

# ZERO LANDFILL RESEARCH

**THE BIG PICTURE 2017-2019**



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YOSE  
GRTE  
DENA

# 100 M. POUNDS

Each year, over 100 million pounds of waste are generated in national parks by park operations, visitors, and other sources.



This is not wholly representative of all waste-generating activities in parks and does not completely account for waste generated in gateway communities or by park concessions. Although the National Park Service (NPS) promotes visitation and enjoyment of parks, the agency must provide sustainable parks now and in the future. In 2016, the NPS partnered with Subaru of America and the National Parks Conservation Association to pilot a Zero Landfill Initiative (ZLI) in three NPS units – Yosemite National Park (YOSE), Grand Teton National Park (GRTE), and Denali National Park and Preserve (DENA). The overarching goal of the initiative is to realize a steady decrease in waste generated in parks and an increase in materials being recycled and composted.

**The primary purpose of these studies was to better understand how park managers and partners can achieve waste management goals through effective direct and indirect management strategies for NPS visitors and NPS and concession staff, thereby helping to ensure a sustainable future for the parks.**

## 2017

EXPLORING  
VISITOR  
ATTITUDES,  
VALUES, &  
BEHAVIORS

In 2017, researchers with the Leave No Trace Center for Outdoor Ethics and Penn State University collaborated with NPS staff and other key partners to collect data at select frontcountry locations in Yosemite National Park, Grand Teton National Park, and Denali National Park and Preserve to understand how the ZLI goal could most effectively be met.

## 2018

CAMPGROUND  
VISITOR &  
EMPLOYEE  
ATTITUDES &  
BEHAVIORS

A second ZLI study in 2018 by the same research team explored specific campground visitor attitudes and reported and actual behaviors toward waste in the pilot parks with a multi-method experimental design using paired observation and survey data. Also included in the 2018 study was an exploration of NPS and concession staff attitudes and reported behaviors in the pilot parks via online surveys.

## 2019

EXAMINING  
THE EFFICACY  
OF INDIRECT  
MANAGEMENT  
APPROACHES  
TO INFLUENCE  
PARK VISITOR  
BEHAVIOR

The final phase of research in 2019 examined the efficacy of data-driven messaging placed on waste infrastructure in frontcountry and campground sites in YOSE, GRTE, and DENA. The specific data collection locations used in 2019 were the same ones used in 2017 and 2018. Messages were designed using communication and behavioral theories and data from the 2017 and 2018 studies. The frontcountry and campground messages were deployed through an experimental design to determine the efficacy of data-driven communication for influencing park visitor waste and recycling behavior.



# PROPER DISPOSAL

Perhaps the most important finding from this research, for frontcountry, campground, and staff samples, is that visitor and staff attitudes, norms, behavioral intentions, and behaviors are largely aligned with proper disposal of waste and recyclable material in the parks.

Despite visitors' persistently low awareness of the Zero Landfill Initiative (ZLI) by name, the data suggests that visitors are inclined to engage in environmentally responsible behaviors that benefit and protect national parks. Furthermore, the data reveals that moral norms and ease are important for park visitors and could be targeted in future ZLI messaging in parks and surrounding communities, online, on signage, and in other printed materials. Such messages could reinforce visitors' sense of "the right thing to do" in national parks and surrounding areas, as well as focus on how easy it is to help the parks. Additional high-level findings:

Overall, respondents **strongly disagreed** with the notion that recycling in national parks is useless, and that recycling in national parks takes too much time.

RECYCLING

USELESS

BENEFICIAL

Respondents **strongly disagreed** with the notion that recycling and trash disposal are inconvenient, nor do they consider trash disposal and recycling to be confusing.

RECYCLING

INCONVENIENT & CONFUSING

CONVIENT & CLEAR

'Avoid the purchase of items in the park that cannot be reused or recycled' was considered by respondents to be the **most difficult** behavior to perform.

PURCHASE ITEMS

DIFFICULT

EASY

'Sort my waste items between recycling and trash while in the park,' was considered by respondents to be the **easiest behavior** to perform.

SORT ITEMS

DIFFICULT

EASY





By combining the findings from the 2019 treatment-focused study with the results from the frontcountry visitor (2017) and campground studies (2018), it is possible to begin to holistically understand park visitor perceptions, norms, behavioral intentions, and behaviors. Both the 2017 frontcountry-focused and 2018 camper-focused studies purposely used similar methods and variables, so that results would inform parkwide management strategies regarding visitor waste and recycling behaviors. Comparative findings suggest that both frontcountry visitors' and campers' perceptions (e.g., attitudes, beliefs, norms) largely align with proper disposal of waste and recyclable material in national parks despite the low rates of ZLI awareness by either group of respondents. Results from both studies suggest that frontcountry visitors and campers are predisposed to engage in environmentally responsible behaviors that benefit and protect national parks. Similar results were found in the third, 2019 study.

## **Despite these encouraging results, there is room for improvements to existing ZLI-related efforts, particularly in park campgrounds.**

When eliminating the 54% of campers who disposed whole bags of waste/recyclables (recorded as unclear), 74% of campers were observed properly disposing waste and recycling (2018). By comparison, only 12% of frontcountry visitors in 2017 were observed disposing whole bags of waste/recyclables, whereas only 6.6% of frontcountry visitors were observed disposing whole bags of waste/recyclables in 2019, indicating an improvement in rates of proper disposal in frontcountry. Therefore, the opportunity to improve sorting and associated diversion rates is likely much greater in campgrounds than in frontcountry locations given the large percentage of whole bag disposal observed in park campgrounds. However, in all settings studied, there is potential to improve the waste and recycling behaviors of park visitors.

Improved infrastructure and paired messaging incorporating similar findings regarding behavioral influences between frontcountry visitors and campers are viable strategies for continuing to improve diversion rates as indicated by the findings of the 2019 research. Salient findings regarding perceived difficulty and moral norms were evident in both studies, and informed the treatments deployed in 2019. Aligning with trigger points, such as visitors' perceived moral norms, frontcountry visitors and campers both have supportive attitudes related to their perceived responsibility for conservation of national parks. These significant and very similar drivers of behavioral intent provide insights to potential messaging strategies that can be used in most settings across the pilot parks. Overall, as the 2019 results indicate, messaging must produce elaboration and highlight the ease of sorting and proper recycling, while reinforcing that these behaviors are visitors' responsibility (moral norms), and are vital for the health of the environment. Furthermore, the opportunity to improve planning behaviors by letting visitors (frontcountry, and in particular, campers) know what can and cannot be recycled in the parks, while encouraging them to make a difference by bringing reusable materials, may continue to improve diversion rates over time.

# 2017

## EXPLORING VISITOR ATTITUDES, VALUES, & BEHAVIORS

The primary goal of this study was to explore visitor **attitudes and behaviors toward waste disposal and recycling** in select national parks. This was carried out through direct visitor observations paired with visitor surveys at Yosemite National Park (YOSE), Grand Teton National Park (GRTE), and Denali National Park and Preserve (DENA) to better understand how park managers can achieve waste management goals through effective educational and management strategies.





# EXPLORING VISITOR ATTITUDES, VALUES, & BEHAVIORS



In order to explore visitor attitudes and behaviors, researchers stratified sampling across the selected park units over a three-month period in summer of 2017. Approximately 20-25 days of sampling were allotted for data collection in each park. A total of  $N = 2790$  surveys (including paired and non-paired) were administered to visitors, and  $N = 7558$  observations were recorded.

Although ZLI messages, infrastructure, and programmatic efforts varied in 2017 among the pilot parks, there were increased diversion rates for each park. DENA increased from 18 to 23%, GRTE increased from 20 to 33%, and YOSE increased from 24 to 30% (D. Coogan, personal communication, January 9, 2018). This increased diversion suggests that initial ZLI efforts have been effective. Continued enhancements to the ZLI may increase diversion rates in the future. Given the overall alignment of visitors with ZLI goals, the results indicate that if the necessary support structure (heightened awareness, robust education, enhanced messaging, well-labeled and located infrastructure) were in place in the parks, visitors would willingly participate in ZLI efforts.



# 66%

Approximately 66% of respondents brought items into the park that they later disposed of within the park.



# 74%

Nearly three quarters (74%) of the sample reported disposing of waste items in a trash container in the park.



# 55%

Over half of the sample (55%) reported disposing of recyclable material in a recycling container in the park.



# 30%

Approximately 30% of respondents purchased an item in the park that they later disposed of in the park.



# Difficult

'Avoid the purchase of items in the park that cannot be reused or recycled' was considered by respondents to be the most difficult behavior to perform.




# Easy

The item 'Sort my waste items between recycling and trash while in the park' was considered by respondents to be the easiest behavior to perform.



# 74%

Nearly three fourths (approximately 74%) of visitors properly disposed of their waste and recycling.



Results indicate that if park visitors sought information regarding waste management (prior to their visit), they were statistically more likely to dispose of waste/recycling appropriately in the park.



The data reveal that park visitors who looked at/or saw signage regarding waste management were statistically more likely to dispose of waste/recycling appropriately.







Having the right messages in place, accessed prior to a visit and/or seen by visitors on-site, **can lead to greater compliance** and appropriate waste disposal and recycling.

NON-COMPLIANT

COMPLIANCE



Results suggest that messages focusing on the **ease of proper waste disposal/recycling** may be effective at aligning visitor behavior with ZLI goals.

STRICTLY FACTS

FOCUS ON EASE OF DISPOSAL



**Moral norms are an important construct**, and could be leveraged for effective messaging to park visitors (eliciting a sense of responsibility, feelings of guilt, etc.).

NO MORAL NORMS MENTIONED

LEVERAGE MORAL NORMS



**Vendors/concessions can play a more active role** in educating visitors (e.g., at point of purchase) about which items can be recycled versus those items which must go to landfill.

NO MESSAGING

VENDOR MESSAGING



Results indicate that when visitors are **less engaged** with waste/recycling infrastructure, they are **less likely** to properly dispose of materials. More visually engaging signage is likely warranted on and around the infrastructure, both to capture visitor attention and to influence proper disposal.

LESS ENGAGED

CAPTURE ATTENTION

## CAMPGROUND VISITOR & EMPLOYEE ATTITUDES & BEHAVIORS

**The primary purpose of this study was to better understand **how park managers and partners can achieve waste management goals through effective direct and indirect management strategies** for NPS campground visitors and NPS and concession staff. This study explored specific campground visitor (campers) perceptions (i.e., attitudes, normative beliefs, intent) and behaviors towards waste, and proper disposal of waste, in select national park campgrounds participating in the ZLI, and also explored perceptions (i.e., attitudes, normative beliefs, intent) and reported behaviors of NPS and park concession staff. The camper investigation was carried out through direct visitor observation paired with visitor surveys at campgrounds in Yosemite National Park (YOSE), Grand Teton National Park (GRTE), and Denali National Park and Preserve (DENA); the NPS and concession staff investigation in each park was facilitated via an online survey.**





# CAMPGROUND VISITOR & EMPLOYEE ATTITUDES & BEHAVIORS



To explore camper perceptions and behaviors, researchers stratified sampling across the selected park units over a three-month period in summer of 2018. Approximately 20-24 days of sampling were allotted for data collection in each park. A total of  $N = 1292$  surveys (paired and nth surveys) were completed with campers, and  $N = 456$  paired observations were obtained. NPS and concession staff attitudes, beliefs, self-reported behaviors, and behavioral intentions were explored via an online survey administered over an approximately two-week period during the summer/early fall of 2018. A total of  $N = 921$  surveys (NPS staff  $N = 494$ ; concession staff  $N = 427$ ) were completed.

While numerous findings in this study are noteworthy, perhaps most notable is that the attitudes, norms, and behaviors of campers included in this sample largely aligned with proper disposal of waste and recyclable materials in national parks. Regardless of low camper awareness of the ZLI, the data suggested that campground visitors are predisposed to engage in environmentally responsible behaviors that benefit and protect national parks. Additionally, data revealed that both NPS and concession staff attitudes, beliefs, reported behaviors, and behavioral intent also align with the goals of ZLI, and staff are similarly predisposed to engage in behaviors that benefit parks.



# 51%

Just over half of the respondents (51%) reported purchasing items in the park that they later disposed of within the park.



# 34%

Just over one-third (34%) of observed campers properly disposed of their waste and recyclable materials, whereas only 12% did not properly dispose of their waste and recyclable materials. However, 54% of observed waste disposal was recorded as "unclear," meaning that the camper deposited a bag of items for which the observer/surveyor was unable to determine the contents.



# 74%

When "unclear" disposal events were removed from the analysis, proper disposal was 74%, improper was 26%.



# 64%

Of plastic bags deposited, 64% were deposited into trash receptacles, while 36% were deposited into recycle bins.



# 95%

Campers who deposited a bag of items used a plastic bag 95% of the time.



## Influence

Multiple regression analysis suggests that the constructs 'perceived difficulty' and 'conservation' had significant influence on camper's behavioral intention.





# Aligned

Overall, NPS and concession staff perceptions (i.e., attitudes, beliefs, norms) – self-reported current, and suggested future behaviors – aligned with ZLI-related goals.



# Less

Overall NPS staff perceptions – self-reported current, and suggested future behaviors – were less congruent with proper sorting and disposal behaviors than concessionaire staff.



# More

Concessionaire staff indicated that they knew what items could be recycled in the workplace and where they could take recyclables at greater levels than NPS staff.



# More

Concessionaire staff were more inclined to agree than NPS staff that by recycling in [their] workplace, and reducing the amount of trash [they] produce in [their] workplace [they are] helping to conserve natural resources, and helping to protect the health of the environment.



# More

Concessionaire staff were more likely than NPS staff to reduce the amount of waste materials [they] bring to the workplace, reduce the amount of waste materials they create while working, and only purchase items in the park that can be reused or recycled in the future.



Respondents were largely supportive of ZLI-related behaviors and therefore efforts around this initiative may continue to **positively influence perceptions and behaviors**, and improve diversion rates.

NEGATIVE INFLUENCE

POSITIVE INFLUENCE



Given that about **half of campground respondents purchased items that were later disposed of in the park**, management should consider working with vendors to supply more (or perhaps only) materials that are either reusable or recyclable in the park campgrounds.

CONTINUE TO STAY THE SAME

MORE REUSABLE/RECYCLABLE



Due to the fact that more than half of observed campers dispose of bags of waste/recyclables, and approximately 95% of those used plastic bags, and the majority of these went into the trash, it is speculated that many campers did not sort and may have improperly disposed of recyclable materials. There are a number of potential strategies that could be implemented to increase sorting behaviors, such as:

- Not allowing plastic bag disposal in the campgrounds
- Messaging that discourages use of whole bag disposal and encourages sorting behaviors at the receptacles
- Decreasing the size of receptacle doors so that whole bags of waste are more difficult to dispose of
- Adding a recycling receptacle specifically for plastic bags (not containing waste)
- Implementing a bag system at campground check-in where campers are provided with recyclable bags and separate trash bags

DECREASED SORTING BEHAVIORS

INCREASE SORTING BEHAVIORS





Based on the high levels of reported support for the ZLI-related behaviors for NPS and concessionaire staff, both entities should **consider consistent messaging and infrastructure** that leverages the positive perceptions found through this study.

- NPS should work with concessionaire partners and consider adopting some of their practices, since, based on the results of this study, their efforts are more effective than current NPS initiatives at aligning staff with the goals of ZLI.



NPS should examine the concession **on-boarding process** for new or seasonal staff.



Consider **developing or improving existing annual/seasonal trainings about ZLI**, and consider adding more targeted messaging on existing infrastructure.

# 2019

## EXAMINING THE EFFICACY OF INDIRECT MANAGEMENT APPROACHES TO INFLUENCE PARK VISITOR BEHAVIOR

**This research examined the efficacy of data-driven messaging placed on waste infrastructure in frontcountry and campground sites in Yosemite National Park (YOSE), Grand Teton National Park (GRTE), and Denali National Park and Preserve (DENA).**



The specific data collection locations used in 2019 were the same ones used in 2017 and 2018. Messages were designed using communication and behavioral theories and data from the 2017 and 2018 studies. The frontcountry and campground messages were deployed through an experimental design to determine the efficacy of data-driven communication for influencing park visitor waste and recycling behavior.

The treatment signage significantly affected frontcountry visitor interaction with infrastructure, and the ease treatment significantly increased campers' proper disposal of waste in campgrounds. While the treatments did not produce significant effects on all of the attitudes or behaviors under examination in this study, the persuasive message treatments have the potential to increase engagement and elaboration (i.e., process of scrutinizing and contemplating information, which is key to attitude, and ultimately behavior change) in visitors regarding proper waste/recycling behaviors (frontcountry), and can significantly increase proper disposal of waste and recycling materials (campgrounds).



# Key Findings:

**Frontcountry visitor interaction with waste infrastructure was increased by data-driven messages. Frontcountry visitors exposed to the ease treatment message were over two times more likely to engage, and those exposed to the moral norms treatment message were nearly two times more likely to engage with waste infrastructure. This is reflected in approximately 12% more visitors spending time elaborating on the messages while they were in the act of disposing of waste and recyclable materials, compared to control conditions.**

## Implications:



Despite the amplified level of engagement, it did not equate to increases in sorting or proper disposal of waste or recyclable material in the frontcountry. However, it is speculated that there are three reasons why the amplified level of engagement did not equate to increases in sorting or proper disposal of waste or recyclable material in the frontcountry:

# 1

**Frontcountry visitors most often dispose of a single item, requiring no sorting. Therefore, onsite messages are unlikely to further influence this particular behavior and may be unnecessary.**

# 2

**There may be a ceiling effect (i.e., limited potential to influence desired behavior beyond current levels) on proper waste disposal behavior in the frontcountry. In other words, the proportion of visitors who are improperly disposing of waste and recyclable materials is relatively low, and therefore improvement related to this behavior is likely limited.**

# 3

**Since its inception in 2016, the ZLI has progressed in the parks through improved waste infrastructure and messaging at the bins. The resulting improvements in diversion and proper disposal rates in the frontcountry are clearly positive results stemming from the ZLI.**

# Key Findings:

Data-driven messaging increases the proper disposal of waste for campers, but only if the message targets ease. Ease messages on waste infrastructure in campgrounds are likely to increase the proper disposal of waste among visitors, and such messages should be widely used in the pilot parks due to their ability to influence behavior.

# Implications:



There is substantial room for improvement in visitor behaviors in park campgrounds. For example, approximately 36% of campground visitors improperly placed plastic bags in the recycle receptacles during the campground study in 2018. However, **by simply informing campers in this study that plastic bags are not recyclable, nearly 35% fewer campers improperly disposed of their plastic bags** in the recycling receptacles during the 2019 study.

CONTINUE CURRENT PROCEDURES

EDUCATE VISITORS



It is clear that **simple messaging that improves knowledge**, and persuasively targets ease and normative constructs, can make a significant improvement in plastic bag disposal in campgrounds.

DETAILED MESSAGING

SIMPLE MESSAGING



The **ease message significantly increased proper disposal** of waste and recyclable materials with campers compared to control conditions; campers were more than two times more likely to properly dispose of waste and recyclables, resulting in approximately 9% more visitors engaging in this compliant behavior than under control conditions.

CONTROL CONDITIONS

EASE MESSAGE





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