largest number of respondents were from the *customer service (front of house)* division (28%), followed by *administrative and management* (20%), *food and beverage (back of house)* (14%), *retail* (14%), *outdoor* (12%), *facilities* (11%), and *custodial* (3%).

R1. Factors defining employees' perceptions toward disposal of waste and recycling—principal components analyses

The principal components analyses with varimax rotation suggested that the data factor into seven unique constructs, interpreted and labeled according to a review of previous research (see Introduction) as follows: *self-reported waste behaviors, perceived difficulty of waste behaviors, self-efficacy, workplace culture, knowledge, moral norms and attitudes, and waste behavioral intentions* (Armitage and Conner 2001). Items with factor loadings higher than .40 were included in each construct. Cronbach's α of .65, a value generally accepted in parks and outdoor recreation research (Vaske 2008), was used as the cut point for scale reliability.

TABLE 1. NPS and concessioner employment status.

Park Unit	Employment	Status	Count	% within Park Unit
YOSE	NPS	Permanent/Term	126	70.4%
		Seasonal	53	29.6%
	Concession	Permanent/Term	80	94.1%
		Seasonal	5	5.9%
GRTE	NPS	Permanent/Term	81	52.3%
		Seasonal	74	47.7%
	Concession	Permanent/Term	35	17.2%
		Seasonal	169	82.8%
DENA	NPS	Permanent/Term	77	61.6%
		Seasonal	48	38.4%
	Concession	Permanent/Term	3	3.8%
		Seasonal	76	96.2%
Total	NPS	Permanent/Term	284	61.9%
		Seasonal	175	38.1%
	Concession	Permanent/Term	118	32.1%
		Seasonal	250	67.9%

Park: $p < .001$; Cramer's $V = .41$ (medium-large effect)

Employer: $p < .001$; Cramer's $V = .30$ (medium effect)

NPS Division	YOSE		GRTE		DENA		Total	
	Count	%	Count	%	Count	%	Count	%
Interpretation	23	13.5%	31	20.1%	32	25.6%	86	19.1%
Visitor and Resource Protection	38	22.2%	41	26.6%	15	12.0%	94	20.9%
Facilities Management	30	17.5%	23	14.9%	22	17.6%	75	16.7%
Science and Resource Management	35	20.5%	33	21.4%	30	24.0%	98	21.8%
Business Resources Administration	38	22.2%	20	13.0%	17	13.6%	75	16.7%
Superintendent's Office	7	4.1%	6	3.9%	9	7.2%	22	4.9%

Park: $p=.02$; Cramer's $V=.22$ (small-medium effect)

Concession Division	YOSE		GRTE		DENA		Total	
	Count	%	Count	%	Count	%	Count	%
Facilities	9	10.7%	25	12.3%	6	7.8%	40	11.0%
Administrative and Management	32	38.1%	31	15.2%	9	11.7%	72	19.7%
Outdoor	8	9.5%	13	6.4%	21	27.3%	42	11.5%

TABLE 2. NPS and concessioner divisions.

Table 3 presents *self-reported waste behaviors* factors for both NPS and concession employees ($\alpha=0.77$ and $M=5.76$). With regard to R1, within the *self-reported waste behavior* factor, the highest individual item mean resulted from “I use a reusable water bottle rather than purchasing bottled water or other drinks while working in the park” ($M=6.58$; scale where 1=completely untrue of me and 7=completely true of me). The lowest individual item mean resulted from “If purchasing an item in the park, I only purchase items that can be reused or recycled” ($M=4.39$).

Table 4 presents *perceived difficulty of waste behaviors* factors for both NPS and concession employees. The *perceived difficulty of waste behaviors* factor resulted in four items with a $\alpha=0.76$ and $M=5.18$. Regarding R1, within the *perceived difficulty of waste behaviors* factor, the highest individual item mean resulted from “sort my waste items between recycling and trash in my workplace.” ($M=5.89$; scale where 1=very difficult and 7=very easy). The lowest individual

item mean resulted from “avoid the purchase of items while working that cannot be reused or recycled” ($M=4.59$).

Table 5 presents the resulting *attitudinal* factors, which included a five-item *self-efficacy* factor ($\alpha=0.83$; $M=5.55$), a three-item *workplace culture* factor ($\alpha=0.63$; $M=5.64$), a two-item *knowledge* factor ($\alpha=0.79$; $M=5.97$), and an eleven-item *moral norms and attitudes* factor ($\alpha=0.90$; $M=6.30$). Regarding R1, within the *self-efficacy* factor, the highest individual item mean resulted from “trash disposal in my workplace is confusing” ($M=5.89$; scale where 1=strongly disagree and 7=strongly agree). The lowest individual item mean resulted from “recycling in my workplace is inconvenient” ($M=5.29$), although the mean difference between the highest and lowest item was not substantial. Within the *workplace culture* factor, the highest resulting mean item was “recycling is part of [NPS/my company’s] workplace culture” ($M=5.78$), which was not substantially different than the lowest item, “my supervisor thinks it

Component	Variables	Factor loading	Mean (<i>sd</i>)
Self-reported waste behaviors²			5.76
$\alpha=0.77$			(0.91)
	I sort all of my waste items for disposal in appropriate recycling and trash containers while working in this park.	.732	6.10 (1.24)
	I make an effort to reduce the amount of waste materials I create while working in this park.	.773	6.03 (1.20)
	I make an effort to reduce the amount of waste materials I bring with me to work in this park.	.776	5.89 (1.40)
	I use a reusable water bottle rather than purchasing bottled water or other drinks while working in the park.	.452	6.58 (1.11)
	If purchasing an item in the park, I only purchase items that can be reused or recycled.	.614	4.39 (1.52)
	I have sought out information on trash/recycling at my workplace.	.648	5.54 (1.71)
	I have been provided information on trash/recycling at my workplace.	.565	5.86 (1.60)
Single-item measure			—
	I purchase items in the park (such as from concessionaires, convenience stores, etc.) that I later dispose of in my workplace.	—	4.53 (1.91)

¹Measured on a scale where 1=completely untrue of me and 7=completely true of me

²KMO=.792; Bartlett's test of sphericity, $p<.001$

TABLE 3. Principal components analysis for self-reported waste behaviors of employees.

TABLE 4. Principal components analysis for perceived difficulty of waste behaviors of employees.

Component	Variables	Factor loading	Mean (<i>sd</i>)
Perceived difficulty of waste behaviors^{1, 2}			5.18
$\alpha=0.76$			(1.26)
	Reduce the amount of waste materials I bring to my workplace.	.780	5.26 (1.62)
	Sort my waste items between recycling and trash in my workplace.	.699	5.89 (1.50)
	Reduce the amount of waste material I create while working.	.830	4.97 (1.75)
	Avoid the purchase of items while working that cannot be reused or recycled.	.734	4.59 (1.76)

¹Measured on a scale where 1=very difficult and 7=very easy

²KMO=.761; Bartlett's test of sphericity, $p<.001$

TABLE 5. Principal components analysis for attitudinal predictive measures.^{1,2}

Component	Variables	Loading	Mean (<i>sd</i>)
Self-efficacy $\alpha=0.83$			5.55 (1.48)
	Recycling in my workplace is inconvenient*	.789	5.29 (1.96)
	Trash disposal in my workplace is inconvenient*	.777	5.65 (1.77)
	Trash disposal in my workplace is confusing*	.732	5.73 (1.73)
	Recycling in my workplace is confusing*	.727	5.52 (1.81)
	Recycling in my workplace is difficult*	.703	5.48 (1.81)
Workplace culture $\alpha=0.63$			5.64 (1.29)
	My supervisor thinks it is important to recycle in my workplace	.805	5.54 (1.66)
	Recycling is part of [NPS/my company's] workplace culture	.801	5.78 (1.57)
	My workplace provides plenty of opportunities to refill water bottles	.576	5.60 (1.85)
Knowledge $\alpha=0.79$			5.97 (1.39)
	I know what items can be recycled in my workplace	.857	5.84 (1.53)
	I know where to take my recyclable items in my workplace	.874	6.11 (1.51)
Moral norms and Attitudes $\alpha=0.90$			6.30 (0.87)
	Recycling in national parks is a responsible behavior	.623	6.70 (0.91)
	Recycling in national parks is useless*	.595	6.55 (1.11)
	It is pointless to me to recycle while working in a national park*	.584	6.48 (1.18)
	One of this park's primary goals should be to reduce the amount of waste it sends to the landfills	.552	6.15 (1.38)
	By reducing the amount of trash I produce in my workplace, I am helping to protect the health of the environment	.835	6.38 (1.09)
	By recycling in my workplace, I am helping to protect the health of the environment	.825	6.35 (1.11)
	By recycling in my workplace, I am helping to conserve natural resources	.817	6.33 (1.21)
	I would feel guilty if I did not recycle while working in this park	.736	6.17 (1.42)

TABLE 5 (cont'd). Principal components analysis for attitudinal predictive measures.

I have a responsibility to reduce the amount of waste I produce while working in this park	.785	6.26 (1.20)
It would be wrong for me to not recycle while at work	.770	6.32 (1.25)
I can help to make a difference by bringing fewer disposable items with me while working in this park	.567	5.66 (1.60)
Items removed for cross-loading or insufficient reliability		
The amount of waste produced by staff at national parks is a problem	—	4.60 (1.74)
Recycling in national parks takes too much time*	—	5.90 (1.63)

¹Measured on a scale where 1=strongly disagree and 7=strongly agree

²KMO=.898; Bartlett's test of sphericity, $p < .001$

*Items reverse coded

is important to recycle in my workplace" ($M=5.54$). Within the knowledge factor, of the two items the higher was "I know where to take my recyclable items in my workplace" ($M=6.11$), suggesting relatively high understanding among respondents. Regarding the moral norms and attitudes factor, the item with the highest mean value was "recycling in national parks is a responsible behavior" ($M=6.70$), with the lowest mean resulting from the item "I can help to make a difference by bringing fewer disposable items with me while working in this park" ($M=5.66$).

Table 6 presents the waste behavioral intentions factor. The waste behavioral intentions factor resulted in six items with a $\alpha=0.85$ and $M=5.86$. Regarding R1, the highest individual item mean resulted from "bring a reusable water bottle rather than purchasing bottled water" ($M=6.69$; scale where 1=very unlikely and 7=very likely). The lowest individual item mean resulted from "only purchase items in the park that can be reused or recycled" ($M=4.85$).

R2. Predictors of behavioral intentions towards proper disposal of waste and recycling—Multiple Regression Model

To examine R2, a multiple regression analysis was conducted to examine the influence of measured components on behavioral intentions. Perceived difficulty of waste behaviors as well as moral norms and attitudes were significant (Table 7; Figure 1). The remaining factors established through R1 (i.e., self-reported waste behaviors, self-efficacy, workplace culture, and knowledge) were not significant.

Regarding R2, we checked for collinearity and found no evidence that it existed in the model (All VIF <4.0 [range 1.09 to 1.75] and Tolerance $>.10$ [range .58 to .92]). Overall, the model was statistically significant ($F(8, 714) = 128.74$,

$p < .001$, adj. $R^2 = .59$), where perceived difficulty of waste behaviors and moral norms and attitudes explained about 59% of the variance in behavioral intentions (Figure 1).

DISCUSSION AND IMPLICATIONS

Discussion

Both NPS and park concession employees' attitudes, norms, self-reported behavior, and intent towards the disposal of waste and recycling materials generally align with the goals of ZLI. Within the resulting factors established through the exploration of R1, there are several individual items with mean-value discrepancies, which may highlight areas for improvement with regard to leveraging employee perceptions and behaviors in the future. For example, "only purchase[ing] items that can be reused or recycled" resulted in a substantially lower mean value indicating less behavioral alignment with this item. Also "avoid[ing] the purchase of items while working that cannot be reused or recycled" was perceived as the most difficult, while "sort[ing] my waste items between recycling and trash in my workplace" was perceived as the least difficult. Respondents indicated generally that they "know where to take recyclable items" and they felt that "recycling in national parks is a responsible behavior." However, the item "I can help to make a difference by bringing fewer disposable items with me while working in this park" resulted in a lower mean, suggesting less agreement with this item. Respondents were most likely to "bring a reusable water bottle rather than purchasing bottled water" and least likely to "only purchase items in the park that can be reused or recycled."

Perceived difficulty of waste behaviors (e.g., the difficulty of "reducing amount of waste [they] bring to the workplace"

Component	Variables	Factor loading	Mean (sd)
Waste behavioral intentions^{1, 2}			5.86
$\alpha=0.85$			(1.01)
	Reduce the amount of waste materials I bring to my workplace	.853	5.72 (1.46)
	Reduce the amount of waste materials I create while working in this park	.870	5.73 (1.241)
	Only purchase items in the park that can be reused or recycled	.707	4.85 (1.62)
	Bring a reusable water bottle rather than purchasing bottled water	.467	6.69 (0.90)
	Sort all of my waste items for disposal in recycling and trash containers while working in this park	.687	6.38 (1.11)
	Reduce the amount of waste materials I create while working in this park	.891	5.80 (1.39)

¹KMO=.825; Bartlett's test of sphericity, $p<.001$

²Measured on a scale where 1=very unlikely and 7=very likely

TABLE 6. Principal components analysis of waste behavioral intentions of employees.

TABLE 7. Multiple regression explaining self-reported waste behavioral intentions.

Predictor*	Employer	Standardized coefficient	Unique variance explained	p-value	Effect size
Perceived difficulty	NPS	.34	7.3%	<.001	Medium
	Concession	.38	9.3%	<.001	Medium
	Total	.35	8.0%	<.001	Medium
Moral norms and attitudes	NPS	.57	18.5%	<.001	Large
	Concession	.45	11.0%	<.001	Medium-Large
	Total	.52	15.5%	<.001	Large

*Self-reported waste behaviors, self-efficacy, workplace culture, and knowledge were not significant.

and “avoiding the purchase of items that cannot be reused or recycled” (and *moral norms and attitudes* (e.g., normative perceptions and attitudes regarding items such as “recycling in national parks is a responsible behavior,” “by recycling in my workplace I am helping to protect the health of the environment,” “I have a responsibility to reduce the amount of waste I produce while working in this park,” and “it would be wrong for me to not recycle while at work”) were significant predictors of self-reported behavioral

intentions for NPS and concessioner staff. Thus, aspects of *perceived difficulty of waste behaviors* and *moral norms and attitudes* are the most important factors that should be considered with employees with regard to as ZLI and other sustainability-focused concepts. While *self-efficacy*, *workplace culture*, and *knowledge* were not significant factors in this particular study, these features likely do play a role in behaviors (i.e., they still have relatively high mean values in this study) and should be considered in

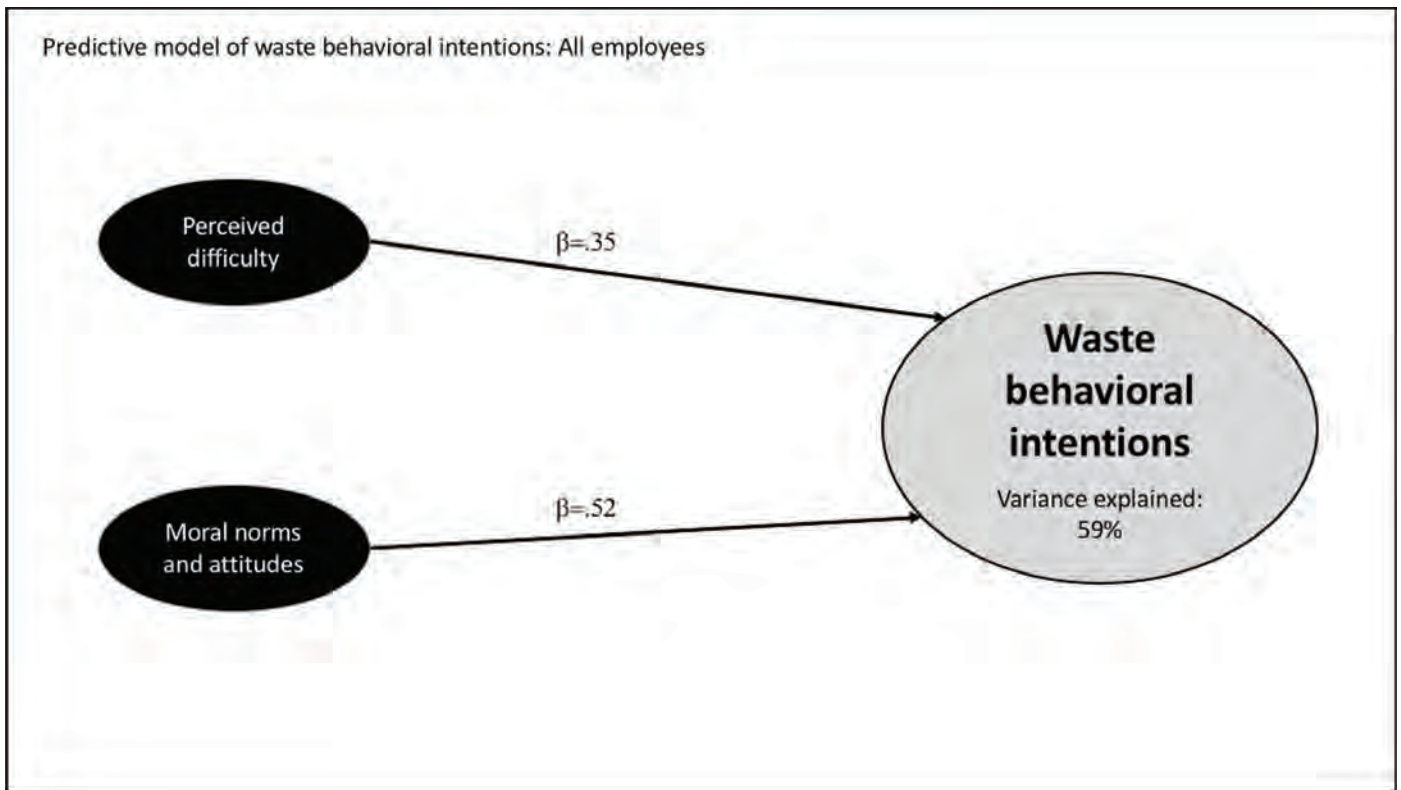


FIGURE 1. Predictive model of waste behavioral intentions for all employees.

future research and as important factors for leveraging employee behaviors.

Implications

Based on the high levels of reported support for ZLI-related behaviors from NPS and concessioner staff, both organizations should consider consistent messaging and infrastructure that leverage the positive perceptions found through this study, and considers those items (that had less alignment to inform strategies. Perhaps most importantly, the difficulty (or, alternatively, the ease) associated with proper disposal of waste and recycling could be targeted in future ZLI-related messaging and trainings aimed at both NPS and concession staff. Onsite ease-focused messaging was effective with campground visitors in these parks (Taff et al. 2022) and similar types of communication strategies focused on NPS and concession staff may be effective at increasing proper recycling and waste disposal with this demographic as well. For example, in campgrounds in these same national parks, messages stating “Taking one minute to sort your recycling is an easy way to help this park” were two times more effective than control conditions at changing proper disposal behaviors with campers (Taff et al. 2022). With regard to the findings from this study, *moral norms and attitudes* (e.g. sense of responsibility, feelings of guilt, making a difference, responsible behaviors, conserving resources) were also found to have a significant influence

on staff behavioral intentions to properly dispose of waste and recyclable material. Messaging and trainings focused on moral norms could be effective in further influencing appropriate waste-related behaviors with staff.

With consideration of these findings, park managers (both NPS and concession) should collaboratively examine their employee on-boarding and seasonal/annual trainings to make them consistent and identify gaps regarding ZLI-related messaging and associated behaviors. Standard seasonal trainings for both NPS and concessioner employees should in particular reinforce how *easy* it is to reduce the amount of waste they bring to work, and how *easy* properly sorting recycling and waste materials can be in the workplace. Furthermore, training should highlight how it is the employee’s *responsibility* to consistently behave in this manner to conserve and preserve the park’s well-being.

Managers should continue to encourage staff to bring reusable items to work rather than purchasing items in the park; and if staff must purchase items while at work, consider only those that can be reused and recycled. In targeted locations (e.g., areas where waste and recyclables materials are prevalent, such as staff kitchens, dining halls, cafeterias, etc.) managers should provide concise and effective messaging on signage and through other dissemination strategies (e.g. reminder emails, reward

systems for reduced waste, messages on bins, etc.) regarding how and where to properly dispose of waste and recyclables.

Limitations and Future Research

There are a number of limitations and associated future research suggestions that emerged from this study. Rather than reaching park staff onsite, which generally yields higher response rates, this study used an online, emailed survey, which typically yields lower response rates and therefore less representative results. This approach also negated the opportunity to conduct a non-response check, which should be used in future research. Given our survey methodology, this study only collected self-reported, rather than actual objective or observed, data. The survey used in this study was constructed based upon established TBP-related research; more variables that target perceived difficulty and social norms are merited in future research. Future research may consider implementing message treatments through experimental design methodologies, and examining the resulting behaviors as well as waste and recycling streams to determine efficacy.

CONCLUSIONS

The purpose of this study was to examine NPS employees and park concession staff attitudes, norms, self-reported behavior, and intent towards the disposal of waste and recycling in the ZLI pilot parks, including YOSE, GRTE, and DENA. The TPB was used to advance the limited understanding of these types of behaviors in this context. Perhaps the most notable finding is that NPS and concession staff attitudes, norms, reported behaviors, and behavioral intent align with the goals of ZLI, and staff are predisposed to engage in behaviors that benefit parks. Perceptions related to difficulty and moral norms are the biggest driver of future intent to properly dispose of waste and recyclables in these parks. Findings suggest that messaging and trainings focused on ease and personal responsibility may continue to improve perceptions of ZLI and the efficacy of the program.

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REFERENCES

Ajzen, I. 1991. The theory of planned behavior. *Organizational Behavior and Human Decision Processes* 50: 179–211. [https://doi.org/10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T)

Armitage, C.J., and M. Conner. 2010. Efficacy of the theory of planned behaviour: A meta-analytic review. *British Journal of Social Psychology* 40(4): 471–499. <https://doi.org/10.1348/014466601164939>

Başak, T.K. 2007. The impact of the European Landfill Directive on waste management strategy and current legislation in Turkey's Specially Protected Areas. *Resources, Conservation and Recycling* 52(1): 119–135.

Basnet, K. 1993. Solid waste pollution versus sustainable development in high mountain environment: A case study of Sagarmatha National Park of Khumbu region, Nepal. *Contribution to Nepalese Studies* 20(1): 131–139.

Brown, T.J., S.H. Ham, and M. Hughes. 2010. Picking up litter: An application of theory-based communication to influence tourist behaviour in protected areas. *Journal of Sustainable Tourism* 18(7): 879–900. <https://doi.org/10.1080/09669581003721281>

Brymer, R., S. Dumyah, and A.B. Brymer. 2017. Exploring sustainability's frontier—marketization and transparency on public lands. *World Scientific Reference on Entrepreneurship. Volume 3: Sustainability, Ethics, and Entrepreneurship*. A.J. Guerber, G.D. Markman, and S. Chih-Yi Su, eds. https://doi.org/10.1142/9789813220614_0006

Canepa, J.R.L., C.Z. Larios, M.E.M.V. Treviño, and D.I.G. Sánchez. 2012. Basic diagnosis of solid waste generated at Agua Blanca State Park to propose waste management strategies. *Waste Management & Research* 30(3): 302–310. <https://doi.org/10.1177/0734242X11415312>

Casey, A., and A. Becker. 2019. Institutional and conceptual barriers to climate change adaptation for coastal cultural heritage. *Coastal Management* 47(2): 1–20. <https://doi.org/10.1080/08920753.2019.1564952>

Chan, L., and B. Bishop. 2013. A moral basis for recycling: Extending the theory of planned behavior. *Journal of Environmental Psychology* 36: 96–102. <https://doi.org/10.1016/j.jenvp.2013.07.010>

Coggins, G.C., and R.L. Glicksman. 1996. Concessions law and policy in the National Park System Symposium: The National Park System. *Denver University Law Review* 74(3): 729–778.

Dangi, T.B., and W.J. Gribb. 2018. Sustainable ecotourism management and visitor experiences: Managing conflicting perspectives in Rocky Mountain National Park, USA. *Journal of Ecotourism* 17(3): 338–358. <https://doi.org/10.1080/14724049.2018.1502250>

- Dillman, D.A., J.D. Smyth, and L.M. Christian. 2015. *Internet, Phone, Mail, and Mixed Mode Surveys: The Tailored-Design Method*. (“Web questionnaires and implementation,” pp. 301–350.) Hoboken, NJ: John Wiley & Sons. 301–350. <https://doi.org/10.1017/CB09781107415324.004>
- Grazhdani, D. 2016. Assessing the variables affecting on the rate of solid waste generation and recycling: An empirical analysis in Prespa Park. *Waste Management* 48: 3–13.
- Greaves, M., L.D. Zibarras, and C. Stride. 2013. Using the theory of planned behavior to explore environmental behavioral intentions in the workplace. *Psychology* 34: 109–120.
- Hellmann, D.J. 2017. The National Park Service at 100. *Akron Law Review* 50(1): Article 2.
- Kaseva, M.E., and J.L. Moirana. 2009. Problems of solid waste management on Mount Kilimanjaro: A challenge to tourism. *Waste Management & Research: The Journal for a Sustainable Circular Economy*. <https://doi.org/10.1177/0734242X09337655>
- Mahmud, S.N.D., and K. Osman. 2010. The determinants of recycling intention behavior among the Malaysian school students: An application of Theory of Planned Behavior. *Procedia–Social and Behavioral Sciences* 9: 119–124. <https://doi.org/10.1016/j.sbspro.2010.12.123>
- Mateer, T., B.D. Taff, Z.D. Miller, and B. Lawhon. 2020. Using visitor observations to predict proper waste disposal: A case study from three U.S. National Parks. *Current Research in Environmental Sustainability* 1: 16–22. <https://doi.org/10.1016/j.crsust.2020.01.001>
- McCullough, B.P. 2013. Identifying the influences on sports spectator recycling behaviors using the theory of planned behavior. *International Journal of Sports Management and Marketing* 14(1–4). <https://doi.org/10.1504/IJSMM.2013.060631>
- Miller, Z.D., B. Lawhon, B.D. Taff, F. Schwartz, and P. Newman. 2019. Identifying strategies to reduce visitor-generated waste in national parks of the United States: The Zero Landfill Initiative. *Applied Environmental Communication and Education* 19: 303–316.
- Oke, A. 2015. Workplace waste recycling behavior: A meta-analytical review. *Sustainability* 7(6): 7175–7194. <https://doi.org/10.3390/su7067175>
- Pitas, N.A. 2020. Factors influencing perceived appropriateness of concessioner activity in Grand Teton National Park. *Parks Stewardship Forum* 36(3): 519–528. <https://doi.org/10.5070/P536349866>
- Przydatek, G. 2019. Waste management in selected national parks—A review. *Journal of Ecological Engineering* 20(4): 14–22.
- Santucci, D.C., M.F. Floyd, J.N. Bocarro, and K.A. Henderson. 2014. Visitor services staff perceptions of strategies to encourage diversity at two urban national parks. *Journal of Park and Recreation Administration* 32(2): 15–28.
- Schuett, M.A., and G. Bowser. 2006. Managers’ perceptions of issues in serving racial and ethnic minorities in urban parks. *The George Wright Forum* 23(4): 40–48.
- Strydom, W.F. 2018. Applying the theory of planned behavior to recycling behavior in South Africa. *Recycling* 3(3). <https://doi.org/10.3390/recycling3030043>
- Susan, L.S. 2017. Operationalising both sustainability and neo-liberalism in protected areas: Implications from the USA’s National Park Service’s evolving experiences and challenges. *Journal of Sustainable Tourism* 25(12): 1848–1864. <https://doi.org/10.1080/09669582.2016.1260574>
- Taff, B.D., Z. Miller, B. Lawhon, S. Freeman, and P. Newman. 2022. Effective communication and campground recycling: Lessons learned from Yosemite, Grand Teton, and Denali National Parks. *Land* 11(10): 1872. <https://doi.org/10.3390/land11101872>
- Tonglet, M., P.S. Phillips, and A.D. Read. 2004. Using the theory of planned behavior to investigate the determinants of recycling behavior: A case study from Brixworth, UK. *Resources, Conservation and Recycling* 41(3): 191–214.
- Varner, J. What’s in national parks’ trash cans—and what you can do. August 2016. <https://www.npsa.org/articles/1289-what-s-in-national-parks-trash-cans-and-what-you-can-do>
- Vaske, J.J. 2008. *Survey Research and Analysis: Application in Parks, Recreation and Human Dimensions*. State College, PA: Venture.