

THESIS

ROCKY MOUNTAIN NATIONAL PARK WASTE AUDIT AND RECYCLING
BEHAVIORAL CHANGE INTERVENTION INITIATIVE

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ABSTRACT

ROCKY MOUNTAIN NATIONAL PARK WASTE AUDIT AND RECYCLING BEHAVIORAL CHANGE INTERVENTION INITIATIVE

Many federal, regional, and local municipalities and organizations have identified solid waste management, with a focus on landfill waste reduction, to be a core component of their sustainability operations. Rocky Mountain National Park (RMNP) is one such organization seeking to increase sustainability through improved landfill waste diversion. RMNP conducted a park-wide waste audit in the summer of 2011, identifying the Family Campground location type as having the greatest opportunity to increase recycling rates and decrease trash volumes. Moraine Park Campground, the largest campground in RMNP, was selected for a two-year behavior change campaign and study.

Community-based Social Marketing (CBSM) was used as the framework to identify strategies to increase recycling behaviors of park visitors. In accordance with CBSM, observations of waste disposal behaviors and intercept surveys with Moraine Park Campground visitors were conducted. Analysis of this data was performed using two qualitative data analysis techniques: Template Analysis and Constant Comparison. Such analyses identified the barriers to recycling to be awareness, convenience, and commitment. Analyses identified recycling benefits to include general environmental benefits, a connection to place, cleanliness, and the preservation of the environment for future generations. Utilizing CBSM tools for strategy development, strategies to promote recycling behaviors included: gaining recycling commitments upon campground entrance, receipt of equipment for sorting recyclables, Ranger

programs to increase recycling commitment and awareness, and the use of multiple recycling prompts to act as reminders.

These strategies were implemented in Moraine Park Campground in the summer of 2012 with varying success and consistency. A second waste audit conducted in 2012 found recyclables in the landfill waste stream reduced in the Family and Group Campground overall by 6% and 19%, respectively, as compared to the 2011 waste audit. This equates to a 23% decrease of recyclables in the waste stream in the Family Campground and a 68% decrease in the Group Campground. In addition, an exit survey was distributed to campers to determine their awareness of the strategies, and the perceived effectiveness of the implemented strategies. Results indicate that a camper's commitment to recycle coupled with the receipt of a reusable recycling bag was the most effective recycling behavior change strategy. Moreover, prompts in high visibility locations to remind campers to recycle were also highly effective. To further increase recycling in RMNP campgrounds, the barriers and benefits to long-term, institutional behavior change of park employees should be further researched.

This study provides insight into the use of behavior change strategies for sustainable waste management in a National Park campground setting. The results can help other locations with similar visitor/employee interactions develop strategies to increase recycling participation.

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CHAPTER I

INTRODUCTION

Landfill Waste Reduction and Waste Stream Audits

Municipal solid waste management poses many global impacts affecting human and environmental health safety. These challenges include ground and surface water pollution (Cumar & Nagaraja, 2011), vegetation contamination (Ferrier, Frostick, & Spajt, 2009), increased transmission of infectious disease (Maqbool, Bhatti, Malik, Pervez, & Mahmood, 2011), greenhouse gas emissions (Bogner, et al., 2007; United Nations Environmental Programme, 2010), localized air pollution (Chiriac, Carre, Perrodin, Vaillant, Gasso, & Miele, 2009), land degradation (Bai & Sutanto, 2002), and resource depletion. These impacts are in large part due to the sheer quantity of solid waste generated worldwide. For example, among developed countries, the Organization for Economic Co-operation and Development estimates 650 million tons of municipal solid waste was generated in 2009 across the globe, equating to 540 Kg per capita (OECD, 2011). In the USA, a 2009 US EPA report estimates that 243 million tons of trash was generated in the USA, or the equivalent of 4.34 pounds (1.97 Kg) per person per day (United States Environmental Protection Agency, 2010).

For these reasons, many federal, regional, and local municipalities and organizations have identified solid waste management, with a focus on landfill waste reduction, to be a core component of their overall sustainable development initiative (CCME, 1996; Farmer, et al.,

1997; Greater Vancouver Regional District, 1995; McCartney, 2003; Einsiedel & Morrison, 2008). Sustainable development is defined as development that meets the current needs without compromising the needs of future generations (United Nations, 1987). Sustainable solid waste management, however, is one of the most difficult challenges facing facilities managers today. (Smyth, Fredeen, & Booth, 2010). This is because sustainable solid waste management requires a detailed and integrated understanding of the solid waste stream from waste generation to disposal (Farmer, et al., 1997). There are, however, many opportunities available to drastically reduce the amount of waste sent to the landfill. These opportunities include, but are not limited to: waste prevention and source reduction, reuse, recycling, composting, and energy recovery. (Smyth, Fredeen, & Booth, 2010; United Nations Environmental Programme, 2010). Determining the appropriate opportunity for achieving landfill waste diversion is integral in developing a sustainable solid waste management plan, and thus requires an in depth understanding of the amount, nature, and composition of the waste generated in all functional areas of the operation (McCartney, 2003).

One way to gain insight into the composition of the current waste stream is to conduct a waste stream analysis, and is commonly accomplished through a waste stream audit. Used by federal and local governments, university campuses, hospitals, and private companies, a waste stream audit is defined as “a statistical analysis of the waste flow in the disposal system ... and the composition of the waste stream” (Greater Vancouver Regional District, 1995, p. 69). Generally speaking, the purpose of a waste audit is to analyze the amount, nature, and composition of the waste generated in the specific areas of interest while also determining the ways in which waste is produced and managed (Ashwood, Grosskopf, & Schneider, 1995; Felder, Petrell, & Duff, 2001). Waste audits can also be used to evaluate the effectiveness of

waste reduction activities through the implementation of a reoccurring waste audit monitoring program. During the creation of a sustainable solid waste management plan, the information obtained from a waste stream audit is a vital first step in identifying waste minimization opportunities that must be targeted in the waste diversion work plan (CCME, 1996; Dowie, McCartney, & Tamm, 1998). For example, specific materials, such as paper or organics, can be identified for targeted reductions.

Behavioral Change Intervention through Community Based Social Marketing

Once waste minimization opportunities have been identified through the waste stream audit, the next step of the waste reduction work plan is to develop waste reduction strategies that “meet the needs and characteristics of the organization” (CCME, 1996, p. 5). Identifying *how* the needs and characteristics of the organization should be met, however, is not discussed in the CCME waste audit and waste audit work plan procedure. Before waste reduction strategies can be developed that meet the needs and characteristics of the organization, a behavioral analysis, assessing the underlying barriers that are precluding sustainable behaviors, must first be understood before meaningful waste diversion strategies can be developed (Monroe, 2003). Many well-documented behavioral change campaigns exist, all sharing the common link that individual behavioral change can lead to large impacts on society when compounded across populations (Reynolds, 2010).

One widely accepted and proven psychologically-based sustainable behavioral change approach is Community-based Social Marketing (CBSM). CBSM has been used for creating sustainable behavioral change on topics ranging from household energy conservation (Abrahamse, Steg, Vlek, & Rothengatter, 2005) to community recycling and composting initiatives (Einsiedel & Morrison, 2008; Haldeman & Turner, 2009). Traditionally, behavior

change initiative developers have relied wholly on information and educationally intensive campaigns to promote sustainable behavior change, believing that once attitudes are changed, behaviors will follow. Unfortunately, many documented studies indicate that an increased public awareness and understanding of an issue will not necessarily motivate the targeted audience to perform the desired sustainable behavior. (McKenzie-Mohr, 2000b). CBSM differs from these other approaches in that it takes a systematic and researched-based approach, first identifying the barriers and benefits which preclude or encourage the sustainable activity, and subsequently develops strategies to reduce the identified barriers and increase the benefits (McKenzie-Mohr, 2011).

Waste Audits and Behavioral Change Initiatives: Need of Study

As discussed above, waste audits are used across public and private sector for the purposes of determining the types and quantities of waste produced, and for the identification of waste diversion opportunities (Dowie, McCartney, & Tamm, 1998; Farmer, et al., 1997). A waste audit alone, however, does not inform how waste diversion opportunities can lead to the development of strategies which encourage sustainable waste disposal. Most published studies that do seek to identify waste reduction strategies based on data from waste audits assume that pre-established and readily accessible waste diversion strategies will be appropriate. These laundry lists of strategies include, but are not limited to: two-sided office printing, better use of signage on recycle bins, the use of china in the cafeteria, and the encouragement of occupant participation through periodic email reminders (Ashwood, Grosskopf, & Schneider, 1995). Some of these strategies could potentially work well at reducing waste from the waste stream, but in order to ensure a successful and comprehensive waste diversion initiative, an assessment of the underlying barriers precluding sustainable waste disposal behavior should also

compliment the waste audit process before meaningful waste reduction strategies can be developed. Currently, little research has been conducted correlating waste audit results with behavioral change initiatives, such as CBSM, for the purposes of improving landfill diversion rates.

Rocky Mountain National Park's Landfill Waste Reduction Initiative

The founding mission of the National Park Service (NPS) is to “conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations” (16U.S.C., 1916, p. §1). In response to this mission, Rocky Mountain National Park (RMNP), established January 26th, 1915 in Colorado's North-Central mountains, has sought to achieve sustainability throughout all park operations. Solid waste management is one such aspect of park operations that RMNP has deemed to be an integral part of their overall sustainability goals (Soviak K. , 2007). With approximately 3 million annual visitors and almost 500 permanent and seasonal employees, who drive, camp, hike, eat, site-see, and live throughout the park, managing and maintaining RMNP's diverse infrastructure and facilities, while adhering to the NPS mission, has proven to be a difficult challenge (Park Statistics, 2011). These infrastructure and facilities include: four entrance stations, five visitor centers, six campgrounds with 586 camp sites, 92 miles of paved roads, and approximately 355 miles of hiking trails (Rocky Mountain Facts & Figures, 2011). Despite diverse and unique infrastructure challenges, RMNP has accomplished the creation and implementation of a sustainable solid waste management plan over the past few years. In 2009, for example, RMNP produced 3,815 cubic yards of solid waste, while diverting 1,115 cubic yards (22.6%) to recycling. In 2010 the park improved its efforts by diverting 1,927 cubic yards (40.53%) to recycling (Soviak K. ,

2011). Even though these sustainability initiatives and initial results are commendable, park management, through anecdotal observation, believe that their landfill diversion rates have the potential to be even further increased.

In order to accomplish such progressive sustainable solid waste management goals, RMNP is seeking to identify new and innovative waste diversion strategies targeted at visitors and employees with the hopes of promoting greater waste diversion activities. This study seeks to build on the existing literature by identifying and implementing waste minimization strategies developed with the use of a waste audit and the CBSM approach at RMNP. There is currently a lack of information relating waste audit results at multi-functional facilities, such as large National Parks, with waste diversion behaviors. Furthermore, as noted Zhang et al. (2011), little research exists on waste diversion behavior change intervention programs targeted at transient groups, such as National Park visitors or seasonal employees. A need, therefore exists, for research that has the potential to extend to similar location types, such as other Federal and State Parks, campgrounds, trailheads, and more broadly, University and business campuses which contain multiple location type areas.

Purpose Statement

The purpose of this sequential, mixed methods study was to increase landfill diversion rates in RMNP. The effectiveness of the identified and implemented behavioral change strategies were validated via a second waste audit occurring after the developed behavioral change strategies were implemented. Overall, the research consisted of 4 phases that were adapted to fit the CBSM approach:

- Phase 1: Conduct an initial waste audit to determine location types and waste categories that have the potential for waste diversion improvements. Select the location and waste category for the behavior change initiative.
- Phase 2: Determine the barriers and benefits precluding/promoting location type occupants from conducting landfill diversion activities. The barriers and benefits will be determined using intercept surveys and observations.
- Phase 3: Develop the waste diversion behavioral change strategies based on the identified barriers and benefits in collaboration with Park management. Recommend the strategies for implementation.
- Phase 4: Conduct a second waste audit to determine the effectiveness of the implemented strategies.

Research Questions

Four research questions, developed from the four phases of research, frame the investigation of RMNP's waste stream:

- Q1. Which location type and waste category has the greatest potential for increasing landfill diversion?
- Q2. What are the barriers and benefits that preclude/promote location type occupants from conducting the desired sustainable waste disposal behavior?
- Q3. What behavioral change strategies will reduce landfill waste in the designated location type in RMNP?
- Q4. Based upon the results from the second waste audit, were the waste diversion behavioral change strategies effective at increasing landfill waste diversion?

Study Objectives

The main objective of this study is to reduce landfill waste from RMNP's waste stream. The results of this study have potential application to other federal and state parks, as well as private tourist and visitor areas. Through the successful development and implementation of the proposed behavior change strategies, greater awareness of sustainable behavior change will may be achieved across the park system and academic communities. This research brings together work in construction and facilities management, environmental psychology, sociology, and natural resource management. By leveraging the strengths of these distinct academic disciplines, this study will further promote collaboration and interconnection when tackling sustainability issues such as landfill waste reduction.

Terms and Definitions

The following definitions are provided to clarify how specific terms are used in this study:

- Waste Audit: A statistical analysis of the waste flow in the disposal system ... and the composition of the waste stream (Greater Vancouver Regional District, 1995).
- Waste Stream: The flow of one type of material from design, manufacture, use, and disposal (Del Borghi, Gallo, & Del Borghi, 2009).
- Waste Category: A distinct type of waste useful for developing waste reduction and diversion opportunities (CCME, 1996).
- Location Type: A location with a specific use unique among other locations (e.g. group campsites vs. family/individual campsites vs. trailheads).

- Community-based Social Marketing: A psychologically based pragmatic approach at fostering sustainable behavior change (McKenzie-Mohr, 2011).
- Behavioral Change Intervention: A comprehensive program targeted at influencing and altering behaviors to better align with sustainability goals.
- Pro-environmental behavior: Behavior that consciously seeks to minimize the negative impacts of one's actions on the natural and built world (Kollmuss & Agyeman, 2002).
- Family Campground: Contains campsite capacity space for a small group of people of approximately the size of one family (~4-6 people).
- Group Campground: Contains campsite capacity space for a large group of people or approximately the size of multiple families (~15-25 people).

Theoretical Perspective

Sustainable behavior change through CBSM is the theoretical perspective guiding this study. The guiding theory behind CBSM is that individual behavioral change is central to achieving a sustainable future (McKenzie-Mohr, 2000b). This concept has been adopted by many national sustainability campaigns, and has been seen to be an effective method at creating large scale behavioral change across population (Reynolds, 2010). The CBSM approach builds on the concept of individual behavioral change, developing strategies that fulfill and satisfy the wants and needs of the target audience. In order to do this, research must be conducted exploring the beliefs, motivations, and behaviors of this population (Reynolds, 2010).

Delimitations

Both waste audits occurred during the summer. Their results, therefore, represent summertime visitor and employee waste disposal behaviors. The implemented behavioral change strategies were limited to summertime users. A second limiting factor of this study was that a pre-selected group of location types and waste categories were analyzed by the waste audits. Therefore, opportunities to reduce landfill waste were delimited to these location types and waste categories. Furthermore, once the specific location type was selected, the behavioral change strategy was only applicable to the designated location type.

CHAPTER II

LITERATURE REVIEW

Sustainability and Landfill Waste Reduction

In 1984, The Worldwatch Institute published the first edition of *State of the World*, a report identifying the current state of Earth and the problems it faces in its transition to a “sustainable” society (Rochlin, 1985). Among other things, this report documented how human consumption of Earth’s resources is currently unsustainable (Brown, Chandler, Flavin, Postel, Starke, & Wolfe, 1984). In order to cope with and manage this unsustainable reality, a new social movement is required. Called a ‘Sustainability Revolution’, it demands participants to adopt a “new value system, consciousness and worldview” (Edwards, 2005, p. 5). As a part of this new value system, consciousness and worldview, the adoption of a new approach to development is needed. Sustainable development, as defined by the Brundtland Commission in their report *Our Common Future* (United Nations, 1987, p. 24) is “development that meets the needs of the present without compromising the ability of future generations to meet their own needs”. If not sustainable, development within the built environment, encompassing food, clothing, shelter and jobs, will leave a world “prone to ecological and other crises” (United Nations, 1987, p. 42).

It is within this broader sustainability context that many federal, regional, and local municipalities and organizations have identified solid waste management, with a focus on

landfill waste reduction, to be a core component of reaching their overall sustainability goals (CCME, 1996; Farmer, et al., 1997; Greater Vancouver Regional District, 1995; McCartney, 2003; Einsiedel & Morrison, 2008). This is in large part due to the sheer quantity of solid waste generated throughout the world. For example, in 2009 the USA generated 243 million tons of trash or the equivalent of 4.34 pounds per person per day (United States Environmental Protection Agency, 2010). Once disposed of in the landfill, solid waste creates many environmental and ecological pollutants. One such pollutant is called leachate, a fluid generated as rain water infiltrates through water-soluble landfill waste (Maqbool, Bhatti, Malik, Pervez, & Mahmood, 2011). Once generated, this liquid waste has decades long negative impacts, effecting local vegetation (Ferrier, Frostick, & Spajt, 2009), groundwater (Cumar & Nagaraja, 2011), surface water quality, and the increased transmission of infectious diseases such as typhoid fever, bacillary dysentery, and infectious hepatitis (Maqbool, Bhatti, Malik, Pervez, & Mahmood, 2011).

Waste management and landfill waste disposal also create a multitude of environmentally harmful and polluting gases. Greenhouse gas emissions related to collection, separation, treatment, transfer and disposal have been cited as having significant environmental impacts (United Nations Environmental Programme, 2010). Once waste is finally disposed, methane gas emissions represent the major source of greenhouse gases released from landfills (Bogner, et al., 2007). Twenty five times the global warming potential of carbon dioxide over a 100 year time period, a wide array of technologies are currently available to capture this gas, but have not been adopted by most landfill management organizations. Additionally, the effectiveness of such technologies is currently unknown (Jung, Imhoff, & Finsterle, 2011). Also emitted from landfills are volatile organic compounds (VOC's), creating other environmental hazards to

humans and wildlife (Chiriac, Carre, Perrodin, Vaillant, Gasso, & Miele, 2009). Finally, landfill space constraints are ever increasing due to global population growth and rapid third world industrialization. This is most evident in island nations experiencing rapid population growth, such as Singapore (Bai & Sutanto, 2002). As these impacts demonstrate, improved landfill waste diversion efforts support many human and environmental benefits, which in turn promote greater sustainable development.

Despite these dauntingly negative impacts of landfill waste, many examples of successful landfill waste reduction initiatives for the purposes of achieving overall sustainability exist. Two cities leading the charge in this endeavor are Vancouver, BC, and San Francisco, CA. Beginning in 1995, the greater Vancouver, BC region created a Regional Solid Waste Management Plan, outlining targeted waste reduction goals and the ways in which they would reach those goals (Greater Vancouver Regional District, 1995). This plan, updated in 2008, lays out a roadmap for the city's eventual path towards zero waste (Greater Vancouver Regional District, 2008). Another city pushing the envelope towards zero waste is San Francisco, CA. As of 2010, San Francisco reported a 72% landfill waste diversion rate, the largest in the USA. This achievement was due in large part to their progressive state and local policy, public-private partnerships, and sustained investment in outreach and public engagement (Tam, 2010). These examples show that landfill waste reduction efforts are possible and achievable, but require a dedicated and integrated commitment to sustainability principles.

Waste Audits

While the importance of sustainable solid waste management is well understood, the development of solid waste management plans for the purposes of achieving institutional

sustainability are one of the most difficult challenges facing facilities managers today (Smyth, Fredeen, & Booth, 2010). This is due to the fact that sustainable solid waste management requires a detailed understanding of the solid waste stream, examining waste from its generation to disposal (Farmer, et al., 1997). There are, however, many opportunities available to drastically reduce the amount of waste sent to the landfill. These opportunities include, but are not limited to: waste prevention and source reduction, reuse, recycling, composting, and energy recovery. (Smyth, Fredeen, & Booth, 2010; United Nations Environmental Programme, 2010). Determining the appropriate opportunity for achieving landfill waste diversion is integral in developing a sustainable solid waste management plan, and thus requires an in depth understanding of the amount, nature, and composition of the waste generated in all functional areas of the operation (McCartney, 2003).

Once an organization, city or institution has committed to sustainable development principles and landfill waste diversion, the first step to gaining insight into the composition of their current waste stream is to conduct a detailed waste stream analysis. The most common way to accomplish this analysis is through a waste stream audit. Waste stream audits have been effectively used in a variety of areas, including: cities (Environmental Science Associates, 2006), medical centers (Mohee, 2005), restaurants (Nilsson, Bjuggren, & Frostell, 1998), laboratories (Dowie, McCartney, & Tamm, 1998), golf courses (McCartney, 2003), and university campuses (Felder, Petrell, & Duff, 2001; Smyth, Fredeen, & Booth, 2010; Zhang, Williams, Kemp, & Smith, 2011). A waste stream audit is defined as “a statistical analysis of the waste flow in the disposal system ... and the composition of the waste stream” (Greater Vancouver Regional District, 1995, p. 69). A waste stream audit allows an organization to analyze the amount, nature, and composition of the waste generated in the specific areas of interest, while also

determining the ways in which the waste is produced and managed (Ashwood, Grosskopf, & Schneider, 1995; Felder, Petrell, & Duff, 2001). A waste stream audit is therefore an effective way to characterize the various forms of waste generated, allowing the opportunity to identify areas for waste reduction, reuse, recycling, and composting (Smyth, Fredeen, & Booth, 2010; Thompson & Wilson, 1994).

Conducting a waste audit begins with the development of a waste audit procedure or waste audit protocol. The protocol defines the process for the audit, with sections including but not limited to: the waste measurement approach, waste categories, waste measuring techniques, sample size, activity areas, and categories and weighing (CCME, 1996; Felder, Petrell, & Duff, 2001). Determining the appropriate waste audit approach depends on the needs and goals of the organization, which ultimately dictates the type of information collected to make useful waste reduction strategies (CCME, 1996). Waste audits can also be used to evaluate the effectiveness of waste reduction activities through the implementation of a reoccurring waste audit monitoring program. In general, the information obtained from a waste stream audit is a vital component in identifying waste minimization opportunities that must be targeted in the waste diversion work plan (CCME, 1996; Dowie, McCartney, & Tamm, 1998).

Waste Reduction and Sustainable Behavioral Change

“The cornerstone of sustainability is behavior change” (McKenzie-Mohr, 2000a).

Once a waste audit has been conducted and the composition of the waste has been characterized, the next step of the waste reduction work plan is to develop waste reduction strategies that “meet the needs and characteristics of the organization” (CCME, 1996, p. 5). Identifying *how* the needs and characteristics of the organization should be met, however, is not

discussed in the CCME waste audit and waste audit work plan procedure. In order to develop waste reduction strategies based on the needs and characteristics of the organization, it is necessary to understand the underlying behaviors of the individuals within the organization. Once these behaviors are understood, strategies can be implemented to sustainably augment the behaviors, such as promoting recycling and waste reduction (Monroe, 2003). This process is called sustainable behavioral change.

Personal and individual behavior change is a central component of sustainability campaigns (Halpern, Bates, Mulgan, Aldridge, Beales, & Heathfield, 2004). Individual behavior change is important because individual impacts, when compounded across populations, can lead to big impacts on the environment (Jackson, 2005). Furthermore, changes in individual behaviors are needed because technical efficiency gains tend to be overtaken by continued consumption growth (Steg & Vlek, 2009). There are many examples of successful sustainability campaigns which focused on individual behavioral change. In an article by Reynolds (2010), the author discusses how national programs emphasizing small sustainability changes to fight climate change can lead to meaningful reductions in global carbon emissions. Another initiative based out of the United Kingdom concentrating on individual behavior change is entitled “Every Action Counts”. This program focuses on empowering local community organizations to promote sustainable lifestyles behaviors within the community (Walton, 2007). Also out of the UK, the Prime Minister’s Strategy Unit has developed a paper discussing the importance of personal responsibility and the role of behavioral change on public policy. This document argues that ‘governments cannot go at it alone’, and that greater engagement and participation from individual citizens will be necessary in order to achieve the desired sustainability goals (Halpern, Bates, Mulgan, Aldridge, Beales, & Heathfield, 2004).

Behavior Change Theory

The field of pro-environmental behavior is well documented and discussed in the physiology and sociology literature. Developed in the 1960's by US psychologists, pro-environmental behavior is defined as “behavior that consciously seeks to minimize the negative impact of one's actions on the natural and built world” (Kollmuss & Agyeman, 2002, p. 240). Within this context, the field of pro-environmental behavior looks at the range of complex interactions between humans and the environment, including the psychological roots of environmental degradation and its connections to environmental behaviors (Kollmuss & Agyeman, 2002). Comparable to the field of pro-social behavior, which investigates models of altruism and empathy, pro-environmental behavior studies “voluntary, intentional behavior that results in benefits for another: the motive is unspecified and may be positive, negative, or both” (Eisenberg & Miller, 1987, p. 92). These fields were developed when scholars began looking into the connections between sustainable behaviors and other influences. The first question asked was “why do people act environmentally and what the barriers to pro-environmental behavior?” (Kollmuss & Agyeman, 2002, p. 240).

Over the past 50 years, numerous frameworks have been developed which try to answer this question. The oldest and simplest approach is called the attitude-behavior approach. This approach generally suggests that a person's behaviors will follow their intentions, or attitudes regarding the topic (Smith & Coskeran, 2006). While well documented in the early literature, this approach has many central flaws. First, it relies on the logic that an increased knowledge and awareness will lead to pro-environmental behavior. Even though large communication-based campaigns may have an impact at changing attitudes, studies show that behaviors do not necessarily follow suit (Kollmuss & Agyeman, 2002). Another main flaw is that measuring

attitudes can be much broader in scope than the action wished to be changed. For example, an individual may carry the attitude that they are generally concerned for the environment; however there may be variety of reasons why they do not perform a specific pro-environmental behavior, such as recycling (Newhouse, 1991).

More recently, a variety of frameworks have been developed acknowledging the separation between attitudes and behaviors. The theory of planned behavior is one such framework which addresses the multitude of variables which impact the ultimate behavior. As an extension of the theory of reasoned action (Ajzen & Fishbein, 1980), the theory of planned behavior focuses on the disparity between stated intentions and actions (Ajzen, 1991). It reasons that in addition to the individual's attitudes to the behavior, the perceived ability to perform that behavior and the individual's perception of social pressure are also factors which influence the intentions and ultimate actions (Tonglet, Phillips, & Bates, 2004). Furthermore, the theory of planned behavior acknowledges the potential for additional beliefs and related dispositions, therefore allowing the inclusion of additional factors, including personal or moral norms, past experiences and behaviors and consequences of the behavior (Ajzen, 1991).

Another theoretical framework developed specifically to examine sustainable behaviors is called the framework of environmental behavior (Barr, Gilg, & Ford, 2001). Building off of Ajzen's theory of planned behavior (1991), the framework for environmental behavior identifies social and environmental variables, situational variables, and psychological variables as factors which influence the behavioral intention and ultimate behavior. The goal of this framework is to show that values and behaviors are linked, but are influenced by a range of situational and psychological factors. Ultimately, this framework allows for different behaviors to be impacted

by different antecedents, and that a static and linear approach to behavior change does not address the unique complexities of behaviors decisions (Barr & Gilg, 2007).

Other researchers have taken a more sociological approach to explain environmental behaviors. For example, Fietkau and Kessel (1981) offer a model of ecological behavior consisting of four variables: environmental attitudes and values (modified by knowledge), the possibility to act pro-environmentally, incentives for pro-environmental behavior, and perceived consequences of the behavior. Following Fietkau and Kessel's work, Blake (1999) identifies that many pro-environmental behavior models are limited because they fail to consider the individual, social and institutional constraints. Blake therefore reasons that the factors leading to pro-environmental behaviors are both internal (personal) and external (institutional).

The list of frameworks and approaches presented are by no means exhaustive or complete. Factors such as age, comfort, convenience, and habits have not been discussed in this review. These examples of frameworks and approaches sufficiently show the many conflicting and competing factors shaping our decisions and actions related to sustainable behaviors (Kollmuss & Agyeman, 2002). These varying frameworks demonstrate that pro-environmental behaviors are influenced by unique and specific factors and situations, and that changing attitudes alone will not necessarily change the targeted behaviors (Andreasen, 1994). Furthermore, if one were to institute a behavioral change campaign, such as landfill waste reduction, a detailed investigation of the specific factors and conditions influencing the desired behavior would be required.

The development and implementation of a program aimed at changing sustainable behaviors is called social marketing. Social marketing is defined as “a program designed to influence the voluntary behavior of target audiences to improve their personal welfare and that of

the society of which they are a part” (Andreasen, 1994, p. 110). Some organizations and governments have created social marketing tool kits or approaches with the goal of developing successful sustainable behavior change programs. One such tool developed for the Communications Leadership Institute and by Spitfire Strategies is entitled “Discovering the Activation Point” (2006). This approach focuses on planning for persuasion, selection of the proper target audience, and building knowledge and will as a means of spurring sustainable action. A second approach developed in a report for the World Wildlife Fund entitled “Meeting Environmental Challenges: The Role of Human Identity” (2009), seeks to identify and work within the social structures of human identity to promote pro-environmental behavior. Called identity campaigning, it focuses on the aspects of a person’s identity which either leads them to demand environmental change on the part of organizations, or the motivation to engage in sustainable behavior. While very helpful and insightful, one major flaw of these approaches is that they focus on strategic advice and solutions, but lack a procedural process useful for behavior change campaign developers.

Turning Theory into Action: CBSM, A Tool for Fostering Sustainable Behavior Change

A different and well-documented social marketing behavioral change tool which addresses the complexities of behavior change is called Community-based Social Marketing (CBSM). CBSM is different from ‘Discovering the Activation Point’ and ‘Meeting Environmental Challenges: The Role of Human Identity’ in that it takes a researched-based approach, providing a step by step process to design a behavior change campaign geared towards the specific and unique needs and characteristics of the organization. Developed by Environmental Psychologist Dr. Doug McKenzie-Mohr, CBSM offers environmental program

developers the necessary psychological tools to design and implement a successful sustainable behavior change initiative (McKenzie-Mohr, 2000b).

The development of this tool is based on two highly researched and documented principles: 1. Information-intensive and awareness building campaigns, which utilize media advertising and printed materials, are able to enhance knowledge and create supportive attitudes, but have little or no impact on behaviors. 2. Economic motives have little to no effect on changing behaviors to be sustainable (McKenzie-Mohr, 2011). It is in this light that CBSM was developed to identify people's current behaviors and work backwards to select a particular tactic suited to augment that behavior (McKenzie-Mohr, 2011). Research shows that the CBSM approach has successfully bridged the gap from pro-environmental knowledge to sustainable action, and has characterized many local and regional sustainability projects to date (Kollmuss & Agyeman, 2002). These projects range from sustainable fisheries development (Thompson M. H., 2008) to good housekeeping practices among auto repair shops (Berg, 2008). The CBSM process has also been successfully implemented in the field of waste reduction, including recycling and composting campaigns (Einsiedel & Morrison, 2008; Haldeman & Turner, 2009).

The CBSM approach consists of 5 distinct steps: 1. Behavior selection, 2. Barrier and benefit identification, 3. Behavior change strategy development, 4. Strategy piloting, and 5. Broad-scale strategy implementation and evaluation. The following sections provide an explanation of each step, highlighting the importance of each step in the development of a successful behavioral change campaign.

Step 1: Behavior Selection

Selecting the appropriate behavior is vital in developing an effective behavioral change campaign. According to a 2010 report by the City of Townsville, Queensland, Australia, it showed that 241 specific behaviors exist that could have varying impacts on home energy usage (Hargroves, Desha, & Reeve, 2010). These identified behaviors are known as “end-state, non-divisible”, meaning that the selected behavior produces the desired environmental outcome, and cannot be divided into further sub-actions. CBSM specifies that three factors should be evaluated when selecting the appropriate behavior for the behavior change campaign. These factors are the environmental impact of the behavior, the likelihood of behavior implementation by the target audience, and the degree to which the behavior has already been adopted. These factors are known as the impact, probability, and penetration (McKenzie-Mohr, 2011).

Step 2: Barrier and Benefit Identification

Once the targeted behavior has been selected for the behavior change campaign, the specific barriers and benefits to performing that behavior must be determined. It is important to evaluate the specific barriers and benefits to each behavior, because even related behaviors, such as waste reduction and waste recycling, have been discovered to have significantly different barriers to overcome (Ebreo & Vining, 2001). Four steps are proposed for uncovering the barriers and benefits to the specific behavior: Literature review, Observations, Focus Groups, and Surveys. When the behavior in question does not permit focus groups or surveys, or when financial resources are not available, the focus groups and surveys can be substituted with intercept surveys. Intercept surveys consist of two questions: What makes it difficult or challenging for you to do [the specific behavior]?, and what do you see as beneficial or rewarding about doing [the specific behavior]? (McKenzie-Mohr, 2011). Intercept surveys have

been effectively used in situations where the target audience is a transient occupant, such as litterers and waste disposers in suburban and urban outdoor environments (Bator, Bryan, & Schultz, 2011).

Step 3: Behavior Change Strategy Development

The identified barrier and benefit data to the desired sustainable behavior should be used in two ways: to reduce the barriers and increase the benefits of the desired behavior, while simultaneously increasing the barriers and reducing the benefits of the opposite behavior. In order to accomplish this task, CBSM has compiled a list of effective behavior change tools that can be used to encourage the benefits and discourage the barriers when developing a behavioral change initiative. These tools have been well documented in the psychology literature, and include: gaining commitment (Abrahamse, Steg, Vlek, & Rothengatter, 2005; Artz & Cooke, 2007), social norms (Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007; Berg, 2008), social diffusion (Dahle & Neumayer, 2001), utilizing prompts (Artz & Cooke, 2007; Duffy & Verges, 2009), effective messaging (Dillahun, Becker, Mankoff, & Kraut, 2008; Dahle & Neumayer, 2001), incentives (Pucher & Buehler, 2008), and convenience (Shaheen, Guzman, & Zhang, 2010). These tools, depending on the specific barriers and benefits, can be augmented to fit the specific waste diversion needs. For example, if low motivation exists to engage in the sustainable behavior, commitment or incentive strategies may be used to enhance the appeal of the sustainable behavior (McKenzie-Mohr, 2000b). These tools vary depending on the barrier or benefit, but one common theme to strategy development is that direct and frequent personal contact is necessary in order to carry out an effective behavioral change strategy (McKenzie-Mohr, 2011).

Step 4: Strategy Piloting

Piloting the strategies should be considered the test run before broad-scale implementation. Piloting allows strategy developers an opportunity to address problems before launching the community-wide campaign. Through this process, problems in the strategy implementation are fixed before they become more difficult or expensive to correct. Piloting also allows for small-scale evaluation of the strategy's impact. This is accomplished by comparing the results of the implemented strategy against a control group. Piloting can also allow two strategies to be compared and tested against each other to see which one is more effective at encouraging sustainable behavioral change (McKenzie-Mohr, 2011).

Step 5: Broad-scale Strategy Implementation and Evaluation

Broad-scale strategy implementation is the final step of CBSM. At this point, piloting has demonstrated that the strategies can bring substantial sustainable behavior change. Constant evaluation of the strategy should be conducted in order to track the program's effectiveness. Actual observations or reliable records, such as water meter readings or waste audit values, should be used as opposed to self-reports or opinions. This ongoing evaluation allows strategy developers to detect behavior disengagement among the target population, and make revisions to the strategy to counter them (McKenzie-Mohr, 2011).

Shortcomings of Previous Waste Audit and Waste Reduction Initiatives

As previously discussed, the CBSM process has been widely used in a variety of sustainable behavior change campaigns. Many examples of successfully implemented waste audits exist; occurring across the governmental, institutional, and commercial sectors. A waste audit has the potential to pair very well with the CBSM process in that an annual waste audit

partially fulfills the requirements of Step 1: Identifying Behaviors, and Step 5: Broad-scale implementation and Evaluation. Despite potential collaboration, there seems to be a lack of research and literature connecting behavioral change initiatives, such as CBSM, with waste characterization studies utilizing waste audits. Most waste reduction studies that use a waste audit as a means of characterizing the waste stream do not utilize an occupant behavioral change tool to foster improvement in landfill diversion rates.

One reason for this rift between waste audit studies and behavior change campaigns is that some waste audit studies simply do not attempt to develop waste diversion strategies in the first place. For example, a waste audit study conducted at the University of British Columbia was used to test the accuracy of waste sampling and extrapolation over time and space, with the overall aim to determine whether the proposed waste audit methodology generated accurate results. (Felder, Petrell, & Duff, 2001). Another reason is that many waste audit studies focus on other aspects of the waste stream other than waste reduction. Two audits, one conducted at a medical center and the other at ten separate dental offices, sought to identify improvements to the current disposal methods of hazardous and dangerous materials. These audits, while important in terms of human health, did not attempt to address strategies for reducing the amount of generated waste from entering the landfill (Farmer, et al., 1997; Mohee, 2005).

The vast majority of waste audit studies are conducted, however, to develop landfill waste diversion strategies. These strategies frequently falter because they are based on incomplete data. This is primarily due to the fact that their initiatives rely solely on the results of the waste audit and do not attempt to systematically identify the barriers and benefits to creating sustainable behavioral change. As previously discussed, waste audits only provide information as to the categories and locations that present the greatest opportunity for landfill diversion

improvements. The development of a waste reduction work plans that neglect to identify the current barriers to waste disposal can lead to incomplete or misguided findings (Dahle & Neumayer, 2001). Furthermore, many waste audit studies offer waste diversion strategies without validating the strategies with a second, post waste stream analysis. These waste audit studies, while providing valuable insight into the make-up of the current waste stream, fall short on offering scientifically sound waste diversion strategies.

McCartney's (2003) study involving an analysis of a golf course's waste stream is a good example of the shortcomings of many waste diversion analyses. This study preformed a waste audit following the activity area approach outlined in CCME. This approach provided a successful waste audit, and results were used not only to identify areas of landfill diversion improvements, but also suggested strategies to achieve the needed waste diversion improvements. These strategies, such as "placing recycle bins ... with appropriate information signage" (p. 295) in the clubhouse and maintenance yard to promote aluminum can recycling are speculation at best, due to the lack of behavioral knowledge of the location type occupants. To compound the situation, no implementation or validation of the recommended strategies were conducted because a second waste stream audit was beyond the scope of the study.

Many times, successful, psychologically-based strategies can be implemented based solely on the results of the waste audit alone. While successful, these strategies were not developed based on the unique needs and characteristics of the organization, but were put in place arbitrarily. For the Atomic Energy of Canada Limited (AECL) Company, located in Manitoba, Canada, this seemed to be the case. Between 1995 and 1996, AECL preformed two waste audits, one to create a baseline of current waste diversion rates, and a second to test and validate the success of the employed strategies. These strategies, which relied upon the direction

and enthusiasm of their Go Green team, were centered on communication, educational materials, and general involvement with all employees at the facility. At the conclusion of the implemented initiatives, the second waste audit revealed that the AECL facility was able to increase its recycling rate in from 3% in 1995 to 71% in 1996. This massive recycling rate increase was associated to an increase in the types of materials accepted for recycling, employee awareness and participation in recycling efforts, and an increase in recycling bins throughout the facility. It should be noted that, due to the success of this waste reduction initiative, the implemented strategies were cited by the researcher that they could be used for some locations of similar make-up, but not necessary for all (Dowie, McCartney, & Tamm, 1998).

While the previous waste reduction initiative was hugely successful, there was no apparent justification for the implementation of the waste reduction strategies. Similarly to the AECL waste reduction study, a study conducted by Smyth et al. (2010) examined waste disposal types and quantities at the University of Northern British Columbia (UNBC), and suggested possible strategies for waste minimization efforts based on the results of a waste stream audit. The waste stream audit identified paper products, single use beverage containers, and compost as the three types of waste which present the greatest opportunity for landfill reduction. The strategies that were suggested, such as an education and awareness campaign targeted at informing people of the tie between paper and trees, were created based on speculation, not on the researched needs of the UNBC community.

Some waste reduction studies identify that occupant behaviors play a key role in developing waste reduction strategies, but do not implement a structured behavioral change identification approach such as CBSM. A study by Zhang, et al. (2011) is one such example which provides a case study analysis of a University-wide, multi-year sustainable waste

management campaign. This campaign, lasting over 15 years, has drastically improved landfill waste diversion rates. Strategies, such as the development of a Waste Management Team in 2004, to the creation of a sustainable purchasing policy in 2006, were effective at reducing waste at the source. Other strategies, however, such as student e-mails containing sustainable waste management information, were less effective. Zhang concluded that “there is a lack of research on behavioral change interventions targeting transient groups, such as University students” (p. 1614).

Waste reduction efforts taking place on university campuses may be the most applicable to the waste reduction initiative at RMNP due to their similar attributes. These similar attributes include a large size, large population, various complex activities taking place, and the presence of transient groups, (ie: students and park visitors, respectively) (Zhang, Williams, Kemp, & Smith, 2011). Overall, these examples underscore the lack of applied waste disposal behavior change research conducted in collaboration with waste audits and landfill diversion initiatives. Furthermore, as noted by Zhang et al, there is a specific lack of research focusing sustainable behavior change within transient populations (such as RMNP visitors), making the need for a waste reduction initiative targeting behavioral change at RMNP all the more pressing.

CHAPTER III

RESEARCH DESIGN AND METHODOLOGY

This sequential mixed methods study follows the CBSM approach to target waste reduction efforts in RMNP (Figure 1). Four phases define this research: (1) the initial waste audit and behavior selection (quantitative), (2) barrier and benefit identification (qualitative), (3) behavior change strategy development (qualitative), and (4) strategy piloting and evaluation (quantitative). The qualitative steps form the focal point of this research and represent the dominant method of data collection. This methodological approach to the study was adapted from research conducted by Johnson and Onwuegbuzie (2004) on mixed method studies. Defined by Johnson and Onwuegbuzie as “the class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study” (p. 17), this study seeks to utilize aspects from both research paradigms to form the methodology. The following sections detail and define the methodology for the study, discussing the four phases of the study and how the 5-step CBSM approach is integrated into the phases. This study received an “exempt” status by Internal Review Board. See Appendix A for IRB approval letter.

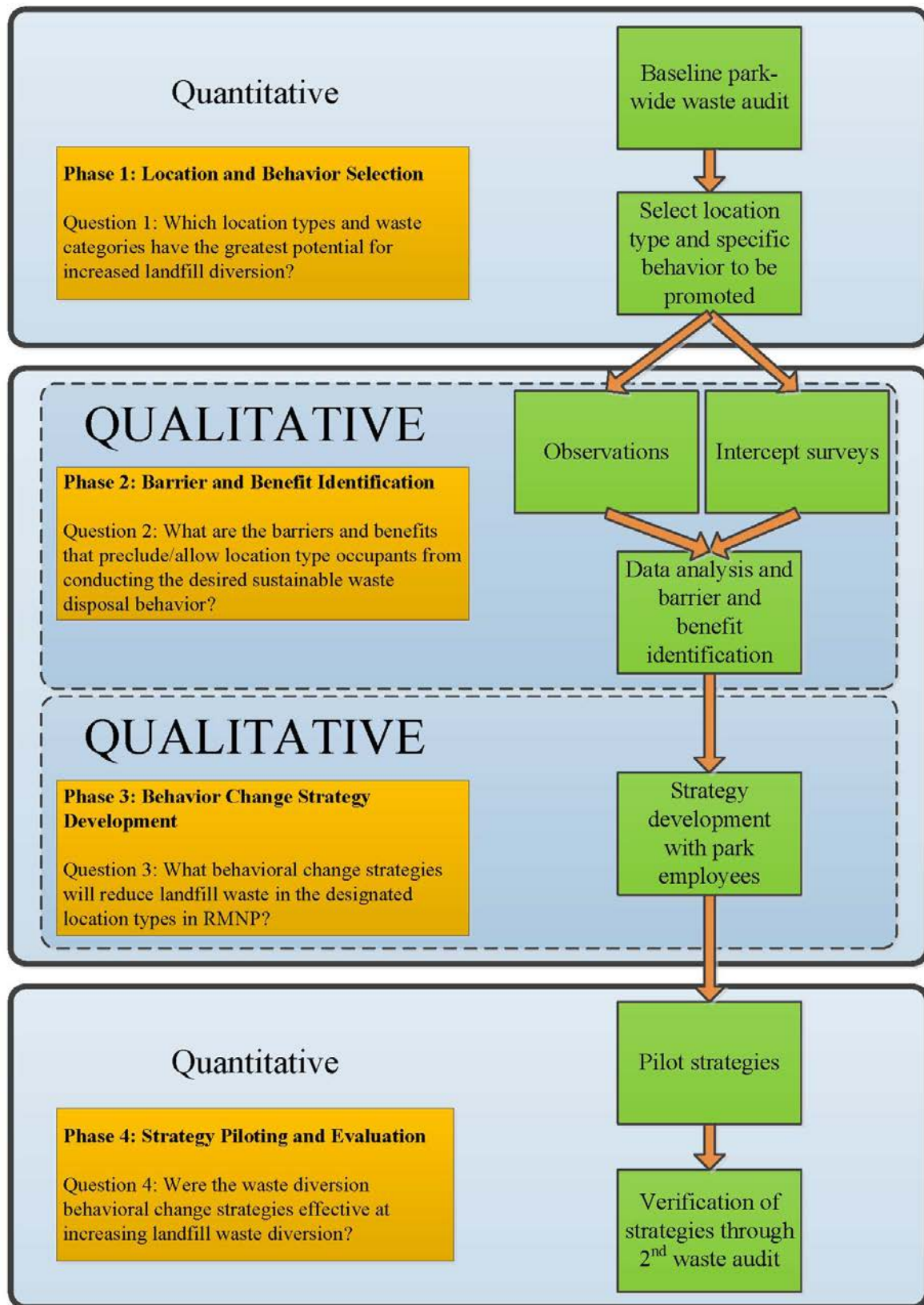


Figure 1. Flow chart of research phases

Phase 1: Location and Behavior Selection

The first step of CBSM is the selection of the desired behavior to be promoted (McKenzie-Mohr, 2011). In the context of this study, this step identifies the location type and waste category with the greatest potential to impact RMNP's landfill diversion rate and the location that will benefit the greatest from a waste diversion behavioral change initiative. As previously discussed in the literature review, selection of this behavior is determined by the environmental impact of the behavior, the likelihood of behavior implementation by the target audience, and the degree to which the behavior has already been adopted. In order to identify this behavior in the context of RMNP landfill waste diversion, a park wide waste audit, consisting of 8 location types and 6 waste categories, was conducted to determine the specific location types and waste categories with the poorest diversion rates.

Upon identification of these location types and waste categories, hauled waste quantities were compared from each location type to determine the potential overall impact of a behavioral change initiative. Following the CBSM methodology for behavior selection, the location type with the overall highest potential for landfill diversion was selected and used for the following behavioral change initiative. In order to present the methodological approach in the future steps, the location and waste category was determined to be Family Campgrounds and general recycling. Moraine Park Campground was selected as the specific location for the study, since it is the largest, most waste productive campground within RMNP.

Phase 2: Barrier and Benefit Identification

Step 2 of the CBSM approach consists of identifying the barriers and benefits that inhibit and motivate people to conduct landfill diversion activities within the selected location type (McKenzie-Mohr, 2011). In order to identify these barriers and benefits, observations and intercept surveys were conducted. This aspect of the research was qualitative in design, allowing the researcher to explore a host of potential barriers and benefits to emerge throughout the course of the research. Since recycling in Moraine Park Campground was selected as the behavior change initiative, the specific approach to conducting observations and intercept surveys was tailored to meet the needs of that specific site.

Observations

Observing people's waste disposal behaviors within the location type is an important first step in determining the barriers and benefits to sustainable waste disposal (McKenzie-Mohr, 2011). It allows the researcher a first-hand experience with the participants, providing the opportunity to record unusual and useful information as it occurs (Creswell, 2009). In conducting these observations, the researcher recorded all waste disposal actions and sub-actions, identifying the actions/sub-actions that may pose a barrier or a benefit. Within Moraine Park Campground, field note observations were conducted of the campsite layout, waste generation and collection at the campsite, transportation of waste to the disposal area, and final waste disposal.

The researcher did not directly communicate or interact with the park visitors. There was no personal information recorded, and no documented identifiable features of the park visitors. Observations were conducted at different times of the day, with at least one set of observations

occurring in the morning and afternoon. Observations were conducted until a general observational trend was established and saturation had been reached. Each observational session lasted at least one (1) hour and no longer than three (3) hours, with a maximum of six (6) observational sessions in total. These recordings were coded and sorted based on similarity of observation, and used in part to develop the landfill diversion strategies.

Intercept Surveys

Intercept surveys are useful when researchers have little time to interact with participants (McKenzie-Mohr, 2011). In a setting such as Rocky Mountain National Park, where park visitors and employees may not be eager or able to offer much of their time, intercept surveys offered a great alternative to longer, drawn out surveys, interviews and/or focus groups. Intercept surveys involve asking two questions to the participants which seek to identify the barriers and benefits to performing the desired sustainable activity. For the purposes of developing recycling strategies in Moraine Park campground, two questions were asked. These were:

1. What makes it difficult or challenging for you to recycle in the park?
2. What do you see as beneficial or rewarding about recycling in the park?

Similar to the observations, intercept surveys were conducted at varying times of the day. Survey participants were purposefully selected in that only visitors who were using the waste disposal facilities were approached for the survey (Creswell, 2009). The only demographic information was the participant's gender, age, and home zip code. Responses were manually recorded via note taking at the time of the survey using a data collection form (Appendix B). Responses were recorded as accurately as possible, making sure to record the general theme of

each response. All survey respondents were over 18 years of age, with informed consent being granted after a verbal introduction and explanation of the research project had been explained. See Appendix C for a copy of the verbal introduction script and Appendix D for the handout explaining the purpose of the research. A target goal was to conduct approximately 30 intercept surveys, with no more than 50 within Moraine Park campground, with greater or fewer surveys being conducted depending on the variability of the survey responses. All survey responses were later coded and sorted based on similarity of response. Upon completion of the observations and intercept surveys, analysis of the data was required to identify and prioritize the discovered barriers and benefits. Multiple qualitative data analysis methods were utilized in order to validate that the appropriate barriers and benefits were identified. Data analysis results are presented in Chapter 4.

Phase 3: Behavior Change Strategy Development

Once the barriers and benefits were identified, social marketing strategies were employed to remove the barriers and enhance the benefits (McKenzie-Mohr, 2011). As discussed in the literature review, many strategies have been identified in the environmental psychology literature in order to accomplish this goal. An iterative and collaborative approach to strategy development was conducted involving the researcher and park management in order to develop the most appropriate and feasible strategies to employ. The collaborative nature of strategy development between the researcher and park management led to greater commitment and buy-in to the recommended strategies.

Phase 4: Strategy Piloting and Evaluation

Strategy piloting occurred in the summer 2012. Based on park management capacity, a selected group of the recommended strategies was adopted and implemented by campground management and Park Interpretive Rangers. The researcher assisted with strategy piloting, but the implementation of the selected strategies was ultimately the responsibility of Moraine Park Campground management.

The success of the piloted strategies was determined based on the results of the second waste audit in the summer of 2012. This waste audit attempted to identically follow the procedure of the 2011 waste audit, and the successfulness of the implemented behavioral change strategies was based upon the degree to which landfill diversion was improved. For comparison, a second RMNP campground that did not pilot the developed recycling strategies was also audited in 2012. This control group was needed in order to ensure that a change in waste diversion amounts was based on the implemented strategies and not an outside environmental factor.

CHAPTER IV

FINDINGS AND DATA ANALYSIS

The overall approach to the findings and data analysis utilize the steps of the CBSM methodology. Below are the results from each step of this process.

2011 Waste Audit

The first component of the study was to determine the appropriate location type and waste category for the behavior change initiative. This was largely accomplished through the successful implementation of a park-wide waste audit. Based on Canadian Council Ministers of the Environment (CCME) *Waste Audit User's Manual* (1996) and interviews with waste audit experts as a guide, the activities area approach was selected as the auditing method. The 2011 waste audit took place in one (1) day on Sunday, August 7th, 2011, auditing waste that was generated primarily from the previous weekend day. The audit lasted one day due to wildlife interaction concerns. A summer weekend day was selected for the waste audit because summer weekends are the peak season for RMNP, representing the largest quantities of waste generated in the park. Auditing waste on August 7th, 2011 best represented an “average” and busy summer day based on park management experience.

The selection of the location types were determined by RMNP facilities managers as places that had the greatest potential for landfill diversion improvements based on their prior observations. Locations that were not audited were locations managed by concessionaires, such

as Visitor Centers. The specific locations that were audited were selected due to their good representation of their correlative location type. A total of eight location types were audited at nine different park locations (Table 1). Various quantities were collected from each location type, with the goal of auditing 1-2 cubic yards of waste from each location type.

Table 1

Location, location type, and volume of waste to be collected

Location	Location Type	Volume Collection goal, cubic yards (cy)
Sprague Lake	Picnic Area	2 cy
Glacier Basin	Group Campground	2 cy
Glacier Basin	Family Campground	2 cy
Park Roadside	Roadside	2 cy
Long Lake	Trailhead	1 cy
Alluvial Fan	Trailhead	1 cy
Mills Road	Year-round Residential	1 cy
Sundance	Seasonal Residential	1 cy
Auto Shop	Employee Workspace	2 cy

The volume of waste collected at each location was determined based on 2 factors: the number of volunteers working at the waste audit, and the speed at which a certain number of volunteers can audit one unit of waste. According to discussions with waste audit experts, 4-6 beginner volunteers can audit roughly eight cubic yards of trash in an eight-hour day.

Furthermore, one cubic yard of waste should provide an adequate representation of the waste stream, and that any additional audited waste is extra (Bachum, 2011). Based on these facts, and due to the fact that the waste audit must be completed in one day with a pre-determined group number of 20 volunteers, a conservative amount of 14 cubic yards of waste was the targeted amount of waste to be audited. When divided between the different location types, 2 cubic yards of waste was collected and audited for each location type except for ‘seasonal residential’ and ‘year-round residential’. Only one cubic yard was collected and audited for these two locations due to resource limitations.

During the waste audit, waste was sorted into the following 6 categories:

1. General Recycling
2. Compost
3. Plastic Water Bottle (specific recyclable material)
4. Paperboard/Cardboard (specific recyclable material)
5. Other (includes batteries, fuel canisters, electronics, and other hazardous or undetermined, non-landfill disposable waste)
6. Trash

RMNP facilities management determined these waste categories as waste types of interest for landfill diversion purposes.

Quantitative Waste Audit Results and Location/Waste Type Selection

In total, 1,736 pounds and approximately 24.4 cubic yards of waste was audited as a part of a larger waste stream analysis project of RMNP's waste stream (Wackerman, Dale, & Plaut, 2011). The results of this waste audit were summarized in an unpublished report submitted to RMNP. Overall, the results show that all location types have potential to improve landfill diversion rates through either increased recycling and/or composting. For the purposes of this behavior change research study, Park management requested that visitor use location types were studied as opposed to employee use location types. This is partially due to the fact that approximately 3 million visitors visit the park, while only 500 employees work in the park.



Figure 2. 2011 Waste audit location and site layout

Based on the 2011 waste audit results, the next step was to select the waste category and location type for the behavioral change initiative. Looking into the specific waste categories, compost consisted of 30% of the Park's total waste stream by weight, offering significant opportunity to improve the Park's landfill diversion rate. Despite this potential significant impact, composting is currently not an option in RMNP due to implementation and infrastructural constraints. Because of this limitation, composting was not considered as a viable waste category for the behavioral change study.

The audited recyclable waste categories were: General Recycling, Plastic Water Bottles, and Paperboard/Cardboard, also making up a significant proportion of the park's landfill waste. The materials in these categories include: aluminum, steel, plastic (#1-7), glass, paperboard and corrugated cardboard. All of these materials, except for paperboard and cardboard, are collected and recycled at all of the location types audited. Paperboard and cardboard represent 5% of the overall waste stream by weight, but there are no immediate plans to begin collecting this material

in RMNP visitor use area location types. The other recyclable materials, which are referred to as comingled recyclables, account for 22% of the Park's landfill waste stream by weight. These comingled recyclable materials present a viable opportunity to increase park landfill diversion efforts and were selected as the waste category to increase park landfill diversion rates. Based on the 2011 waste audit findings, the location types with the greatest potential to increase comingled recycling rates were Group Campgrounds, Family Campgrounds and Trailheads. The percentage of comingled recyclables found in the waste stream by weight at these location types were 28%, 26%, and 23%, respectively (Wackerman, Dale, & Plaut, 2011).

As discussed, Group Campgrounds yielded a slightly higher percentage of waste that could have been recycled than either Family Campgrounds or Trailheads. In terms of total waste produced, Family Campgrounds produced at least five times as much waste as Group Campgrounds and Trailheads during the peak season of May to September (Soviak K. , 2011). Based on these factors, the Family Campground location type was determined to have the highest potential to divert the greatest amount of comingled recyclables from the waste stream. Comingled recycling in the Family Campground location type was therefore selected to be the research focus for the behavioral change intervention initiative.

In addition, the Family and Group Campground location types operate in overlapping locations and settings, consisting of nearly identical user groups (i.e. overnight campers). Even though the behavioral change intervention initiative targeted Family Campground users, it was impossible to keep Group Campground users from experiencing many of the behavioral change strategies. For this reason, results from the second waste audit for both the Group and Family Campground location types were evaluated for strategy effectiveness, even though the strategies

were developed exclusively based on the barriers and benefits discovered for the Family Campground users.

Selection of Moraine Park Campground

Moraine Park Campground was selected as the location to implement a recycling behavioral change initiative in RMNP for a variety of reasons. Moraine Park Campground consists of 245 total campsites and is open year round, making it the largest family campground in RMNP. Due to its large size, at least five, 10 cubic yard dumpsters are filled up and hauled out each week during the peak summer season, (Soviak K. , 2011). It is located along Bear Lake Road and contains hook up facilities for both RV and tent campers. Its relatively low elevation of 8,160 ft. allows for a longer summer camping season than other campgrounds in the Park. Moraine Park Campground was selected because of its overall size and extended length of summertime camping season, allowing more time for a detailed assessment of the current waste disposal and recycling behaviors.

The intent of this study is to identify waste diversion strategies that are successful in Moraine Park Campground that can ultimately be applied to the other campgrounds within RMNP and beyond. Even though Moraine Park is not the specific campground that was audited for the Family Campground location type, park experts believe occupant disposal behaviors are identical. The specific location that was audited in the 2011 waste audit was not a viable choice to conduct the behavioral change intervention because it was closed during the 2012 summer season due to nearby road construction.

Identifying Barriers and Benefits to Recycling in Moraine Park Campground

In order to fully understand the complex factors and variables associated with waste disposal at the Moraine Park Campground, waste disposal site observations, campsite observations, visitor waste disposal behavior observations, and intercept surveys were conducted. These observations and intercept surveys were used to identify the barriers and benefits to recycling in the park campgrounds.

Observations

Waste Disposal Site Area Observations

The waste disposal areas in Moraine Park Campground consist of four separate disposal areas scattered throughout the campground. Each area contains one, 10 cubic yard trash dumpster and two recycling receptacles, each containing three, 39 gallon trash bins inside. These recycling receptacles are roughly 1/20th the size of the trash dumpsters (figure 2). The only exception to this waste disposal layout is the waste disposal area closest to the entrance gate, which contains two, 10 cubic yard dumpsters, two recycling receptacles and one propane fuel canister depository. Generally speaking, the recycling receptacle bins at the waste disposal areas are easily accessible and visible from the road, while the trash bins are set back. The recycling receptacles, however, only allow deposit from one side, whereas the trash dumpsters allow deposit from two. Complete site area observations are located in Appendix E.

Below is a more detailed description of the various waste disposal receptacles found in the Moraine Park Campground:

- 10 cubic yard dumpster: The 10 cubic yard dumpster is a full metal roll-off style dumpster painted light green and positioned in the waste disposal area to be easily accessed from the road. They have 2-3 bear proof hatch-type doors on either side of the dumpster. In large green letters, “TRASH” is written on both sides in the center of the dumpster, with the lettering measuring approximately 5 inches in height.
- Recycling receptacle: The recycling receptacle is approximately 4’ wide, 3’ tall and 2’ deep. It is colored dark green with yellow recycling triangles painted on the side. It has three holes for disposal of recyclables with the two side holes measure 4” x 4” and the middle hole measures 4” x 6”. The three holes drop into three separate 39 gallon plastic waste bin. The three holes all have the same message printed out on white label-making tape: “Cans-Glass-Plastic” is written below the hole, and “No Trash” is written above on all three holes. Further above the hole there is an official marking denoting recycling. In a larger font size, this label says “Glass, #1 & #2 Plastics, Cans”. All three holes have a thick plastic slotted material to allow recyclables to pass through, but restrict unobstructed access into the bin.
- Propane fuel canister depository: The propane fuel canister depository measures approximately 2’ wide, 3’ tall and 2’ deep. The depository is full metal and painted light green. It contains a bear proof lid on top of the receptacle, along with a side door hatch.



Figure 3. Moraine Park Campground waste disposal area including 10 yard dumpster and recycling receptacle

Campsite Observations

Campsites represent the origin of waste generation and initial sorting within Moraine Park Campground. A description of the campsites are therefore necessary in order to understand the waste disposal process within the campground. Unsurprisingly, each campsite has some kind of vehicle, either a car, RV, or a pop-up trailer in which to sleep. If the camper's vehicle cannot accommodate sleeping, at least one usually large tent is set up on site. At many campsites, a tent-like canopy is set up over the picnic table for sun and/or rain protection. The focal point of most campsites is the picnic table, where the preparation and eating of food occurs. A trash bag is usually within close proximity to the picnic table, which is most often tied to either a nearby tree branch, tent pole, or actually to the picnic table itself by campers. It was observed that many campers would allow trash to accumulate throughout the evening and dinner, requiring trash collection to occur after the completion of dinner, but before dark. Bicycles are also common at

the campsites, especially if children are present. Complete campsite observations are found in Appendix F.

Waste Disposal Observations and Analysis

In total, 91 waste disposal observations were conducted over the course of a three-week period from August 14th to September 5th, 2011. These observations generally occurred in the mid-morning and late evening when waste disposal activity was greatest. The first set of observations consisted of detailed narratives, describing every single waste disposal action and sub-action. These observations were conducted in order to understand the general trends and commonly occurring waste disposal behaviors among campers. 19 of these observations were recorded, providing insight into the types of decisions and actions campers make when disposing waste. These observational narratives are provided in Appendix G. Once the common waste disposal trends and behaviors were established, a decision modeling tree was developed to map all waste disposal behaviors and sub-behaviors that were conducted (Figure 3).

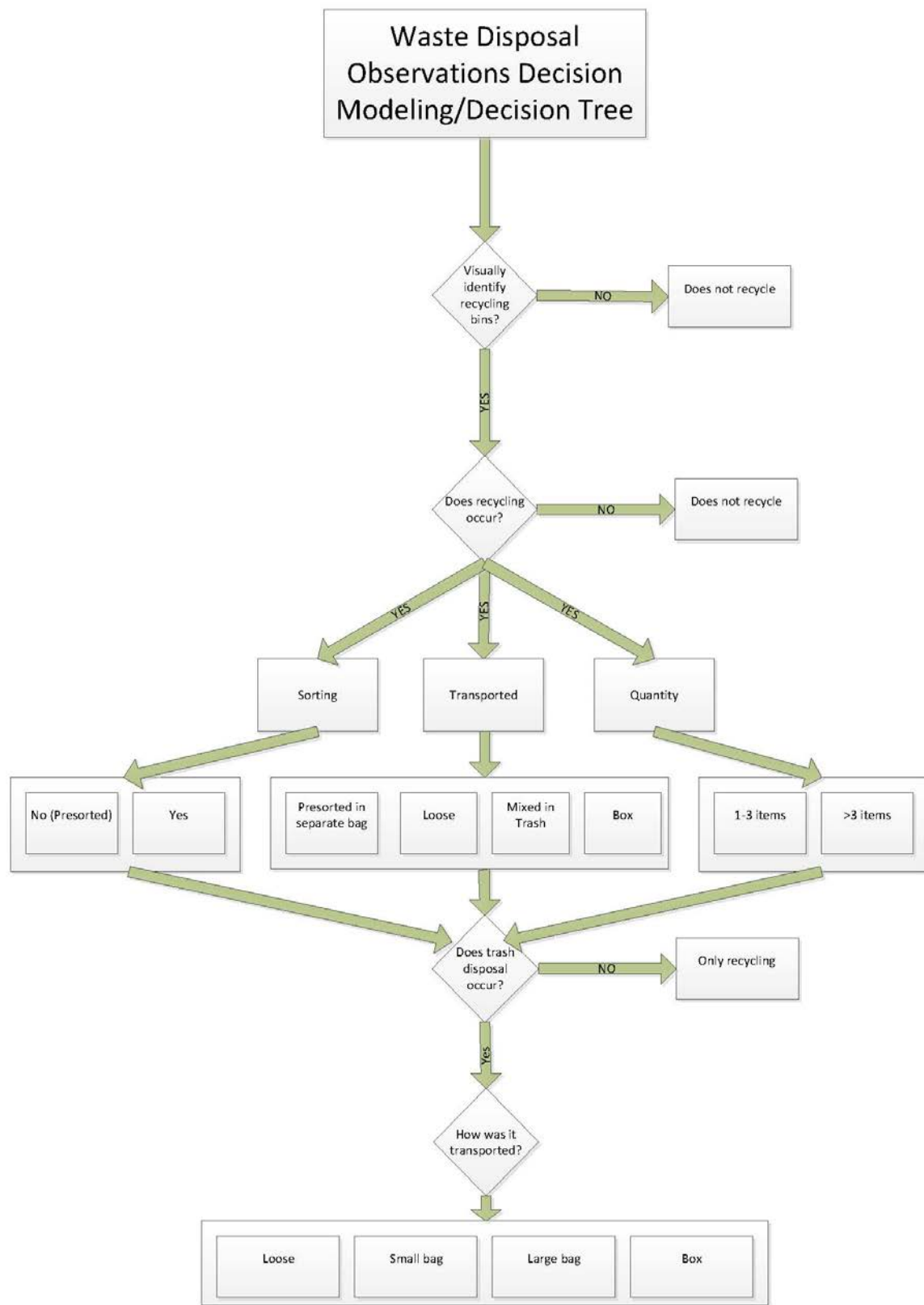


Figure 4. Observational Decision Tree model

Based on the detailed recycling observational narratives and the subsequent decision tree, an observational checklist was created to easily document the waste disposal decisions that occurred. This checklist allowed for easy documentation of all waste disposal actions. These categories include:

- Date, time, number of people, approximate age(s) and gender(s) of waste disposers (classification observations).
- Mode of transportation to waste disposal area. (walk, drive, bicycle)
- Were the recycling bins visually identified as a potential waste disposal method? (Yes/No)
- Did recycling occur? (Yes/No)
- If yes, how the recycling was transported? (Separate bag, loose, mixed in trash, box)
- If yes, did any sorting occur at the recycling bins? (Yes/No)
- If yes, what was the estimated quantity and type of recycling? (# and type of items recycled)
- What was the way in which waste was disposed? (loose, small bag, large bag, box)
- Other interesting comments or observations.

After the initial 19 detailed observational narratives, 72 waste disposal events were observed and recorded using the established observational checklist. These observations took place over the course of 4 separate visits. Appendix H presents the populated pre-determined observational checklist. Analysis of the results reveals that approximately 70% of the campground visitors transported their waste by walking it to the waste collection sites. Most of

these waste disposers were either alone or in a group of two people. Waste disposers were generally over 30 years of age, consisting of a fairly equal mix of males and females.

Further analysis shows that only 24 of the 72 waste disposers recorded using the observational checklist visually identified the recycling bins as a potential way to dispose of their waste. From these 24 recycling receptacle observations, 22 of them, or 31% of the waste disposal observations, actually led to recycling. Out of these recyclers, over 50% transported their recycling loose in their hands, meaning that people were only able to recycle what they could carry loosely in their hands. This observation was corroborated in that 66% of the recycling quantities recorded consisted of only 1-3 recyclable items. These items included things like aluminum cans, and glass and plastic bottles. Additionally, only 14% of the recycling campers sorted their recycling at the recycling receptacle itself, meaning that most campers who recycled sorted their recyclables before approaching the waste disposal area. A majority of the campers (17 of 22 recyclers) using the recycling bin also disposed of trash as well. Almost all (85%) of the trash was transported to the dumpster in either a large kitchen plastic bag or small grocery store plastic bag. Occasionally trash was transported loosely to the dumpster.

To summarize the data, the average waste disposing camper was over 30, who walked to the waste disposal area alone. Most of the people who use the recycling bins are already aware that recycling is an option and come with their recycling pre-sorted. These visitors generally recycle an amount they can carry in their hands, adding up to no more than 3 bottles or cans. While recycling this small amount of waste, these visitors also generally carry a small or large plastic bag full of trash. This difference between recycling and trash transport to the waste disposal area illuminates one of the many potential barriers to recycling in the park.

Intercept Surveys

In addition to waste generation and disposal observations, intercept surveys were conducted to evaluate the perceived barriers and benefits to recycling in Moraine Park Campground. Over the course of 4 separate visits to the campground, 63 intercept surveys were conducted. Intercept surveys were initiated with people who were using the waste disposal facilities in the campground. Each intercept survey lasted no more than 5 minutes, consisting of a variety of short answer and open ended questions. See Appendix B for the intercept survey form.

The short answer questions gathered basic, non-identifying information. This information included:

- Age
- Gender
- Home zip code
- Whether they had recycled in the park? (Yes/No)
- Observation: Whether they recycled in that specific waste receptacle visit? (Yes/No)

Two open-ended questions were also asked which were used to identify the barriers and benefits to recycling in the park campgrounds. These questions were developed using the CBSM approach to conducting intercept survey. Below are the two questions:

1. What makes it difficult or challenging for you to recycle in the park?
2. What do you see as beneficial or rewarding about recycling in the park?

Analyses of the short answer questions reveal similar findings to the observational data. Findings include that the majority of the waste disposers were at least 40 years old and that males and females were equally represented. Furthermore, and also in accordance with the observational data, slightly less than one-third of the respondents recycled at the time of the intercept survey; however 73% of the interviews claimed that they had recycled in the park over the entire length of their visit in the park. Lastly, according to the home zip code responses, over 50% of the visitors were from Colorado, with 6% of the respondents being from outside of the USA.

Two separate data analysis methods were used to analyze the barrier and benefit data: Template Analysis and Constant Comparison Analysis. It should be noted that many of the responses contain multiple barriers and benefits. Furthermore, many responders to the barriers first cited that there were no barriers to recycling, but when further questioned, they were able to develop barriers. For example, many campers' knee-jerk reaction to recycling was that it is very easy, but upon further reflection, many were able to realize some fairly large barriers.

Template Analysis

Below is the coding for the barrier and benefit responses using the Template Analysis method, where second level coding emerged once the templates were populated. Template Analysis is used to thematically analyze and categorize qualitative interview data by coding identified themes and organizing them in a meaningful and useful manner (King, 2007). Hierarchical coding is emphasized, whereas broad themes encompass progressively smaller ones. Data analysis usually begins with *priori* codes used to identify themes that are strongly expected to be relevant to the analysis (King, 2007).

Table 2

Template Analysis: Barriers to recycling

Barriers to Recycling in Moraine Park Campground:		Number of intercept survey responses
Convenience		37
	Space and time for sorting	15
	Distance: Proximity and accessibility to recycling receptacles	16
	Practice: Does not recycle at home	3
	Facilities: Constraints by the actual recycling receptacles	3
Materials		13
	Paper/paperboard/cardboard	9
	Propane cylinders	4
Awareness		19
	Visibility: Did not see recycling bin	6
	Lack of information: Did not know about recycling	9
	Signage lacking: Inappropriate signage on bins	4
Easy, No barrier		23

Table 3

Template Analysis: Benefits to recycling

Benefits to Recycling in Moraine Park Campground:		Number of intercept survey responses
Environmental		56
	General: Generally good for the environment	18
	Landfill: Keeps waste out of landfill	12
	Clean: Keeps park clean	10
	Resources: Resource efficiency	8
	Connection to place: Connection to RMNP	8
Social Reasons		17
	Social pressure/duty: Commitment to community at large	8
	Future Generations: Recycle for our children	6
	Environmental messaging: Represents Park's commitment	3
Habit		10
	Recycling outside of park: Recycling at home	10
Negative reaction to recycling		2

Constant Comparison Analysis

The main goal of a Constant Comparison data analysis is to develop a theory that is grounded in the empirical world (Boeije, 2002). A constant comparison begins by creating preliminary categories or codes according to their conceptual context, and then compared with each other to create higher level, secondary codes. These first and second order codes should be repeated several times until no new meaning is extracted. This inductive process of pattern

discovery is meant to yield analytic or abstract meaning from real world data (Boeije, 2002; Glaser, Barney, & Strauss, 1967). Below is the finalized coding for the barrier and benefit responses using the Constant Comparison data analysis method. Three coding levels were developed to create these codes.

Table 4

Constant Comparison Analysis: Barriers to recycling

Barriers to Recycling in Moraine Park Campground:	Number of intercept survey responses
Awareness: Knowledge of benefits and options to recycle	18
Inconvenient: Physical limitations of the site	18
Commitment: Personal Limitations to find purpose	18
Specific Materials: Paper products and fuel canisters	12
No barrier: Find no barriers	17

Table 5

Constant Comparison Analysis: Benefits to recycling

Benefits to Recycling in Moraine Park Campground:	Number of intercept survey responses
Environmental: Resource and material reuse, less pollution, waste reduction, energy	25
Instinctual/Habit: Recycle at home, recycle here	11
Human Benefits: Cleanliness, convenience, saves money	10
Generally good to do: Very Ambiguous. Sometimes the environment is mentioned	9
Duty: For our children, for saving resources, for decreasing landfill waste	7
Location-based: Connection to place/ RMNP	7
Apprehension about recycling benefits	2

The combination of the Template Analysis and Constant Comparison Analysis was accomplished through the use of a taxonomy. A taxonomy is a classification system used to organize and inventory data into section and sub-sections. Taxonomies can take the form of box diagrams, lines and nodes, or outlines, and is a useful data reduction tool (Spradley, 1979).

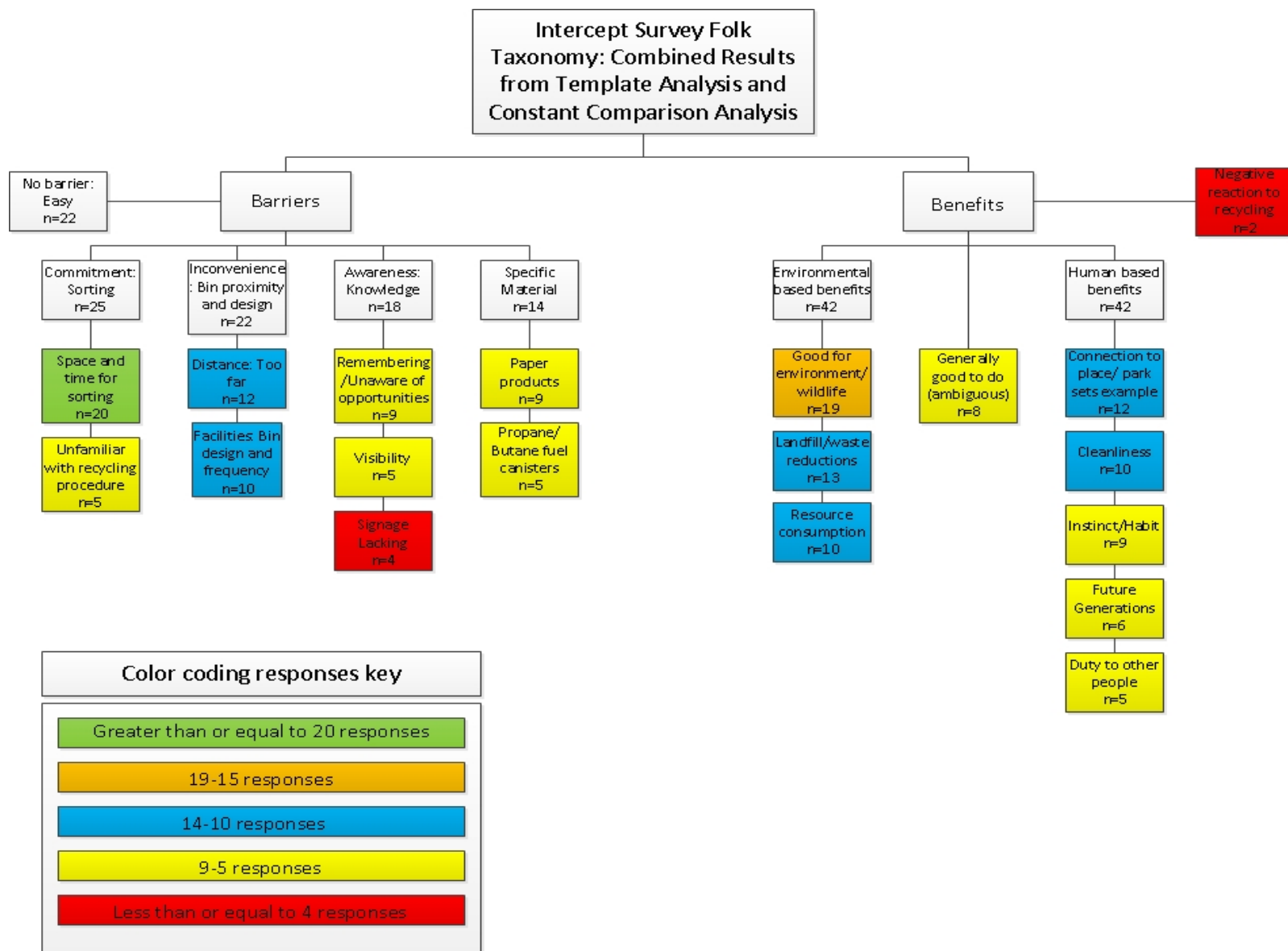


Figure 5. Intercept Survey results depicted in Folk Taxonomy

Barrier and Benefit Findings

Based on the results of the intercept surveys, awareness, convenience, and commitment were identified as the main barriers to recycling in Moraine Park Campground. Examples of such barriers include: visibility and knowledge of the recycling receptacles, method of waste transportation, space for sorting of the materials, and distance of the recycling bins. According to related literature, the first and most significant barrier to be managed is awareness (Kostakis & Sardianou, 2012; Louise, Hunter, & Sutton, 2011). If campers are not aware of recycling options, the impact of convenience and commitment become less relevant. Furthermore, it seems that commitment is frequently tied to awareness or convenience. If either awareness and/or convenience are met, commitment can determine if the sustainable action is performed. However, strategies tackling commitment first, such as signing a pledge, can also lead to increased awareness. This shows that these three categories are intrinsically interrelated and strategies simultaneously addressing all three barriers should be prioritized.

The benefits data was more difficult to code and analyze due to the ambiguity of many the responses. The data suggests that campers lacked a clear understanding as to why they actually recycled, but most believed that recycling was an important behavior. Based on the responses, it was unclear whether people recycled for the benefit of people, for the environment, for the park environment specifically, or all of the above. Generally speaking, most of the camper's responses had an environmental leaning. For example, recycling was cited as important to "save the environment" for the sake of the plants, animals, climate, and for future generations. Campers also made the connection between recycling and the beauty of RMNP. Campers essentially believed that recycling was the right thing to do, especially in the park. This finding is reinforced in that 73% of campers responded that they have recycled in the park,

proving that they perceive a benefit to recycling. Below are the tabulated barriers and benefits to recycling in Moraine Park Campground based on the intercept survey responses.

Table 6.

Final coded barriers to recycling in Moraine Park Campground

Barriers to Recycling in Moraine Park Campground:		# of intercept survey responses
Commitment		25
	Space and time for sorting	20
	Procedural unfamiliarity	5
Inconvenience		22
	Distance: too far	12
	Facilities: bin design and frequency	10
Awareness		18
	Remembering/unaware or opportunities	9
	Visibility	5
	Signage lacking	4
Specific Materials		14
	Paper products	9
	Propane/butane fuel canisters	5
***No barrier	Could not think of a barrier	22

***12 of the “No Barrier” responses were eventually also able to cite a barrier or potential barrier upon further reflection.

Table 7.

Final coded benefits to recycling in Moraine Park Campground

Benefits to Recycling in Moraine Park Campground:		# of intercept survey responses
Environmental-based reasons		42
	Good for environment/wildlife	19
	Landfill/waste reduction	13
	Resource use reduction	10
Human-based reasons		42
	Connection to place/Park sets example	12
	Cleanliness	10
	Instinct/Habit	9
	Future generations	6
	Duty	5
Generally good to do (ambiguous)		8
Negative reaction to recycling		2

These identified barriers and benefits to recycling in RMNP were used in concert with the observational findings to help develop a range of waste reduction strategies. These barriers were

used to help determine the type of strategy selected (ie: increased amount of recycling receptacles, sorting facilities at the campsite), while the identified benefits were used to create motivation to adopt the waste reduction behavior (McKenzie-Mohr, CBSM introductory workshop, 2011). As an example, a cited barrier to recycling was a lack of awareness of the available recycling opportunities. Behavior change tools such as gaining commitments, social norms, prompts through signs and stickers, and social diffusion by Rangers are possible behavior change tools that could be used to address a lack of recycling awareness. The benefits data subsequently framed the delivery of the strategies by highlighting the beauty of the park, discussing how we need to save our natural resources for future generations and that since you recycle at home, you should also recycle here. In this way, the barrier and benefit data was utilized in different ways, but both were vital for successful strategy development.

The coded barriers and benefits to recycling were put into context through the observational findings. Observations such as the method of waste transport and quantity of recyclables discarded were vital in understanding the current state of recycling in Moraine Park Campground. Combining the intercept survey results with the observational findings created a complete picture of the recycling conditions in the campground, preparing the researcher to make higher quality strategies tailored to the specific needs of Moraine Park Campground campers.

Strategy Development

The overall objective of strategy development was to utilize the coded barriers and benefits, while integrating the important observational findings, to develop specifically targeted recycling strategies in Moraine Park Campground. The results of the intercept surveys showed that most campers (all but 2) were aware of, and could cite a benefit to recycling, however the

observational findings showed that recycling only occurred 31% of all waste disposal visits in Moraine Park Campground. This discrepancy between recycling attitudes and behaviors shows that behavior change strategies to promote recycling adoption were needed, not increased education about the value of recycling. CBSM behavior change tools, such as commitment and prompts, were used as the foundation upon which the strategies were formed. These behavior change tools are presented in the CBSM book Fostering Sustainable Behavior (2011). The overall aim of the developed strategies was to create an integrative and multi-dimensional recycling initiative, responding to the unique and diverse needs of campers in Moraine Park Campground.

Development of the recycling strategies was conducted in an iterative, collaborative process between the researcher and RMNP employees. Throughout this iterative process, potential strategies were developed based on the established observations and intercept surveys, and subsequently presented to park management. While the park accepted most of these strategies, some strategies were not approved. One such strategy was the installation of recycling and trash bag hooks into the campsite picnic tables. While the purpose of this strategy was to provide a location for the collection of recyclables at the campsite, park management was concerned that bears could be attracted to the hung bags, creating a hazard to humans and wildlife alike. While this strategy was developed based on the research findings, it was ultimately not one of the suggested strategies due to park management disapproval.

The purpose for taking this collaborative approach with park management during strategy development was to create strategies that would be accepted by RMNP employees, in turn establishing employee buy-in and commitment. Careful attention was made to develop strategies that addressed the specifically identified barrier to recycling in RMNP campgrounds.

Furthermore, the identified benefits were used in conjunction with the CBSM behavioral change tools to create motivation for recycling. The finalized recommended strategies are presented below:

Strategy #1: Entrance gate commitment and recycling receptacle

Barrier Addressed: Commitment to sorting and procedural unfamiliarity

CBSM Tools: Commitment, Social Diffusion, Communication, Prompts, Convenience

Description: While the camper is checking in, the ranger will introduce the Park's recycling campaign (see the script below). Upon receiving a verbal commitment to recycle, the ranger will give a reusable recycling bag for the visitor to use to sort their recyclables throughout their stay. This action makes the commitment visual and durable. The recycling bag or receptacle will have recycling instructions printed on the side, along with a reminder flyer detailing proper waste disposal and management at the campsite. On the reverse side of the flyer a brief Exit Survey will be provided, asking campers to rate the effectiveness of each strategy. These surveys will be collected at the Ranger kiosk upon campground departure.

Ranger 30 second script: "Rocky Mountain NP is seeking to improve recycling rates in order to help preserve and protect our land, save the environment for our children, and keep the park clean and clear of litter. We would like to offer you a reusable recycling bag so you can sort your recyclables at the campsite. Can we count on you to commit to recycling in the park?"

Strategy #2: After dinner/before evening program recycling pick up

Barrier Addressed: Inconvenience to recycling due to distance

CBSM Tools: Convenience, Social Norms, Prompts

Description: Before evening program, but after dinner (8:00PM-8:30PM), a park ranger or camp host will pick up recycling from campsites while conducting their evening campground rove. This time has been observed to be when most campers dispose of their waste. This strategy requires buy-in and support from campground management, but will hopefully prove to drastically increase the convenience of recycling, while simultaneously increasing the barriers to trash disposal. This recycling pick up time will be advertised upon visitor campground entry and through the multiple prompts discussed below.

Strategy #3: Develop and implement a Jr. Ranger and evening program about recycling

Barrier Addressed: Commitment and awareness

CBSM Tools: Prompts, Social Diffusion, Norms, Communication

Description: The Jr. Ranger and evening programs will include the positive reasons and importance of recycling and proper recycling procedure. The program will also incorporate examples of difficult to recyclable items, art projects utilizing recyclables, and other creative components. A prompt sticker will be provided to participants showcasing their commitment to recycling. These programs will increase awareness of the recycling program in the park and the importance of recycling.

Strategy #4: Prompting through multiple media avenues

Barrier Addressed: Lack of awareness and knowledge of recycling opportunities

CBSM Tools: Prompts

Description: Prompts are an effective method to remind and encourage the desired sustainable action. Recycling prompts will be provided in a variety of settings and transmitted through multiple mediums. Below are the potential methods for conveying the recycling message:

- Small plaques at campsite affixed to picnic table: Reminders at the campsite that we recycle in ROMO.
 - Reusable water bottle stickers: These stickers will highlight the unique qualities of the Rocky Mountain drinking water. Slogans like “Better than bottled” or “Direct from the source” should be used to show that the water is safe and healthy for humans and the environment.
 - Podcasts and online information: Podcasts developed by local high school students detailing the importance of recycling. The podcasts will be posted online along with other recycling information (ie: one page brochure) at the location where campsites are reserved.
 - Recycling prompts broadcast on Visitor Center televisions behind information booths.
 - Recycling prompts posted in shuttle buses.
 - Reminder on trash dumpsters for recycling: The above prompts should utilize Injunctive Social Norming like “We recycle in Rocky Mountain NP” with a pictorial representation of a person using the recycling bin.
 - Update the campground map to accurately reflect and emphasize recycling opportunities.
 - Recruit Park volunteers to encourage campground recycling by assisting at the waste disposal areas. Their presence on high traffic days and times (midday and afternoon on weekends) will provide excellent prompts and social diffusion to recycle.
-

A few of these strategies required collaboration with the RMNP graphic design team.

These strategies included the design of the reusable recycling bag graphic and the design of the Jr. Ranger/Evening Program water bottle stickers. The purpose of the reusable recycling bag graphic was to convey a positive, injunctive social norm message, combined with a memorable,

and easy to read recycling slogan. The graphic also contains a durable and visual commitment to recycling by the camper. The goal of this graphic was to create a consistent RMNP recycling slogan that could potentially be used in future recycling messaging throughout park. The reusable recycling bags were used as a part of Strategy #1 implementation. Figure 6 shows the final RMNP reusable recycling bag graphic that was screen-printed on the recycling bag. This logo is unique to RMNP, highlighting Longs Peak which is silhouetted in the background.



Figure 6. Reusable recycling bag logo

The Jr. Ranger/Evening Program reusable water bottle sticker was another logo collaboratively designed with the RMNP graphic design team. The intent of this logo was to create a connection between RMNP and the camper, highlighting the purity and quality of the tap water in the Park. Similarly to the reusable recycling bag logo, the water bottle logo also utilizes injunctive social norm messaging and is place-based for RMNP, containing the same silhouette

of Longs Peak in the background. This sticker was designed to be placed on visitor's reusable water bottles, or anywhere else visitors may see it, further utilizing the behavior change tool of social norms. Figure 7 shows the final sticker disseminated as a part of Strategies #3 and #4: the Jr. Ranger/Evening Programs and prompts:



Figure 7. Jr. Ranger/Evening Program reusable water bottle sticker

Pre-Strategy Implementation

Pre-strategy implementation began in the early summer 2012 with Moraine Park Campground management. Beginning May 20th, the research initiative and specific strategies were presented to campground employees at summer seasonal employee training. Campground Rangers were generally excited and supportive about the research, but voiced concern that recycling bins are already overflowing and that promoting recycling any further will exacerbate the overflow problem. They also expressed concern with Strategy #2 implementation, citing that

their busy summer evening obligations would preclude spending up to 1 hour collecting recycling from individual campsites. The Campground manager assured that they would try the best they could with implementing all of the strategies before and during the 2012 waste audit.

In addition to the research methodology, a 1-page exit survey was developed to evaluate the effectiveness of certain components of each implemented strategy. In the survey, campers were asked to rank a pre-selected list of strategies from 1 to 5, whereas a 1 is an unhelpful strategy and a 5 is a helpful strategy. Survey questions were determined based on significant factors associated with the strategies, including implementation costs and employee time commitments. The survey asked campers to rank the following components of the developed strategies:

- Entrance Gate Recycling Commitment
- Recycling Bag Handout
- Water Bottle Sticker
- Evening Program and/or Jr. Ranger Program
- Campsite Recycling Pick-up
- Recycling Signage Reminders
- In which areas did you see recycling reminders? (please circle)
 - Visitor Center
 - Bus Shuttle
 - Park Website

The purpose of the exit survey is to help inform Park management as to which strategies were the most or least effective at influencing recycling behavior change. Furthermore, it can

help inform management whether to continue supporting strategies that require additional funding. Dissemination of the exit survey was conducted as a part of Strategy #1, printed on the reverse side of the recycling flyer. Collection of the survey took place upon camper checkout at the Ranger kiosk. The survey did not record personally identifying information and was submitted to IRB for approval. IRB approved the survey and the “Exempt” research status was retained. See Appendix I for the 1-page recycling exit survey.

Strategy Implementation

Implementation of the various strategies began at least 1 week prior to the 2012 waste audit. Strategy implementation took place among both the Family and Group Campground location types. Implementation of the strategies required the cooperation of the Campground and Interpretive Rangers. Overall, strategy implementation was conducted with varying success: Some of the strategies were implemented accurately, some of the strategies were implemented erratically, and some of the strategies were not implemented at all.

Strategy #3 was the only strategy that was implemented accurately. The recycling-focused Jr. Ranger program was developed based on the EPA Recycling Lesson Plan website (US EPA, 2011) and was very well received. The evening programs were successfully conducted by park Interpretive Rangers, where the programs were able to generate many questions and discussion among park visitors. At both the Jr. Ranger and Evening programs, reusable water bottle stickers were distributed and “were a big hit” (Brown K. , 2012) by all park visitors.

Strategy #1 was implemented successfully, but on an erratic basis. Strategy #1 implementation began approximately 1 week before the 2012 waste audit. The researcher

conducted two separate visits to observe the implementation of this strategy. During the first visit, the Campground Ranger at the entrance kiosk was observed to be successfully and accurately implementing the strategy. Excited and animated, he handed out the recycling bags and introduced the campground's recycling initiative in the park. During the second visit, a different Campground Ranger implementing Strategy #1 neglected to distribute the recycling bag and discuss the recycling initiative to campers entering the campground. This lack of strategy implementation continued until the Ranger was reminded to do so by a supervisor. These two observational examples highlight the inconsistency of strategy implementation, and the vulnerability of successful strategy implementation based on individual Ranger commitment and buy-in to the strategy.

Strategy #4 was also partially successful, in that only some of the prompts were implemented. These successfully implemented prompts include: Reusable water bottle sticker distribution, Visitor Center recycling prompts, shuttle bus prompts, an updated Moraine Park Campground map reflecting recycling opportunities, and a Park Ranger presence in the campground on key high traffic days to encourage recycling participation. The prompts that were not implemented were: Campsite recycling plaques, on-line podcasts, and recycling reminders on dumpsters.

Strategy #2 was not implemented at all during the summer of 2012. Discussions with campground management after the passing of the strategy implementation period highlighted a lack of personnel and/or time to implement the strategy. In addition, the pre-established campsite recycling pick-up timing did not work well for the campground Ranger's schedules (Mays, 2012). Even though this time was agreed upon with input from campground

management, the implementation of Strategy #2 was not made a priority by campground Rangers, and was ultimately not feasible.

2012 Waste Audit Results

The second waste audit took place July 15th, 2012, identically following the 2011 waste audit protocol. The 2012 waste type categories, location types, length of audit, method of auditing, and approximate waste quantity collected remained as consistent as possible to the 2011 audit. One addition to the 2012 waste audit was the addition of Aspen Glen Family Campground to the location types audited. Aspen Glen Campground did not receive the recycling treatment of the behavior change strategies and therefore acted as a control group to test for external influences to campers recycling behaviors beyond the bounds of the Moraine Park recycling initiative. Aspen Glen campers did have equal opportunity to be exposed to Visitor Center and shuttle bus recycling prompts as the Moraine Park Campground campers.

Specific to comingled recycling (the General Recycling and Plastic Bottle waste categories) in the Family and Group Campground location types, recyclable materials found in the trash waste stream *decreased* in 2012 from the 2011 waste audit results. The Family Campground location type went from 26% to 20% recyclables by weight, and the Group Campground went from 28% to 9% comingled recyclables by weight. The Aspen Glen Family Campground control group consisted of 24% comingled recycling in the waste stream. Waste audit volunteers categorizing the waste stream noted that many of the recovered recyclable items were collected into one small plastic bag for disposal. See Figure 8 for a graphical representation of the Comingled Recyclables results by weight for the Family and Ground Campground location types audited, comparing the 2011 and 2012 results.

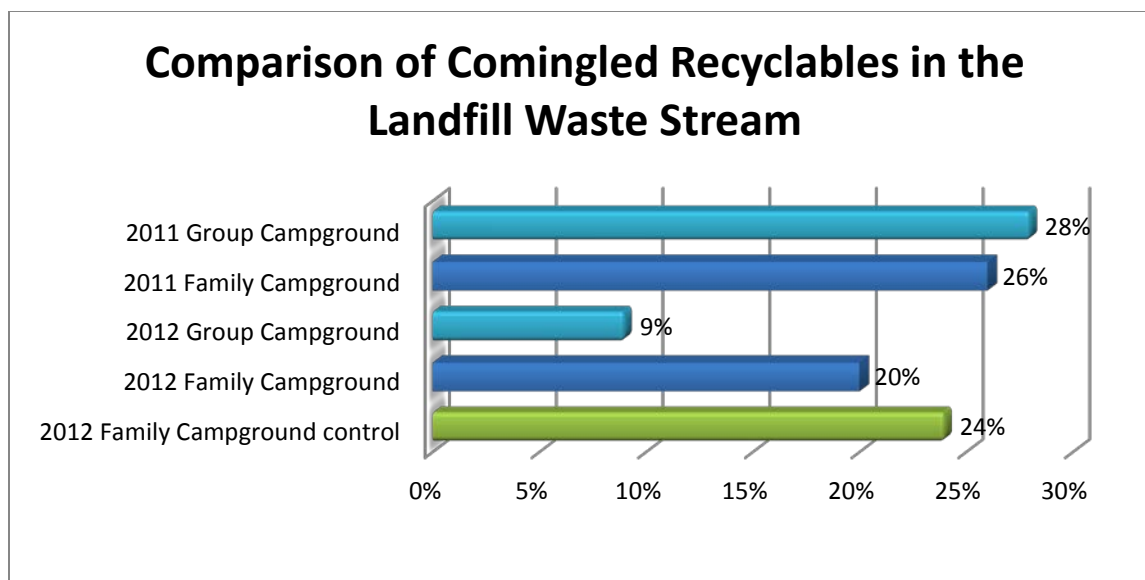


Figure 8. Comparison of comingled recyclables in the landfill waste stream

Exit Survey Results

94 exit surveys were completed and returned during the weeklong implementation of Strategy #1. The exit survey question addressing the effectiveness of “Campsite Recycling Pick-up” was discarded due to the fact that this strategy was not implemented. The two questions with the highest response rate and highest approval rating were both a part of Strategy #1. The strategy “Recycling Bag Handout” was responded to 100% (n=94) of the time, averaging a rating of 4.7 out of 5 points possible. “Entrance Gate Commitment” was responded to 93% (n=87) of the time, averaging a slightly higher rating of 4.8 out of 5 points possible. “Recycling Signage Reminders” and “Evening Program and/or Jr. Ranger Program” each averaged a rating of 4.4 out of 5 possible points, but “Recycling Signage Reminders” were responded to 80% (n=75) of the time whereas “Evening Program and/or Jr. Ranger Program” were only responded to 41% (n=39) of the time. Of the 75 “Recycling Signage Reminders” respondents, 49% responded that they saw recycling reminders at the Visitor Center, while 16% cited the Bus Shuttle, and only 8% cited the Park Website. 27% of respondents did not specify where they saw recycling signage

reminders. Lastly, “Water Bottle Sticker” had the lowest response rate of 29% (n=27) and the lowest rating of 4.0 out of 5. Even though it was not asked, it should be noted that some of the surveys included longhand notes from the survey responders. Five of these longhand responses requested the collection of paper products, along with the other comingled recyclables.

Discussion of the Results

The 2012 Waste Audit and Exit Surveys present a variety of results. Based on a comparison of the 2011 to 2012 waste audits, the 2012 Family and Group Campground location types decreased the amount of comingled recyclables found in the landfill waste stream. The Family and Group Campground location types decreased recyclables in the overall waste stream by 6 and 19 percentage points, respectively, while the control site decreased recyclables by only 2 percentage points. This reduction equates to a 23% increase in the amount of recyclables diverted from the waste stream in the Family Campground location type, 68% increase in recyclable diversion in the Group Campground location type, while only an 8% increase in recyclable diversion in the control Family Campground location. See Table 8 for comingled recyclables decrease and reduction percentages.

Table 8

Comingled recyclables decrease and reduction percentages

	% Point Reduction from 2011 Waste Audit	% Decrease from 2011 Waste Audit
Family Campground	6%	23%
Group Campground	19%	68%
Family Campground Control	2%	8%

These results suggest that the behavior change strategies implemented park-wide (the Visitor Center and shuttle bus signage) may have positively impacted recycling disposal rates, but the strategies implemented exclusively at the Moraine Park Family and Group Campgrounds

had an even greater contribution at decreasing recyclables in the landfill waste stream, as compared to the control site. These varied reductions in recyclables show that the Group Campground disposal patterns may be more volatile than those of the Family Campground's due to the number of individuals per site in the Group Campground. This suggests that augmenting the behaviors of a few key campers may influence Group Campground recycling rates, whereas Family Campground groups are relatively small, necessitating the influence on many campers to affect the overall recycling rates of the Family Campground location type. Given the limitations of the data collection, statistical significance of the reduction of comingled recyclables in the waste stream is not possible to conclude. With additional years of data collection, establishing significance may be possible.

Assessment of the Exit Survey allows for the ordering of the implemented strategies based on two factors: the response frequency and the ranking of the strategy component. The response frequency determines the reach and awareness of the strategy by the camper, and the ranking determines the effectiveness of the strategy, as perceived by the camper. The exit survey results suggest both components of Strategy #1: "Entrance Gate Commitment" and "Recycling Bag Handout" were the two best components of the strategies implemented, having the largest reach and effectiveness on camper recycling behaviors. These were identified because they received the greatest number of responses and highest average ranking, as compared to the other survey questions. These results suggest that Strategy #1 should continue to be implemented in Park campgrounds to encourage recycling participation among campers, despite the associated bag purchasing costs. If it is not possible to continue purchasing reusable recycling bags for distribution, these results suggest that the Ranger should still introduce the recycling initiative to the camper and request a verbal commitment to recycle throughout their stay.

The overarching success of this strategy seems to be due to its simultaneous use of many of the behavior change tools presented in the book Fostering Sustainable Behavior (2011). First, the direct Ranger-camper interaction upon entry into the campground utilizes social diffusion, by delivering a message from a well-known and well-respected member of the park community. Second, the Ranger asks for a verbal commitment by the camper to recycle, coinciding with the distribution of a durable reusable prompt, which included injunctive normative messaging screen printed on the side. Lastly, the inclusion of a recycling flyer and exit survey acted as a prompt at the campsite, reminding campers to recycle throughout their visit.

“Recycling Signage Reminders” is the third best component of the strategies implemented, in that it tied “Evening/Jr. Ranger Program” in terms of strategy effectiveness, but almost doubled its response rate. Almost half of the “Recycling Signage Reminders” respondents cited that they saw reminders to recycle at the Visitor Center, suggesting that this is the best location (out of those listed) to reach the greatest amount of campers with recycling reminders. These results suggest that recycling signage reminders should be continued at the Visitor Centers and broadened to other locations within the campground, including the campground entrances, campsites, and the waste disposal areas. The Evening and Jr. Ranger programs should also be continued, with an added emphasis on expanding participant recruitment through prompts in various locations.

Lastly, the strategy “Water Bottle Sticker” dissemination is the lowest effective strategy, in that it had the lowest strategy ranking and response rate. If park management chooses to facilitate evening and Jr. Ranger programs, water bottle stickers should only be considered if an external funding source is available to assist with the additional purchasing costs.

A certain amount of uncontrollable bias exists with the response number and ranking for the questions “Entrance Gate Commitment” and “Recycling Bag Handout”. This is because the survey was disseminated as a part of Strategy #1, therefore people who were aware of Strategy #1 implementation were also aware and committed to complete and return the survey. This bias does not mean Strategy #1 was not effective, but it should be considered when deciding which strategies to implement in future years.

Observations from the 2012 waste audit and Ranger-camper interaction observations shed light on the effectiveness of the strategy implementation and general Ranger buy-in to the recycling initiative. The 2012 waste audit volunteers observed sorted bags of comingled recyclables in both the Family and Group Campground location types during the waste audit. This observation suggests that these items were sorted by campers for recycling, but were ultimately disposed of in the trash dumpster. This observation was not recorded during the 2011 waste audit (Wackerman, Dale, & Plaut, 2011). One potential reason for this observed behavior is that recycling bins were already filled to maximum capacity and not being emptied by Park employees, thus not allowing the additional volume of recyclables.

The second area of observations took place during strategy implementation, where inconsistent and erratic Park Ranger strategy implementation was observed. Furthermore, one of the strategies was not implemented at all, despite campground management involvement during strategy development. This lack of complete and successful strategy implementation negatively affected the fidelity of the strategies and tempered the reductions of recyclables in the campground landfill waste stream. These observations underscore that the potential to achieve greater reductions of recyclables in the waste stream is possible with better and more consistent Ranger and employee strategy implementation.

These observations underscore the organizational barriers facing RMNP employees that preclude them from successfully implementing the developed strategies. In order to reach the maximum potential of the developed recycling strategies, the barriers and benefits precluding and promoting waste reduction within the organizational culture of RMNP must be assessed. Once this occurs, successful implementation of the developed strategies will more likely be possible, moving the park closer to their goals of sustainable waste management.

Estimated Actual Impact and Cost Savings of the Recycling Initiative

Estimating the actual impact and cost savings of the recycling initiative helps park management determine the overall effect the recycling strategies can have throughout the park in future years. In order to do this, certain assumptions must be made from prior years data, including the quantity of waste generated, the cost of hauling, the capacity of trash dumpsters, and the extent a dumpster is filled before hauling and emptying.

RMNP's Eastside contains 4 campgrounds. These include Moraine Park, Glacier Basin, Aspen Glen and Longs Peak Campgrounds. Over the course of the 2011 summer camping season in RMNP, (May – September) 150, 10 cubic yard dumpsters were hauled to the landfill (Soviak K. , 2011). If these dumpsters are estimated to be $\frac{3}{4}$ full, this equates to 1,125 cubic yards of trash. Furthermore, each dumpster hauled to the landfill costs RMNP \$277.00, totaling \$41,550.00 of hauling fees for the summer camping season. Reducing the amount of waste by 6 to 19 percentage points (the overall % reductions of recyclables in the Family and Group Campground location types in the 2012 waste audit) removes 67.5 to 213.75 cubic yards of waste from the landfill waste stream. Removing 67.5 to 213.75 cubic yards of waste from the

landfill waste stream equates to 9 to 28.5, ¾ full dumpsters. Monetarily speaking, by removing 9 to 28.5 summertime campground dumpsters from the landfill stream, RMNP would realize a waste disposal cost savings of \$2,493.00 to \$7,894.50.

Summary of Findings

Based on the results of the 2011 waste audit and park waste quantities, Family Campgrounds, and specifically Moraine Park Campground, was identified as the location type for the recycling behavioral change initiative. In accordance with CBSM, observations of waste disposal behaviors and intercept surveys with Moraine Park Campground campers were conducted. The analysis of the intercept surveys was performed using two qualitative data analysis techniques: Template Analysis and Constant Comparison Analysis. This analysis was used to identify the barriers and benefits to recycling and waste reduction in the campground. The main recycling barriers identified for park visitors include: sorting and procedural unfamiliarity, bin proximity and design, knowledge of recycling opportunities, and a lack of specific material recycling (e.g. paper). The cited benefits to recycling in the park include: environmental benefits (i.e. waste and resource reductions), connection to place, cleanliness, and a fulfillment of individual duties to preserve the environment for future generations. Based on these results, strategies to promote recycling behaviors were developed in collaboration with Park management. Strategy development went through multiple iterations until a list of strategies were developed that were approved by the researcher and park management. These strategies utilized psychological-based behavior change tools including: visitor commitments, equipment distribution to improve recycling convenience, and increased recycling awareness and visibility through the use of social diffusion and prompts. These strategies were implemented in the summer of 2012, whereas Strategy #3 was implemented accurately, Strategies #1 and 4 were

implemented erratically, and Strategy #2 was not implemented at all. In addition, an exit survey was disseminated as a part of Strategy #1 to evaluate the effectiveness of the individual aspects of the behavior change initiative. Results from the waste audit and exit survey suggest that recycling rates improved during the summer 2012 strategy implementation period, as compared to 2011 waste audit results. Furthermore, entrance gate commitments, recycling bag distribution, and the use of signage prompts, including but not limited to Visitor Center recycling messaging, were found to have the greatest impact on camper recycling behaviors. Evaluation of the strategy implementation suggests even greater reductions of recyclables in the landfill waste stream is possible, highlighting the importance of long-term, organizational behaviors of employees at RMNP and the impact these behaviors can have on reaching visitor sustainability goals. Based on a 6 to 19 percentage point reduction of Moraine Park Campground's waste stream, all Eastside RMNP summertime campgrounds could reduce their waste by 67.5 to 213.75 cubic yards, saving the park between \$2,493.00 and \$7,894.50 in hauling and landfill tipping fees, in addition to the environmental impact savings.

CHAPTER V

SUMMARY AND CONCLUSIONS

The results from this recycling behavioral change research may assist RMNP towards achieving their goals of sustainability through increased landfill waste diversion. More broadly, these results can potentially impact other NPS and public land entities, informing facilities managers as to the method of identifying the appropriate behavior change strategies that will increase recycling adoption by park and campground visitors.

Study Findings

CBSM is a well-documented and research-based approach for creating sustainable behavior change across a variety of situations and conditions. The research conducted in Moraine Park Campground to decrease comingled recyclables in the landfill waste stream provides another successful example of fostering sustainable behavior change using CBSM.

The research found that most Moraine Park Campground campers (97%) were able to identify at least one benefit to recycling in RMNP, but only approximately 1/3 of these campers actually recycled when observed. In order to address this recycling attitude/behavior discrepancy, behavioral change recycling strategies were developed to decrease the barriers to recycling while utilizing the perceived recycling benefits as motivation. Behavior change strategies were implemented, and as a result, comingled recyclables found in the landfill waste stream decreased by 6 and 19 percentage points in the Family and Group Campground location

types, respectively. Strategies that had the greatest impact to recycling behavior change included commitments, convenience, social diffusion by Campground and Interpretive Rangers, and durable, high visibility prompts. These strategies should be considered for future park-wide campground implementation in order to increase recycling participation. The study also found that paper/paperboard/cardboard recycling is desired among campground visitors, and should also be considered in future years. This finding is based on the 2011 and 2012 waste audit findings, intercept survey responses, and exit survey results.

One unexpected finding was the importance of addressing the long-term organizational behaviors of RMNP employees along with the short-term visitor behaviors (Cotter & Schlesinger, 2008). As discussed, an accurate assessment of each strategy's effectiveness seems to have been limited due to varied levels of interest and buy-in by park Rangers for the strategies. Most of the strategies required in-depth and involved Ranger participation and support. However, reliant Ranger support was not consistently yielded. Based on these findings, it seems that a lack of organizational commitment to the strategies by RMNP employees may have impacted the results. In order for the full potential of the strategies to be realized, a stronger organizational commitment and connection throughout all park employees must be established. This unexpected finding was not a limitation of the study itself, but limited the effectiveness of the strategy implementation.

Response to the Research Questions

The four phases guiding this study provided a structure from which the research extended. These four phases were based on the CBSM approach, and were accompanied by four research questions:

1. Which location type and waste category has the greatest potential for increasing landfill diversion?

The location type selected for the behavior change study was Family Campgrounds, specifically Moraine Park Campground. The waste category selected was comingled recyclables, which included: aluminum, steel, plastic (#1-7), and glass. Paperboard and Cardboard were excluded from this category due to the fact that RMNP does not currently collect these materials at the campgrounds.

2. What are the barriers and benefits that preclude/allow location type occupants from conducting the desired sustainable waste disposal behavior?

The barriers to recycling in Moraine Park Campground included: commitment (space and time for sorting, procedural unfamiliarity); inconvenience (distance, bin design and placement); awareness (remembering / unaware of opportunities, visibility, lack of signage); and a lack of specific material recycling (paper products, fuel canisters). The benefits to recycling in Moraine Park Campground included: environmental reasons (environmental benefit, waste reduction, resource reduction); human-based reasons (connection to place, cleanliness, habit, future generations, duty); generally good to do; and two respondents provided a negative reaction to recycling. The identified barriers were used to help determine the type of strategy to be developed and applied, while the identified benefits were used as motivation for the adoption of the recycling strategy.

3. What behavioral change strategies will reduce landfill waste in the designated location type in RMNP?

Four behavior change recycling strategies were developed for Moraine Park Campground campers, each addressing and utilizing the identified barriers and benefits to recycling from the previous phase. Strategies included: camper commitments to recycle made at the campground entrance, campsite recycling pick-up to increase convenience and participation, the development of Jr. Ranger and Evening programs highlighting the importance and procedures of proper recycling, and a variety of recycling prompt placed in high visibility areas to raise recycling awareness. In order to further ease the recycling process at the campsite and to gain a stronger commitment to recycling, reusable recycling bags were distributed to campers who committed to recycling upon campground entrance. Furthermore, prompts to recycle include the distribution of reusable water bottle stickers and informational signage at key visitor use areas. These behavior change strategies were developed through the collaboration with Park and Campground management, and all strategies but the campsite recycling pick-up were implemented.

4. Based upon the results from the second waste audit, were the waste diversion behavioral change strategies effective at increasing landfill waste diversion?

Overall, the implemented behavior change strategies were effective at decreasing recyclables in the waste stream by 6 and 19 percentage points in the Family and Group Campground location types, respectively. This equates to an increased diversion of approximately $\frac{1}{4}$ and $\frac{2}{3}$ of recyclables in the Family and Group Campgrounds. These results are based on a comparison of the 2011 to 2012 waste audit percentages of comingled recyclables found in the landfill waste stream. In order to determine the effectiveness of the various components of the strategies, an exit survey was included in the methodology and disseminated

as a part of Strategy #1. This exit survey revealed the most effective strategies at affecting behavior change were entrance gate commitments coupled with the distribution of reusable recycling bags, and high visibility recycling prompts, such as Visitor Center signage. The least effective behavior change strategy was the distribution of stickers promoting the use of reusable water bottles.

Study Limitations

The goal of this study was to explore the application of CBSM to increase recycling in RMNP family campgrounds over the summer season. CBSM methodology was utilized to accomplish this task, identifying the barriers and benefits to recycling for summertime campground visitors. The results of this study are thus limited to the conditions that were researched: summertime comingled recycling in RMNP campgrounds. Adoption of the developed waste reduction strategies for locations beyond the strict conditions established for this study thus requires further analysis.

The effectiveness of each individual strategy was based on the findings of the Recycling Exit Survey, disseminated as a part of Strategy #1. Administering the survey in this method therefore only examined campers who were exposed and aware of Strategy #1, thus biasing the results towards this group of campers. Unfortunately, this method of survey distribution was the only feasible method available at the time. Future studies should aim to develop survey distribution methods that are not associated with any of the implemented strategies.

Recommendations for Future Research

In order to address the limitations of this study, multiple directions of further research are recommended. First, the CBSM methodology should be applied to other location types within the park for the purposes of developing a comprehensive park-wide recycling and waste reduction initiative. Identifying other location type's barriers and benefits to recycling would help determine the applicability and flexibility of the recommended strategies to other location types.

A second area for future research is to develop a better method of determining the impact and effectiveness of each individual strategy. By developing a method not associated with any of the implemented strategies, an unbiased understanding of the effectiveness of each recycling strategy would be realized, providing RMNP management clear direction on which strategies to implement in future years. The results from this research will also allow management to compare the impact of each strategy against the cost of strategy implementation, ultimately leading to the most efficient use of financial and human resources.

Determining the impact and effectiveness of each strategy in an unbiased method is recommended to be done in two ways: the development and implementation of a survey or brief interview unassociated with any of the implemented strategies, or the implementation and evaluation of one strategy at a time. Due to the time and financial investment needed for individual strategy implementation, the researchers suggest that the former method be used in future studies. This survey or brief interview would include the camper's awareness of each strategy and the effect each strategy had on the camper's ultimate waste disposal behavior.

Implementation of a survey or brief interview may require additional time by the researcher, but would provide clear direction about which strategies to implement in future years.

A final recommendation for future research is to evaluate and address the organizational commitment and connections within RMNP that preclude full implementation of the behavior change strategies. The current study evaluated the perceived barriers and benefits to park visitor recycling, and did not address the unique conditions and issues for park employees and management. In order for the strategies to achieve maximum potential, integrated organizational change must occur throughout all levels of the organization. By doing so, a more complete understanding of the organizational barriers limiting park employees from fully engaging in the waste reduction strategies may be realized. These barriers may include, but are not limited to: facilities/personnel limitations, confusing and contradicting directives, and disenfranchisement due to the bureaucratic nature of the National Park Service. Overall, improving the organizational commitment to the strategies could turn good strategy implementation results into even better, and long-lasting results.

Implications

Waste reduction and recycling strategies are increasingly needed as more individuals and organizations strive towards goals of sustainability. The results from this study could provide public and private campground settings valuable insight into the achievement of sustainable waste management operations. Campground types including, but are not limited to: national parks, state parks, county parks, and other private campground areas (such as KOA) can benefit from the findings of this study. More broadly, other locations containing similar visitor/employee interactions could benefit from the results of this study. Locations of this type

could include amusement parks, movie theatres, and shopping malls, as well as University campuses, where large transient populations co-exist along established long-term employees. As discussed in the Study Limitations section, the results of this study are applicable to the specific conditions of RMNP campgrounds, and implementation under different conditions should be approached with apprehension.

This study proves that CBSM can be successfully implemented in a public lands setting for the purposes of sustainable waste management. Furthermore, this study exhibits the power and impact sustainable behavior change initiatives can make to sustainable facilities management. Further and follow-up research evaluating the on-going and changing variables influencing camper behaviors will be necessary in creating targeted strategies that foster sustainable behavior into the future.

Conclusion

Landfill waste disposal presents many negative impacts, including groundwater contamination, plant and animal degradation, resource depletion, and increased levels of greenhouse gas emissions. Furthermore, as space constraints demand landfill expansion, these expansions directly conflict with our growing populations and subsequent urban boundary advance worldwide. This conflict of interest is especially relevant on growing island nations, where physical geographic barriers dictate land use expansion. Thus, the need for sustainable management of Earth's solid waste is ever increasing problem.

To respond to this waste management need, CBSM provides a framework for fostering sustainable behavior change. Individual behavior change, in aggregate, has the potential to make significant impacts, and this study tested the applicability of CBSM to RMNP campgrounds for

the purposes of increasing recycling. The successful implementation of the CBSM approach in Moraine Park Campground exemplified the opportunities and positive impacts of a behavior change initiative. This initiative addressed the unique barriers and benefits of the campground, thus improving recycling awareness and adoption among campers. These results confirm that a CBSM behavior change initiative for sustainable waste management can be successfully implemented in a National Park Service campground. These results highlight the potential impact a behavior change initiative can make towards reaching sustainability throughout all operations. More specifically, the outcome of this study emphasizes the importance of combining strategies that incorporate commitments, convenience and prompts to improve camper's recycling behaviors.

In addition to increasing recycling rates in Moraine Park Campground among campers, this study underscores the impact RMNP employees can have on visitor recycling behaviors. In order to move towards even greater sustainability in RMNP, a detailed study assessing the barriers and benefits precluding and promoting *long-term, organizational* behavior change of park employees must be conducted. While the number of employees in RMNP are far fewer than the number of visitors entering the park, affecting the cultural, long-lasting employee behaviors can lead to greater and more sustained employee buy-in and commitment to successfully implement the behavioral change strategies proposed in this paper. This study thus highlights the importance of two different types of behaviors that need to be addressed in order to realize the full extent of a behavior change initiative: short-term visitor behaviors targeting specific actions, and long-term institutional employee behaviors targeting the culture of the organization. Only once strategies addressing both types of behaviors are implemented, will a sustainable waste management initiative be able to reach its full potential.

BIBLIOGRAPHY

- Abrahamse, W., Steg, L., Vlek, C., & Rothengatter, T. (2005). A review of intervention studies aimed at household energy conservation. *Journal of Environmental Psychology, 25*, 273-291.
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*, 179-211.
- Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behaviors*. Englewood Cliffs, NJ: Prentice-Hall.
- Andreasen, A. R. (1994). Social marketing: Its definition and domain. *Journal of Public Policy & Marketing, 13* (1), 108-114.
- Artz, N., & Cooke, P. (2007). Using e-mail listservs to promote environmentally sustainable behaviors. *Journal of Marketing Communications, 13* (4), 257-276.
- Ashwood, K., Grosskopf, M., & Schneider, E. (1995). Conducting a waste audit and designing a waste reduction work plan. *CIMS Environment Conference* (pp. 133-136). Halifax, Nova Scotia: 1995 Environment Conference.
- Ashwood, K., Grosskopf, M., & Schneider, E. (1995). Conduction a waste audit and designing a waste reduction work plan. *CIMS Environment Conference* (pp. 133-136). Halifax, Nova Scotia: 1995 Environment Conference.
- Bachum, S. (2011, July 10). Waste audit protocol discussion. (E. Dale, Interviewer)

- Bai, R., & Sutanto, M. (2002). The practice and challenges of solid waste management in Singapore. *Waste Management*, 22 (5), 557-567.
- Barr, S., & Gilg, A. W. (2007). A conceptual framework for understanding and analyzing attitudes towards environmental behaviour. *Geografiska Annaler*, 89, 361-379.
- Barr, S., Gilg, A. W., & Ford, N. J. (2001). A conceptual framework for understanding and analysing attitudes towards household waste-management. *Environment and Planning*, 33 (11), 2025-2048.
- Bator, R. J., Bryan, A. D., & Schultz, P. W. (2011). Who gives a hoot?: Intercept surveys of litterers and disposers. *Environment and Behavior*, 43 (3), 295-315.
- Berg, R. (2008). Denver environmental health tries a new approach: Community-based social marketing. *Journal of Environmental Health*, 71 (5), 53-55.
- Blake, J. (1999). Overcoming the 'value-action gap' in environmental policy: Tensions between national policy and local experience. *Local Environment*, 4 (3), 257-278.
- Boeije, H. (2002). A purposeful approach to the constant comparative method in the analysis of qualitative interviews. *Quality & Quantity*, 36, 391-409.
- Bogner, J., Abdelrafie Ahmed, M., Diaz, C., Faaij, A., Gao, Q., Hashimoto, S., et al. (2007). *Waste management, in climate change 2007: Mitigation. Contribution of working group III to the fourth assessment report of the IPCC*. (B. D. Metz, P. R. Bosch, R. Dave, & L. A. Meyer, Eds.) Cambridge University Press.
- Brown, K. (2012, July 13). Strategy implementation update. (E. Dale, Interviewer)

- Brown, L. R., Chandler, W., Flavin, C., Postel, S., Starke, L., & Wolfe, E. (1984). *State of the world, 1984: A worldwatch institute report on progress toward a sustainable society*. Worldwatch Institute. New York: W. W. Norton & Company.
- CCME. (1996). *Waste audit users manual*. Canadian Council of Ministers of the Environment, Winnipeg, Manitoba, Canada.
- Chiriac, R., Carre, J., Perrodin, Y., Vaillant, H., Gasso, S., & Miele, P. (2009). Study of the dispersion of VOCs emitted by a municipal solid waste landfill. *Atmospheric Environment*, 43, 1926-1931.
- Clarke, M. J., & Maantay, J. A. (2006). Optimizing recycling in all of New York City's neighborhoods: Using GIS to develop the REAP index for improved recycling education, awareness, and participation. *Resources, Conservation and Recycling*, 46 (2), 128-148.
- Cotter, J. P., & Schlesinger, L. A. (2008, July-August). Choosing Strategies for Change. *Harvard Business Review*, pp. 130-139.
- Creswell, J. W. (2009). *Research design: Qualitative, quantitative, and mixed methods approaches*. (3rd, Ed.) Thousand Oaks, CA, USA: SAGE Publications, Inc.
- Crompton, T., & Kasser, T. (2009). *Meeting environmental challenges: The role of human identity*. World Wildlife Fund. Surrey, England: Panda House.
- Cumar, S. K., & Nagaraja, B. (2011). Environmental impact of leachate characteristics on water quality. *Environmental Monitoring and Assessment*, 178, 499-505.

- Dahle, M., & Neumayer, E. (2001). Overcoming barriers to campus greening: A survey among higher educational institutions in London, UK. *International Journal of Sustainability in Higher Education*, 2 (2), 139-160.
- Del Borghi, A., Gallo, M., & Del Borghi, M. (2009). A survey of life cycle approaches in waste management. *The International Journal of Life Cycle Management*, 14 (7), 597-610.
- Dillahunt, T., Becker, G., Mankoff, J., & Kraut, R. (2008). *Motivating environmentally sustainable behavior changes with a virtual polar bear*. Carnegie Mellon University. Pervasive 2008 Workshop.
- Dowie, W. A., McCartney, D. M., & Tamm, J. A. (1998). A case study of an institutional solid waste environmental management system. *Journal of Environmental Management*, 53 (2), 137-146.
- Duffy, S., & Verges, M. (2009). Perceptual affordances of waste containers influence recycling compliance. *Environment and Behavior*, 41 (5), 741-749.
- Ebreo, A., & Vining, J. (2001). How similar and recycling and waste reduction?: Future orientation and reasons for reducing waste as predictors of self-reported behavior. *Environment and Behavior*, 33 (3), 424-448.
- Edwards, A. R. (2005). *The sustainability revolution: Portrait of a paradigm shift*. Gabriola Island, British Columbia, Canada: New Society Publishers.
- Einsiedel, B., & Morrison, K. (2008, June). Waste wise in Calgary. *BioCycle*, pp. 32-34.
- Eisenberg, N., & Miller, P. A. (1987). The relation of empathy to prosocial and related behaviors. *Psychological Bulletin*, 101, 91-119.

- El-Fadel, M., Findikakis, A. N., & Leckie, J. O. (1997). Environmental impacts of solid waste landfilling. *Journal of Environmental Management*, 50 (1), 1-25.
- Environmental Science Associates. (2006). *Waste characterization study*. City and County of San Francisco Department of the Environment, San Francisco.
- Farmer, G. M., Stankiewicz, N., Michael, B., Wojcik, A., Lim, Y., Ivkovic, D., et al. (1997). Audit of waste collected over one week from ten dental practices. A pilot study. *Australian Dental Journal*, 42 (2), 114-117.
- Felder, M. A., Petrell, R. J., & Duff, S. J. (2001). A solid waste audit and directions for waste reduction at the University of British Columbia, Canada. *Waste Management & Research*, 19 (4), 354-365.
- Ferrier, G., Frostick, L. E., & Spajt, T. (2009). Application of geophysical monitoring techniques as aids to probabilistic risk-based management of landfill sites. *175* (4), 301-314.
- Fietkau, H., & Kessel, H. (1981). Environmental learning: Opportunities for changes in environmental awareness (translation). *Models of Experiences* .
- Glaser, Barney, G., & Strauss, A. L. (1967). *The discovery of grounded theory: Strategies for qualitative research*. Chicago: Aldine Publishing Company.
- Greater Vancouver Regional District. (1995). *Greater Vancouver regional solid waste management plan*. GVRD, Vancouver, B.C., Canada.
- Greater Vancouver Regional District. (2008). *Strategy for updating the solid waste management plan*. GVRD, Vancouver, B. C., Canada.

- Haldeman, T., & Turner, J. W. (2009). Implementing a community-based social marketing program to increase recycling. *Social Marketing Quarterly*, 15 (3), 114-127.
- Halpern, D., Bates, C., Mulgan, G., Aldridge, S., Beales, G., & Heathfield, A. (2004). *Personal responsibility and changing behaviour: The state of knowledge and its implications for public policy*. Prime Minister's Strategy Unit. Cabinet Office.
- Hargroves, K., Desha, C., & Reeve, A. (2010). *Identification and assessment of homeowner behaviours related to reducing residential energy demand: Report to the townsville CitySolar community capacity building program*. Griffith University, The Natural Edge Project, Australia.
- Jackson, T. (2005). *Motivating sustainable consumption: A review of evidence on consumer behaviour and behavioural change*. Sustainable Development Research Network.
- Johnson, R. B., & Onwuegbuzie, A. J. (2004). Mixed methods research: A research paradigm whose time has come. *Educational Researcher*, 33 (7), 14-26.
- Jung, Y., Imhoff, P., & Finsterle, S. (2011). Estimation of landfill gas generation rate and gas permeability field of refuse using inverse modeling. *Transport in Porous Media*, 90, 41-58.
- King, N. (2007, April 27). *Template analysis*. Retrieved 2011, November 9. What is template analysis?: http://www2.hud.ac.uk/hhs/research/template_analysis/whatis.htm
- Kollmuss, A., & Agyeman, J. (2002). Mind the Gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research*, 8 (3), 239-260.

- Kostakis, I., & Sardianou, E. (2012). Which factors affect the willingness of tourists to pay for renewable energy? *Renewable Energy*, 38, 169-172.
- Louise, R., Hunter, C., & Sutton, P. W. (2011). Rising to the challenge of environmental behaviour change: Developing a reflexive diary approach. *Geoforum*, 42, 720-730.
- Maqbool, F., Bhatti, Z. A., Malik, A. H., Pervez, A., & Mahmood, Q. (2011). Effect of landfill leachate on the stream water quality. *International Journal of Environmental Research and Public Health*, 5 (2), 491-500.
- Mays, M. (2012, July 15). Campground strategy implementation briefing. (E. Dale, Interviewer)
- McCartney, D. M. (2003). Auditing non-hazardous wastes from golf course operations: Moving from a waste to a sustainable framework. *Resources, Conservation and Recycling*, 37 (4), 283-300.
- McKenzie-Mohr & Associates. (2010). *Site Resources*. Retrieved August 20, 2011, from Fostering Sustainable Behavior: Community Based Social Marketing: www.cbsm.com
- McKenzie-Mohr, D. (2011, November 30). CBSM introductory workshop. Washington, DC, USA.
- McKenzie-Mohr, D. (2000a). Fostering sustainable behavior through community-based social marketing. *American Psychologist*, 55 (5), 531.
- McKenzie-Mohr, D. (2011). *Fostering sustainable behavior: An introduction to community-based social marketing* (3rd ed.). Gabriola Island, British Columbia, Canada: New Society Publishers.

- McKenzie-Mohr, D. (2000b). Promoting sustainable behavior: An introduction to community-based social marketing. *Journal of Social Issues*, 56 (3), 543-554.
- Mohee, R. (2005). Medical wastes characterisation in healthcare institutions in Mauritius. *Waste Management*, 25 (6), 575-581.
- Monroe, M. C. (2003). Two avenues for encouraging conservation behaviors. *Research in Human Ecology*, 10 (2), 113-125.
- Newhouse, N. (1991). Implications of attitude and behavior research for environmental conservation. *The Journal of Environmental Education*, 22 (1), 26-32.
- Nilsson, J., Bjuggren, C., & Frostell, B. (1998). Greening of a campus restaurant at Stockholm University: Sustainable development audits by means of the SDR methodology. *Journal of Environmental Management*, 52 (4), 307-315.
- OECD. (2011). *OECD Factbook 2011-2012*.
- Park Statistics. (2011, May 24). Retrieved July 28, 2011, from nps.gov:
<http://www.nps.gov/romo/parkmgmt/statistics/htm>
- Pucher, J., & Buehler, R. (2008). Making cycling irresistible: Lessons from the Netherlands, Denmark and Germany. *Transport News*, 28 (4), 495-528.
- Purcell, M., & Magette, W. L. (2010). Attitudes and behaviour towards waste management in the Dublin, Ireland region. *Waste Management*, 30 (10), 1997-2006.
- Reynolds, L. (2010). The sum of the parts: Can we really reduce carbon emissions through individual behaviour change? *Perspectives in Public Health*, 130 (1), 41-46.

- Rochlin, G. I. (1985, June/July). Book reviews. *Bulletin of the Atomic Scientists*, 41 (6), p. 45.
- (2011). *Rocky Mountain Facts & Figures*. Brochure, National Park Service.
- Schultz, P. W., Nolan, J. M., Cialdini, R. B., Goldstein, N. J., & Griskevicius, V. (2007). The constructive, destructive, and reconstructive power of social norms. *Psychological Science*, 18 (5), 429-434.
- Shaheen, S. A., Guzman, S., & Zhang, H. (2010). Bikesharing in Europe, the Americas, and Asia: Past, present, future. *Transportation Research Record*, 2143, 159-167.
- Smith, S., & Coskeran, T. (2006). Determinants of household recycling and waste minimisation behaviour: The case of Moulton, Northamptonshire, UK. *Journal of solid waste technology and management*, 32 (2), 71-80.
- Smyth, D. P., Fredeen, A. L., & Booth, A. L. (2010). Reducing solid waste in higher education: The first step towards 'greening' a university campus. *Resources, Conservation and Recycling*, 54 (11), 1007-1016.
- Soviak, K. (2007). *Evaluation and proposal of an expansion to RMNP's recycle program*. Rocky Mountain National Park.
- Soviak, K. (2011, July 15). Rocky Mountain National Park waste interview. (E. Dale, Interviewer)
- Soviak, K. (2011). *Waste management dumps: Fiscal year 05/10-04/11*.
- Spitfire Strategies. (2006). *Discovering the activation point*. Communications Leadership Institute.

- Spradley, J. P. (1979). *The Ethnographic Interview*. Fort Worth: Holt, Rinehart and Winston, Inc.
- Steg, L., & Vlek, C. (2009). Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of Environmental Psychology*, 29, 309-317.
- Stern, P. C. (2000). Psychology and the science of human-environment interactions. *American Psychologist*, 55 (5), 523-530.
- Tam, L. (2010, February). Toward zero waste: A look at San Francisco's model recycling policies. *Urbanist*.
- The National Park Service Organic Act. (1916). 16 U.S.C.
- Thompson, D., & Wilson, M. (1994). Environmental auditing: Theory and applications. *Environmental Management*, 18 (4), 605-615.
- Thompson, M. H. (2008). Fostering sustainable behaviours in community-based co-managed fisheries. *Marine Policy*, 32 (3), 413-420.
- Tonglet, M., Phillips, P. S., & Bates, M. P. (2004). Determining the drivers for household pro-environmental behaviour: Waste minimisation compared to recycling. *Resources, Conservation and Recycling*, 42, 27-48.
- United Nations Environmental Programme. (2010). *Waste and climate change: Global trends and strategy framework*.
- United Nations. (1987). *Report of the world commission on environment and development: Our common future*. Oxford: Oxford University Press.

- United States Environmental Protection Agency. (2010). *Municipal solid waste generation, recycling and disposal in the United States: Facts and figures for 2009*. Washington DC.
- US EPA. (2011, September 20). *Wastes- educational materials*. Retrieved July 16, 2012, from Recycling: <http://epa.gov/osw/education/quest/chapb-2.htm>
- Wackerman, A., Dale, E., & Plaut, J. (2011). *Rocky Mountain National Park waste stream analysis: Results and recommendations*. Institute for the Built Environment, Colorado State University.
- Walton, M. (2007). *What happens when every action counts*. Capacity Global, Every Action Counts.
- Zhang, N., Williams, I. D., Kemp, S., & Smith, N. F. (2011). Greening academia: Developing sustainable waste management at higher education institutions. *Waste Management*, 31 (7), 1606-1616.

Appendix A: IRB Exemption Approval Letter



Research Integrity & Compliance Review Office
Office of Vice President for Research
Fort Collins, CO 80523-2011
(970) 491-1553
FAX (970) 491-2293

DATE: August 1, 2011

TO: MaryEllen Nobe, Construction Management
Elliot Dale, Construction Management

A handwritten signature in cursive script that reads "Janell Barker".

FROM: Janell Barker, IRB Administrator
Research Integrity & Compliance Review Office

TITLE: Rocky Mountain National Park Waste Audit and Behavioral Change Intervention Program

IRB ID: 096-12H

Review Date: August 1, 2011

The Institutional Review Board (IRB) Administrator has reviewed this project and has declared the study exempt from the requirements of the human subject protections regulations as described in 45 CFR 46.101(b)(2): Research involving the use of educational tests,....survey procedures, interview procedures or observation of public behavior, unless: a) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects.

The IRB determination of exemption means that:

- **You do not need to submit an application for annual continuing review.**
- **You must carry out the research as proposed in the Exempt application**, including obtaining and documenting (signed) informed consent if stated in your application or if required by the IRB.
- **Any modification of this research should be submitted to the IRB through an email to the IRB Administrator, prior to implementing any changes**, to determine if the project still meets the Federal criteria for exemption. If it is determined that exemption is no longer warranted, then an IRB proposal will need to be submitted and approved before proceeding with data collection.
- **Please notify the IRB if any problems or complaints of the research occur.**

Please note that you must submit all research involving human participants for review by the IRB. **Only the IRB may make the determination of exemption**, even if you conduct a similar study in the future.

Appendix B: Intercept Survey Template

Moraine Park Campground Intercept Interviews:

- 1. What makes it difficult or challenging for you to recycle in the park?
- 2. What do you see as beneficial or rewarding about recycling in the park?

Barriers	Benefits	Age	Gender	Zip Code	Recycle?

Appendix C: Verbal Script for Intercept Surveys

Verbal Script for Waste Disposal Behavior Study:

Hello, my name is Elliot Dale and I am a graduate student from Colorado State University. I am conducting a study with the goal to develop waste reduction strategies that can be used to increase landfill diversion rates in the park. Do you have a few minutes to answer two questions about your recycling behaviors in the park? I am not collecting any names, so your participation is completely anonymous and confidential. Would you like to participate?

Appendix D: Explanation of Study to Participants



Waste Disposal Behavior Study

Hi, my name is Elliot Dale and I am a graduate student in Construction Management at Colorado State University. Today we are conducting anonymous surveys with visitors/employees in the park to collect information regarding their waste disposal behaviors. The results of these surveys, along with landfill waste behavior observations, will be used to develop landfill waste reduction strategies. The ultimate goal of this research will be to increase the landfill diversion rates from Rocky Mountain National Park. If you would like to learn about the results of this study, or have any other questions, please feel free to contact Elliot Dale at: Elliot.dale@colostate.edu or my advisor, Mary Nobe, Ph.D., mary.nobe@colostate.edu, CSU Dept. of Construction Management. Thank you for your time.

Appendix E: Site Area Observations

General site Moraine Park observations (from site visit on 8/14/11 and 8/17-18/11):

- 247 camp sites are in Moraine Park, containing 4 disposal areas. 1 propane fuel canister disposal site is near front entrance.
- Camper check-out is at noon. Campers begin checking in mid afternoon. Most waste disposal activity occurs after dinner, but before evening program, and in the morning before check-out. These times are between 6:30-8:30PM and 8-11AM.
- No recycling information exists on the campground map that is given out at check in and posted online. Many people use these maps to navigate the labyrinth-like campground.
- No discussion is given to recycling at check-in. The one time a ranger has direct personal interaction with the visitor.
- Recycling bins are well situated at the disposal sites. It is difficult, but possible to not walk by a recycling bin on the way to the dumpster.
- Many campsites purchase bundles of wood from the campground store. This store also sells soda cans and other recyclable items.
- Evening program occurs every night at 7:30PM or 8:30PM. I do not know the content of evening program, but this could be a potential location of waste disposal intervention.
- All campsites with a bag tied up in a tree or on the picnic table all only have one bag for all refuse.
- Signage on bathrooms about disposing of waste for bear safety. This signage does not mention the recycling options.
- Many people driving cars around the campsites at peak evening hours. Anecdotally, many of these cars are driving to dispose of trash and are driving over the 15 MPH speed limit. The cars, and lack of a good sidewalk or shoulder, make pedestrian traffic unsafe.

Observations about disposal sites in Moraine Park:

- All dumpsters are 10 cubic yards large.
- All waste disposal locations have 1 to 2 recycling bins along with the dumpster.
- Recycling bins are approximately 3, 30 gallon bins large. (Very small in comparison to the dumpsters. They are $<1/10^{\text{th}}$ the size of the dumpsters)
- Recycling stations are accessible from only one side. The dumpsters are accessible from two sides.
- Recycling stations have a green recycle triangle painted on the side.
- There are 3 holes to put recycling: These holes are rectangular in shape and approximately measure: 2: 6" X 3" and 1: 8" X 4".

- Recycle bins say: Glass, Plastic (#1 and #2) and Cans. No further distinctions or information is offered including what type of “can” should be recycled.
- There are no clarifying pictures on the bins.
- Recycle bin openings are only large enough to accept 1 item at a time.
- No openings that can accommodate large, flat items such as cardboard/paperboard/paper.
- No nighttime lighting exists at waste disposal site areas.

Appendix F: Moraine Park Campsite Observations

Observations occurred on 8/14/11 and 8/17-18/11:

Observations of a typical camper's behaviors while in camp:

- Check in begins at noon.
- Most people enter the campground mid afternoon and have their site set up by early evening.
- Campers relax and hangout until they eat dinner at around 6-7PM.
- Relaxation and hangout includes:
 - Sitting in folding chairs and talking/drinking beer
 - Walking/biking on the campground roads
 - Building a fire
- Waste disposal occurs the most between 7-8:30PM, where an evening program is hosted by the NPS and it begins to get dark.
- In the morning, waste disposal occurs fairly consistently all morning, depending on what the groups are doing that day.
- Many people will drive their waste to the waste disposal area on their way out of the campground for the day.

Observations of a typical campsite:

- Every campsite has a car or RV.
- Many have a mobile home or pop-up trailer in which to sleep.
- If the campsite does not have an automobile which can accommodate sleeping, at least one tent, usually a large one, is set up on site.
- Many times a tent-like canopy is set up for sun and rain protection.
- Cooking of food occurs at the picnic table. Eating also occurs at the picnic table.
- Campsites usually have a trash bag either tied onto a nearby tree branch, tent pole, or tied to the leg of the picnic table.
- Many campsites will allow trash to accumulate throughout the evening and dinner, and pick all the trash up in one swoop after dinner.
- Bicycles are also common at campsites, especially if there are kids in the group.

Appendix G: Detailed Waste Disposal Observational Script

Observations from Glacier Basin: 8/14/11 11:00 AM

- A person is dropped off in their car. The person gets out with a plastic cup, does not look for the recycling receptacles. They walk slowly straight over to the dumpster and throw away the cup. The recycling bin was on the other side of the person so they did not have a chance to see the recycling area.
- Two children, one male and one female, about 10-15 years old walk with a kitchen sized trash bag. Their campsite is approximately 200 meters away. They dispose of the bag in the dumpster and do not look at the recycling option. There was no opportunity to recycle.
- A mom, dad and two girls about 8 years old all make a long walk down the road towards the dumpsters with their parents. Mom and dad are each holding two kitchen sized trash bags and the girls are holding loose aluminum cans. The parents walk directly to the dumpsters, which is the closest place for waste disposal and immediately throw the kitchen bags of trash into the dumpster. Glass and bottles are audible as they are thrown in. Cardboard is also visible. As the girls are walking past the dumpster towards the recycling bin, dad tells the girls to throw their cans in the dumpster. At this point, mom steps in and tells dad that they have recycling. The bins were on the other side of the dumpster and Dad never saw them. He remorsefully says “Oh they do?” “I didn’t even know that!”. Mom mumbles under her breath “that’s because you’re oblivious...”
 - This seemed to occur because the recycling bins are away from the dumpsters and face towards the road, the opposite direction from the family’s campsite.
- A man drives up to dispose of his trash, which is in his car. The trash bins are directly next to the RV wash out, and the area is highly congested with RVs and cars. An RV driver and the person disposing their trash get into a tiff. The man in the car rushes over to the bins and dumps his bag of trash in the dumpster in a big rush.
- A man in his 40’s and his son walk up to the dumpster, not holding any apparent bags. To get to the dumpster, they must walk directly past the recycling. They walk straight to the dumpster and dispose of something small.
- A man in his 30’s drives up in a truck. He stops in front of the dumpsters and pulls a small grocery bag full of trash out of the bed. He walks directly to the dumpsters without looking around at other waste disposal methods. He throws the trash away immediately without looking around. He walks straight back to the truck. He never visually sees the recycling which is on the back side of the 10 yard dumpsters.

General observations about Glacier Basin visitor recycling behaviors:

- Nobody spends extra time at the bins.
- People know what they're going to do before they get to the trash disposal area.
- It seems that the most useful information would be needed as visitors enter the campground or their camp site.

Observations from Moraine Park campgrounds: 8/14/11 6-8:30 PM

- An older couple is aimlessly walking up the road with a grocery store plastic bag full of trash. The man is holding the bag and walks directly to the dumpster and throws it away. He does not look at the recycling. He continues to look at the campground map and walks on.
- A man drives up in a truck. He parks in front of the dumpsters, pulls out a black kitchen plastic bag. He walks directly over to the dumpster and throws the bag away.
- A man in his 50's is walking alone. He walks up to the disposal area with one large plastic bag. As he is walking towards the dumpster, he walks directly in front of the recycling area and visually notices the recycling receptacles. He proceeds to open up his own bag, pulling out approximately 5 recycling items (plastics). He then walks directly to the dumpster and throws the rest of his trash away.
- Two people walking in their 60's towards the waste disposal area. The woman is holding a small plastic bag full of waste and the man is holding loose paperboard and a bottle. The woman heads directly to the dumpster to dispose of her bag of trash. The man heads to the recycling bin, and immediately recycles the bottle. After reviewing the recycling area, he heads to the dumpster and throws away the paperboard
- A middle aged woman walks directly to the recycling and puts one loose item in it. She then walks directly away.
- A woman in her 40's brings a pot with water and loose trash to the dumpster area. She disposes of the loose trash in the dumpster while bringing the pot of water back to the campsite.
- Two a man and a woman in their 30's walk towards the waste disposal area. The man is holding loose trash and the woman is holding a small white plastic bag full of trash. The man walks directly to the recycling and recycles his items. The sound of glass clanking is audible. The woman walks directly to the dumpster and disposes of her trash. No sorting occurred on site.
- A man in his 50's walks slowly to the waste disposal area with a large white kitchen trash bag. He is holding one bag. He walks directly past the recycling area without looking at it. He disposes of his trash in the dumpster and turns around to walk back from where he came.
- A man and a woman in their 50's walk towards the waste disposal area. The man is holding a small white grocery bag full of trash. The man walks directly to the dumpster and throws it away. The man walks back and the woman goes the other direction.
- A man in his 40's is holding a large black bag and walks directly to the dumpster. He disposes of his bag and walks away.

- A boy, around 12 years old, runs directly up to the recycling bin with a grocery bag full of recyclables. He attempts to put the entire bag in the hole but it will not fit. He then takes a few items out of the bag and pushes them in the recycling hole one at a time. He then makes a second attempt at fitting the entire bag of recyclables in the hole. He is able to squeeze the bag in and immediately turns around and runs away back from where he came.
- A man in his 40's walks directly past the recycling area holding a small plastic bag full of trash. He proceeds to walk to the dumpster where he throws it away and walks back.
- A woman in her 30's drives up to the dumpsters and disposes 2 small plastic bags. She does not look at the recycling and immediately gets back into her car and drives away.


Appendix H: Waste Disposal Observations

ROMO: Family Campground Waste Disposal Observational Form											
Date and time:	Walk, Drive, or Bicycle to disposal area?:	Number of people:	Approximate age(s) by decade:	Male/Female:	Visitor visually identify recycle bins as potential waste disposal method? (Yes (1) /No (2))	Did recycling occur? (Yes (1) /No (2))	If yes, how was it transported? (presorted in sep bag (1), loose (2), mixed in trash (3), box(4))	If yes, Did any sorting occur while at bin? (Yes (1) /No (2))	If yes, quantity and type of recycling?	Way in which waste was disposed (loose (1), small bag (2), large bag(3) box (4))	Other comments/Obs? Examples: Unique waste items, unique behaviors, overheard verbal observations.
8/17: 6PM-8:30PM	Walk	1	30's	Female	1	2					Loose paperboard: First went to recycling and then to dumpster.
8/17: 6PM-8:30PM	Drive	1	40's	Female	2	2					1 Trash out of the car.
8/17: 6PM-8:30PM	Walk	1	50's	Male	1	1	4	2	3 cans	4	Read recycling sign in detail
8/17: 6PM-8:30PM	Walk	1	teens	Female	2	2				1	1 drink cup
8/17: 6PM-8:30PM	Walk	2	60's / >10	Male / Male	2	2				2	
8/17: 6PM-8:30PM	Walk	1	50's	Female	1	1	1	2	small bag of mixed recyclables	2	
8/17: 6PM-8:30PM	Walk	1	50's	Male	2	2				3	Walked around recycling bin.
8/17: 6PM-8:30PM	Walk	2	50's / 50's	Male / Female	2	2				2	
8/17: 6PM-8:30PM	Drive	1	60's	Male	2	2				3	Used bathrooms as well. Large family
8/17: 6PM-8:30PM	Walk	1	40's	Female	2	2				3	Emptied trash bag in dumpster, did not toss bag
8/17: 6PM-8:30PM	Bicycle	3	40's / 40's / 10	Male / Female / Male	2	2				3	
8/17: 6PM-8:30PM	Walk	1	30's	Female	2	2				1	Watermelon rind
8/17: 6PM-8:30PM	Drive	1	40's	Female	1	1	2	2	2 bottles	2	Walked with purpose
8/17: 6PM-8:30PM	Walk	1	60's	Male	1	1	3	1	~4 plastic and glass bottles	3	
8/17: 6PM-8:30PM	Walk	2	40's / 40's	Male / Female	1	1	2	2	1 can, 1 glass bottle	3	
8/17: 6PM-8:30PM	Walk	1	30's	Female	2	2				2	Same person from first observation who tried to recycle paperboard
8/17: 6PM-8:30PM	Walk	1	30's	Male	1	1	2	2	1 plastic bottle		
8/17: 6PM-8:30PM	Walk	1	30's	Male	2	2				2	
8/17: 6PM-8:30PM	Walk	1	40's	Male	1	2				2	
8/17: 6PM-8:30PM	Walk	2	20's / 20's	Male / Female	1	1	2	2	1 plastic water bottle, 1 alum can	3	
8/17: 6PM-8:30PM	Walk	1	30's	Female	2	2				2	
8/18: 8AM - 11AM	Walk	1	50's	Male	2	2				2	Walking dog

8/18: 8AM - 11AM	Walk	1	30's	Male	2	2				2	
8/18: 8AM - 11AM	Walk	1	20's	Male	1	1	1	2	small bag of mixed recyclables	2	
8/18: 8AM - 11AM	Walk	1	40's	Female	2	2				2	Approached recycling bins from wrong side
8/18: 8AM - 11AM	Drive	1	30's	Male	2	2				2	Went to the bathroom at the same time as disposing trash
8/18: 8AM - 11AM	Walk	1	30's	Male	2	2				3	
8/18: 8AM - 11AM	Drive	1	20's	Male	2	2				2	
8/18: 8AM - 11AM	Drive	1	30's	Male	2	2				3	
8/18: 8AM - 11AM	Walk	1	40's	Male	2	2				2	
8/18: 8AM - 11AM	Drive	1	40's	Male	2	2				2	
8/18: 8AM - 11AM	Walk	1	60's	Male	2	2				2	
8/18: 8AM - 11AM	Walk	1	50's	Male	2	2				3	
8/18: 8AM - 11AM	Drive	2	50's	Male / Female	1	1	2	2	A few plastic bottles		Same disposer as #33. After man disposed of trash bag, wife drove up with recycling in back.
8/18: 8AM - 11AM	Drive	1	30's	Female	1	1	1	2	small bag of mixed recyclables	2	
8/18: 8AM - 11AM	Drive	1	30's	Female	2	2				2	
8/18: 8AM - 11AM	Walk	1	40's	Male	2	2				1	
8/18: 8AM - 11AM	Walk	1	>10	Female	2	2				1	Paper napkins
8/18: 8AM - 11AM	Drive	1	teens	Male	2	2				3	
8/18: 8AM - 11AM	Walk	1	>10	Female	2	2				1	Paper
8/18: 8AM - 11AM	Drive	1	30's	Male	2	2				2	Brought trash on roof of car.
8/18: 8AM - 11AM	Walk	1	30's	Female	1	1	2	2	2 cans	2	
8/18: 8AM - 11AM	Drive	2	30's / 30's	Female / Male	2	2				2	
8/18: 8AM - 11AM	Walk	1	40's	Male	1	1	2	2	~6-7 plastic bottles and cans		
8/18: 8AM - 11AM	Drive	2	60's / 60's	Male / Female	2	2				2	
8/18: 8AM - 11AM	Walk	1	40's	Male	2	2				2	Same person as #44. First dropped off the loose recycling, and then brought the trash bag

8/18: 8AM - 11AM	Walk	1	30's	Female	1	1	3	1	2 plastic bottles	2	
8/18: 8AM - 11AM	Walk	2	60's / 60's	Male / Female	2	2				2	
8/31: 6PM-8PM	Drive	1	40's	Male	2	2				2	Immediately drove away
8/31: 6PM-8PM	Drive	1	50's	Male	2	2				2	
8/31: 6PM-8PM	Walk	1	30's	Male	2	2				2	Approached recycling bins from opposite side of recycling
8/31: 6PM-8PM	Drive	1	50's	Female	2	2				3	In car with another person
8/31: 6PM-8PM	Walk	1	40's	Female	1	1	3	2	3 aluminum cans	2	
8/31: 6PM-8PM	Drive	1	50's	Female	2	2				2	One other person in car
8/31: 6PM-8PM	Walk	2	60's / 60's	Male / Female	1	1	1	2	3 glass bottles		Carried recyclables in a reusable bag
8/31: 6PM-8PM	Walk	2	60's / 60's	Male / Female	2	2				2	
8/31: 6PM-8PM	Walk	1	60's	Male	1	1	3	2	2 glass bottles	3	In charcoal bag
8/31: 6PM-8PM	Walk	2	70's / 70's	Male / Female	2	2				3	
8/31: 6PM-8PM	Walk	1	60's	Male	2	2				3	Carried in a plastic bin
8/31: 6PM-8PM	Walk	2	30's / 30's	Male / Female	2	2				4	Large bag inside of a box
8/31: 6PM-8PM	Walk	1	70's	Male	2	2				3	
8/31: 6PM-8PM	Walk	1	70's	Male	1	1	1	1	~6 plastic bottles	2	Brought 3 small plastic bags, one was full of recycling, 2 full of trash
8/31: 6PM-8PM	Walk	1	60's	Female	2	2				3	
8/31: 6PM-8PM	Walk	2	60's / 60's	Male / Female	2	2				3	Walking the dog
9/4: 6PM - 8PM	Drive	2	30's / 30's	Female	1	1	2	2	1 glass bottle	1	
9/4: 6PM - 8PM	Walk	4	2 x 70's / 2 x 10	Male	1	1	2	2	1 can	2	child recycled the can.
9/4: 6PM - 8PM	Drive	1	40's	Male	1	1	2	2	2 plastic water bottles	2	
9/4: 6PM - 8PM	Walk	1	70's	Male	2	2				2	Trouble opening dumpster door.
9/4: 6PM - 8PM	Walk	2	70's / 70's	Male / Female	2	2				2	Approached from opposite side of recycle bins.
9/4: 6PM - 8PM	Walk	1	70's	Female	1	1	2	2	1 aluminum can		
9/4: 6PM - 8PM	Walk	2	40's / 40's	Male / Male	1	1	2	2	2 aluminum cans	2	
9/4: 6PM - 8PM	Walk	1	< 10	Male	2	2				2	Reusable grocery bag.

Appendix I: Rocky Mountain National Park Research Permit

 SCIENTIFIC RESEARCH AND COLLECTING PERMIT Grants permission in accordance with the attached general and special conditions. United States Department of the Interior National Park Service Rocky Mountain NP	Study#: ROMO-11029 Permit#: ROMO-2011-SCI-0045 Start Date: Aug 01, 2011 Expiration Date: Dec 31, 2013 Coop Agreement#: n/a Optional Park Code: n/a
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Name of principal investigator: Name: Elliot Dale Phone: 970-491-5041 Email: n/a
Name of institution represented: Colorado State University
Co-Investigators: Name: Mary Nobe Phone: 970-491-5215 Email: mary.nobe@colostate.edu
Project title: Rocky Mountain National Park Waste Audit and Behavioral Change Intervention Program
Purpose of study: The purpose of this study is to identify location types in RMNP in need of waste diversion improvements, and pilot a waste diversion initiative targeted at fostering landfill waste diversion behavioral change in one such location type. The behavioral change strategies will be based upon the Community Based Social Marketing approach with the goal of creating sustainable behavior change in the area of landfill waste diversion.
Subject/Discipline: Management (Administration)
Locations authorized: The waste audit will take place at multiple locations around the park. These locations include: Sprague Lake, Glacier Basin, Park Roadside locations, Long Lake, Alluvial Fan, Mills Road, Sundance, and the Auto Shop. The behavioral change intervention component of the research is yet to be determined, and is contingent upon the results of the waste audit.
Transportation method to research site(s): Access by motor vehicle will be my proposed method of access to the study locations. License plate numbers are not unknown at this time.
Collection of the following specimens or materials, quantities, and any limitations on collecting: Author will be conducting brief intercept interviews. These will not be paid for using federal funds.
Name of repository for specimens or sample materials if applicable: Repository type: Will be destroyed through analysis or discarded after analysis Objects collected: During the waste audit, trash will be collected, sorted, and then discarded through the pre-existing waste stream avenues. No other specimens or materials will be collected during this study
Specific conditions or restrictions (also see attached conditions): Please read these conditions carefully as they are legally binding. If you want to request a change in your permit conditions, please contact your designated park permit lead. This permit must be carried at all times by field staff while sampling within the park. The permit also acts as an entrance

pass. Individual investigators should be prepared to show the permit and personal identification at the park gate and as requested by any park staff member.

Park regulations must be followed. Researchers are responsible for knowing and complying with all park and National Park Service regulations unless specifically exempted from a regulation below. A copy of the most recent Compendium is available upon request from the Park Dispatch Office ((970) 586-1204).

Entrance to closed areas is not permitted without specific written permission. If you wish to enter a closed area to conduct research, please contact your designated park permit lead to discuss. Permission must be issued in writing by the Chief Ranger's Office.

Researchers must share data with the park. The permittee is required to submit an Investigator's Annual Report. In addition, copies of completed research products should be sent to the park within five years of the expiration of the research permit. This would include electronic or hard copies of all scientific publications and gray literature including theses/dissertations, all published data sets, and all unpublished data sets. A presentation to park managers may be requested upon completion of the project to explain the management implications of the completed work.

Protect rare plants and archeological resources. Unless specified below, no rocks may be removed and no soil disturbed during this project.

Equipment installation and plot markers are not generally allowed. Unless specified below, the permittee is not allowed to install equipment or plot markers of any kind.

Recommended by park staff(name and title):

Reviewed by Collections Manager:

Judith Vink, Research Administrator Yes ☐ No ☒ NA

Approved by park official:

Date Approved:

John G. Mack, Acting Chief Resources Stewardship 7/28/11

Title:

Chief, Resources Stewardship

I Agree To All Conditions And Restrictions Of this Permit As Specified
(Not valid unless signed and dated by the principal investigator)

Elliott Dale
(Principal investigator's signature)

7/28/11
(Date)

THIS PERMIT AND ATTACHED CONDITIONS AND RESTRICTIONS MUST BE CARRIED AT ALL TIMES
WHILE CONDUCTING RESEARCH ACTIVITIES IN THE DESIGNATED PARK(S)

Appendix J: Recycling Exit Survey

Moraine Park Campground Recycling Survey

We need your feedback!

Rocky Mountain National Park is trying out several approaches to increase recycling. This survey will help determine the recycling strategies to continue funding. *Your input is valuable!*

When done camping, please drop this survey off at the entrance kiosk in the box labeled “Recycling Survey”.

Rank the approaches used during your stay in Moraine Park campground using the scale provided below.

Rank	Ranking Example
1	Strategy was not helpful for recycling: BAD APPROACH
2	
3	Strategy did not affect recycling: NEITHER GOOD or BAD APPROACH
4	
5	Strategy was very helpful: GOOD APPROACH
N/A	Did not notice strategy

Recycling Strategies Used in Moraine Park Campground	Bad Approach		Neither Good or Bad		Good Approach	Did Not Notice
Entrance Gate Recycling Commitment	1	2	3	4	5	N/A
Recycling Bag Handout	1	2	3	4	5	N/A
Water Bottle Sticker	1	2	3	4	5	N/A
Evening Program and/or Jr. Ranger Program	1	2	3	4	5	N/A
Campsite Recycling Pick-up	1	2	3	4	5	N/A
Recycling Signage Reminders	1	2	3	4	5	N/A
In which areas did you see recycling reminders (please circle):	Visitor Center		Bus Shuttle		Park Website	Did not Notice

For more information about the survey, please contact Elliot Dale @ Elliot.dale@colostate.edu or Dr. Mary Nobe @ Mary.nobe@colostate.edu. This survey data is administered by Colorado State University and the research results will be shared with campground management to develop successful campground recycling strategies.

Thank you for your time and feedback!