Frontcountry Leave No Trace Program Evaluation, City of Boulder Open Space and Mountain Parks

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Abstract

A pre/post study was conducted in 1999 of city of Boulder Open Space visitors to determine if their knowledge and behavior changed following a “front country” Leave No Trace educational effort. Respondents were asked Leave No Trace knowledge and behavior questions at trailheads. Visitors were then contacted at the same trailheads to educate them about Leave No Trace principles. A brochure was handed out to reinforce the contact. Signs were placed. Respondents were surveyed later to again measure their Leave No Trace knowledge and behaviors. Surveys were also analyzed to determine whether central or peripheral routes of communication appear to be a more compelling approach. Additionally, results were compared by user group, age, and frequency of visits to open space, gender, and years living in the county. Results indicate that Leave No Trace knowledge did increase, albeit minimally, and only differed significantly by gender. Overall, Leave No Trace knowledge was considerably high before the treatment. Also, familiarity with regulations was more predictive of whether an individual actually practiced Leave No Trace behaviors than was one's Leave No Trace knowledge or time spent thinking about specific Leave No Trace behaviors. This indicates that Leave No Trace educational or central route, efforts may not be as effective as other strategies in changing behavior when visitors are already highly knowledgeable of Leave No Trace principles. More effective strategies likely include raising awareness of consequences of non-compliance, social desirability of compliance and heuristic approaches that trigger individual reaction

Frontcountry Leave No Trace Program Evaluation

Introduction

City of Boulder Open Space and Mountain Parks formed a partnership with Leave No Trace, Center for Outdoor Ethics in 1997 to conduct a pilot "frontcountry" program. Projections on recreational use show that there are far more people, with their numbers growing at a far greater rate, for day hiking than for backpacking. (Cordell et al, 1999) Leave No Trace, Inc.'s roots are in promoting backcountry low impact practices. Open Space and Mountain Parks proved to be a good laboratory to investigate frontcountry uses. (Jones, 1999) This paper summarizes the results of a study conducted in 1999 and as a follow-up to the 1997 pilot program.

Increasing numbers of people wanting to experience the outdoors place demands on land managers to meet public enjoyment and resource protection goals. Resource protection and visitor experience are generally managed through education, site management and regulation enforcement. Visitors usually prefer management techniques that are less intrusive, such as education, because they value the land and have higher education levels. (Hendee & Dawson, 2002)

Land managers hope that communication, reasoning and internalization will change people's belief structure, their underlying ethic, to "do the right thing" when out on the land. The Elaboration Likelihood Model describes this form of communication as the central route of persuasion (Petty, McMicheal, & Brannon, 1992; Roggunbuck, 1992). Peripheral route is the model's other form of communication. The peripheral route relies heavily on the source of the message and is short term in duration. Questions about how much someone thinks about an issue or how much knowledge they have help inform the effectiveness of central route processing at promoting an enhanced environmental ethic.

The strength of an appeal is an important part of encouraging positive behaviors. "Awareness of Consequences" messages highlight the detrimental consequences of behaviors, hoping that knowing these consequences will positively modify behavior. "Moral" and "Fear" appeals are two types of Awareness of Consequences appeals. (Gramman & Vander Stoep, 1987) Fear appeals would include a loss of privileges. Moral appeals center on socially desirable behaviors. Identity appeals is another form of appeal and focuses on people's image of themselves. (Gramman, Bonifield, and Kim, 1995) In three frontcountry natural areas, dog walkers intention to pick-up their pets' leavings, a Frontcountry Leave No Trace practice, was tested using moral appeals, fear appeals, and identity appeals. (Barry, 2000; Barry, Ellis, & Ruddell, 2001) Fear and moral appeals were most effective.

Methods

City of Boulder staff and volunteers conducted the pre-treatment survey in September of 1999 at City of Boulder Open Space trailheads. Five multi-use trailheads were selected to ensure a large sample size and a sufficient sample of recreational activities. Every visitor was asked to fill out a survey. A total of 803 surveys were

completed correctly. The refusal rate was less than 10%. A five month educational treatment of trailhead contacts, brochures, signs, local public access video spots and newspaper articles was conducted. In February and March, 2000 the original 803 survey respondents were then mailed the post-treatment survey, a reminder postcard and a second survey if the had not retuned the first. This resulted in 388 valid surveys in the post survey sample, a 48% return rate. Demographic characteristics were compared in the pre and post-surveys; no statistically significant differences were identified.

Pre- and post-survey results were entered into a statistical software package (SPSS) for analysis. In addition to a variety of descriptive functions (e.g., frequencies, means, medians), the analysis included comparisons between groups (e.g., activity types, years of residence in Boulder County, gender) as well as pre/post comparisons for individuals. These comparisons included the following tests: paired sample t-tests, cross-tabs / chi-square analysis, analysis of variance, and multiple regression. In most instances, a p-value of .05 was used to determine statistical significance.

Results

I. Effect of Different Variables On Compliance with Regulations

Compliance with specific Leave No Trace behaviors, including "picking up poop" and "keeping your dog under voice and sight control," appears to be predicated by something stronger than knowledge. How long someone thinks about or how much one knows had almost no effect on their likelihood to comply with a specific Leave No Trace behavior. In this instance, processing or thinking about a behavior has minimal effect on whether or not they actually do that behavior. This calls into question whether central route processing is occurring among visitors and the effectiveness of long term change in behavior based on an educational campaign. Familiarity with the regulation to pick up poop (Table 1) has a somewhat greater affect than the number of reasons (Table 4) on whether or not the according behavior is followed.

Question: How much does *familiarity* with the poop regulation and the *number of reasons* listed for **picking up poop** contribute to predicting whether or not someone will actually pick up poop?

Regression Results **Table 1**

Variable	**Beta Weight**	**R-square**	**Significance**
Overall model		.151	.001
Familiarity	-.215		.009
# of Reasons	-.284		.001

Results: While the model and the predictor variables are all determined to be significant ($p<.05$), the r-square value and respective beta weights are comparably small. Significance is most likely being achieved due to sample size. The results of this analysis indicate that familiarity with the regulation and the number of reasons one can list for following the poop regulation contribute minimally to actually predicting poop pick-up behavior. In comparing the two independent variables, familiarity with the regulation has a greater affect on whether or not someone says they will pick-up their dog's poop. (as determined by the beta weights) (See following t-test analysis).

Question: Does poop pick-up behavior differ by one's *familiarity* with the poop regulation?

T-Test Results **Table 2**

Familiarity	**Mean Score for Poop Pick-up behavior**	**Significance**
		.001
Yes	2.88	
No	1.86	

Mean is measured on a scale of 1 (always) to 5 (never).

Results: This result is counter to what intuition might suggest. Those familiar with the regulation were less likely (2.88) to follow the regulation than those who were not familiar it (1.86). This result is difficult to interpret, and the statistical significance might be more attributable to sample size than any true trend for people to ignore poop pick-up regulations.

Question: How much does *the amount of time thinking about dog management* and *the number of reasons one can list to keep dogs under voice and sight control* contribute to or explain the likelihood of actually **keeping dogs under voice and sight control**?

Regression Results **Table 3**

Variable	**Beta Weight**	**R-square**	**Significance**
Overall model		.003	.875
Time thinking	.037		.723
# of Reasons	-.037		.720

Results: Neither the time spent thinking about dog management nor the number of reasons one can list were good predictors of whether an individual actually followed the regulation of keeping a dog under voice and sight control. There appear to be other reasons that motivate one to follow, or fail to follow, the rule.

Question: How much does *time thinking about Leave No Trace and number of reasons listed to pick up poop* contribute to predicting whether or not someone will **actually pick up poop**?

Regression Results **Table 4**

Variable	Beta Weight	R-square	Significance
Overall model		.003	.854
Time thinking	.051		.779
# of Reasons	.029		.619

Results: Neither the time spent thinking about picking up poop nor the number of reasons one can list were good predictors of whether an individual actually followed the regulation of picking up poop. There appear to be other reasons that motivate one to follow, or fail to follow, the rule.

Question: How much does *time thinking about Leave No Trace and number of reasons listed to pick up trash* contribute to predicting whether or not someone will **actually pick up trash**?

Regression Results **Table 5**

Variable	Beta Weight	R-square	Significance
Overall model		.021	.173
Time thinking	-.110		.180
# of Reasons	-.104		.155

Results: Neither the time spent thinking about picking up trash nor the number of reasons one can list were good predictors of whether an individual actually followed the regulation of picking up trash. There appear to be other reasons that motivate one to follow, or fail to follow, the rule.

Question: How much does *time thinking about Leave No Trace and number of reasons listed to stay on trail* contribute to predicting whether or not someone will **actually stay on trail**?

Regression Results **Table 6**

Variable	Beta Weight	R-square	Significance
Overall model		.029	.085
Time thinking	-.031		.027
# of Reasons	-.170		.686

Results: Neither the time spent thinking about staying on trail nor the number of reasons one can list were good predictors of whether an individual actually followed the regulation of staying on trail. There appear to be other reasons that motivate one to follow, or fail to follow, the rule.

Question: How much does *time thinking about Leave No Trace and number of reasons listed to share the trail* contribute to predicting whether or not someone will **actually share the trail**?

Regression Results **Table 7**

Variable	Beta Weight	R-square	Significance
Overall model		.024	.130
Time thinking	-.063		.056
# of Reasons	-.148		.412

Results: Neither the time spent thinking about sharing the trail nor the number of reasons one can list were good predictors of whether an individual actually followed the regulation of sharing the trail. There appear to be other reasons that motivate one to follow, or fail to follow, the rule.

Question: How much does *time thinking about Leave No Trace and number of reasons listed to leave an area as you found it* contribute to predicting whether or not someone will actually **leave an area as they found it**?

Regression Results **Table 8**

Variable	Beta Weight	R-square	Significance
Overall model		.016	.253
Time thinking	-.053		.118
# of Reasons	-.121		.496

Results: Neither the *time spent thinking about leaving an area as they find it* nor the *number of reasons* one can list were good predictors of whether an individual actually followed the regulation of leaving it as you find it. There appear to be other reasons that motivate one to follow, or fail to follow, the rule.

II. Leave No Trace Knowledge

While there was a statistically significant improvement from the pre- to the post-test in Leave No Trace knowledge, the important conclusion is that visitors have a high knowledge level of Leave No Trace behaviors. Knowledge levels have increased substantially since the pilot in 1997. (Jones, 1999)

Frequency of visitation, years of residence, activity type and age did not make any difference in Leave No Trace knowledge. Women had a statistically significant higher knowledge level than men, but both had a high knowledge levels.

Leave No Trace IQ FREQUENCIES: **Table 9**

# answered correctly out of 6	Pre-test Frequencies	Post-test frequencies
1	1	0
2	4	1
3	10	13
4	45	26
5	112	107
6	199	220
Mean Score	**5.32**	**5.46**

In the following analysis, paired t-tests are not possible on individual Leave No Trace questions with *nominal*-level responses (e.g. true/false). Therefore, data were combined to give each respondent a numeric score (1-6) indicating how many Leave No

Trace questions were answered correctly (n Leave No Trace "IQ"). This allowed for the data to be set at an *interval/ratio* level, and therefore can be manipulated more by statistical analyses. A paired t-test was computed using this new IQ variable. The following is a summary of this data:

Paired Samples T-Test **Table 10**

	N	df	Significance (2-tailed)
Pre-test IQ – Post-test IQ	351	350	0.006

Conclusion: The increase in averages from 5.32 to 5.46 is considered statistically significant, meaning a true increase in Leave No Trace knowledge appears to have occurred. However, the difference (.014) represents an approximate 2% gain overall. From both a practical and management implication perspective, the increase in knowledge is relatively weak.

Question: Please indicate whether you think each of the following statements is true or false by circling the appropriate response.

Table 11

Survey Item	**Pre-test Results[1]**		**Post-test results[1]**	
	True	False	True	False
1a. orange peels take several years to decompose	79%	20%	83%	17%
1b. tossing dog poop off the trail hurts native plants…	86%	12%	90%	10%
1c. collecting leaves or flowers is OK … in moderation	10%	91%	3%	97%
1d. when a trail is muddy walking on grass … is OK	6%	94%	5%	95%
1e. Trails and trail activity (-) effect birds at 100 yards	81%	19%	81%	19%
1f. Walking off trail increases the (-) effect on ...wildlife	99%	1%	98%	2%

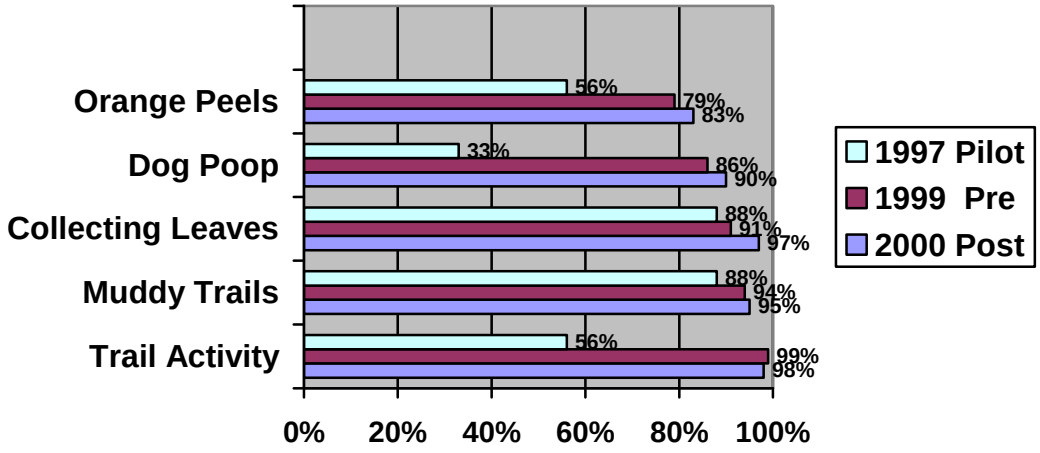
[1]numbers may not equal 100% due to rounding errors and missing data
Chi-square test of significance indicated no significant differences in pre and post-test data

Conclusion: The statistical test of significance (chi-square) indicated that there was no demonstrated difference in percent of people who answered any one of the above six Leave No Trace items correctly in the pre- and post-tests. Despite small differences in

the pre and post tests on some items (e.g. 86% vs. 90% in the pre/post tests for #1-b), the differences between pre and post tests can only be attributed to random error.

The following graph summarizes knowledge gain as a result of Leave No Trace on Open Space campaign. It appears that the campaign has caused a sizable increase in visitor knowledge. However, increased knowledge does not necessarily equal behavior change.

Figure 1: LNT IQ Knowledge Questions - Correct Answers



III. Self Reported Behavior

Social desirability—respondents saying what they think the surveyor wants to hear--is likely driving people's self-reporting of improved behavior as a result of the Leave No Trace Program. This is particularly true in light of the results found in Section I "Effect of Different Variables On Compliance with Regulations" of this paper.

Question: Did respondents report a perceived change in their behavior following the Leave No Trace outreach effort?

Table 12

Post-test question: How have your actions changed due to leave no trace?

Action	Frequency	Valid Percent
Much better	14	5%
Somewhat better	73	31%
No change	150	63%
Somewhat worse	1	less than 1%
Total	238	
Missing	150	

Result: The results listed above are only descriptive; inferences are therefore drawn by the researcher. In terms of self-reports by users, more than a third of respondents indicated that their Leave No Trace behaviors improved as a result of the outreach. This might be attributable to social desirability; users perhaps want to appear receptive to the Leave No Trace outreach program, and also want to appear as compliant users of the open space system.

IV. Argument Strength

For dog management, a fear-based appeal of "losing dog walking privileges" had the highest likelihood of influencing people to improve their dog management. Other fear-based appeals of "keeping their dog safe" was in the second tier of answers. Also in the second tier were moral based appeals such as "dogs hurting or scaring wildlife" and other visitors. The identity appeal of the dog reflecting negatively on the walker scored the lowest of any appeal.

For low impact practices, moral-based appeals were highest. There appears to be a disconnect between what people say is their primary motivation, and their reaction when given a scenario where privileges might be lost if they fail to comply. This is not unusual; third party consequences can create a variety of undesirable feelings and reactions (e.g., embarrassment) that are not necessarily at stake when one violates his/her ethics, unless that ethic is very core to his or her persona. Dog-walking ethics are probably not a central part of most people's personal code of ethics. Therefore, they can compromise those ethics with only mild sanctions (e.g., some level of dissonance), whereas a third party reprimand creates greater discomfort.

Question: Which of the following statements do you think would be likely to influence you to improve your dog management?

Table 13

	Most likely				**Least Likely**
Dogs disturb others' enjoyment of open space	40.9	28.0	20.4	4.8	5.9
Dogs could hurt or scare others	41.8	31.0	15.8	6.0	5.4
Dogs could hurt or scare wildlife	47.1	32.3	16.4	1.6	2.6
Dogs could reflect negatively on me	18.2	17.7	28.7	12.7	22.7
Control keeps dogs safe from other dogs	38.9	24.9	21.1	9.2	5.9
Control keeps dogs safe from other animals such as skunks, porcupines or coyotes	40.9	24.7	18.8	7.5	8.1
Control keeps dogs safe from natural hazards such as the plague	28.4	23.5	23.5	8.7	15.8
You can get a ticket if your dog is not under voice and sight control	31.7	18.8	26.3	12.9	10.2
Not controlling my dog may lead to a loss in dog-walking privileges	**52.4**	16.6	15.5	7.5	8.0

Result: Contrary to the results in the following question that indicated a self reported intrinsic motivation to practice Leave No Trace behaviors, the most compelling rationale for following dog management rules is to retain dog-walking privileges; more than 53% of the respondents – the highest of any statement – indicated that to be the most likely reason to improve their dog management. The second tier statements appear to stem from keeping dogs safe from other parts of the ecosystem (e.g., wildlife, other dogs), and insuring a quality experience for other users.

Question: There are a number of reasons for practicing low impact recreation techniques. Of the following reasons, which one reason would be most likely to influence you to change your behavior?

Table 14

Reason	**Frequency**	**Percent**
We have a responsibility to lessen our impact on the natural environment	**114**	**29.4**
It is the right thing to do	**83**	**21.4**
They protect the health of the land for future generations	58	14.9
They maintain the beauty of the natural area	41	10.6
By practicing low impact behaviors, fewer restrictions will be put in place	37	9.5
These practices reduce impacts on plants and wildlife	36	9.3
Other	5	1.3
They minimize land erosion	2	.5
They reduce impacts on other visitors	2	.5

Result: Most respondents indicate an intrinsic motivation (e.g., it is the right thing to do) for practicing low impact techniques. This would indicate that one's ethics

and sense of responsibility to nature provide the incentive, rather than extrinsic motivations such as possibility of sanctions (e.g., fines). Intrinsic motivation is derived from deeply held values and ethics, and these are very difficult constructs to influence within a singular education campaign.

V. Awareness of Leave No Trace Program

More than two thirds of Open Space visitors had heard of the Leave No Trace Program. Those who lived in Boulder County longer were more likely to have heard of it; older visitors (65+) were less likely. Although older visitors were less likely to be aware of the program, they were no less likely to know the correct responses to the six Leave No Trace true-false questions.

VI. Most Effective Contact Mechanism

Trailhead contacts were thought by a large majority of respondents to be the most effective outreach mechanism. Visitors liked the personal nature of the education. Other outreach techniques played a supporting role.

Question: Which one outreach method do you think had the most effect in changing your behavior when visiting open space trails?

Table 15

Outreach methods	Frequency	Percent
Trailhead contacts	**238**	**61%**
Information board	66	17%
Sign	52	13%
Channel eight	52	13%
Newspaper	35	9%
Word of mouth	36	9%
No other ways	30	8%
Other	28	7%
Received mail	25	6%

Result: Consistent with other outdoor education survey results, (Roggunbuck, 1992) personal contact appeared to have the greatest impact, with more than 61% of respondents citing that strategy as having the greatest effect. The remaining options failed to garner more than 17% of responses. Clearly, person-to-person contact is the most effective, according to the users.

Question: Why do you think this outreach method was more effective than others? (open-ended)

Table 16

Outreach methods	Frequency	Percent
Personal	**118**	**30.4%**
Convenient	17	4.4%
Makes me think	16	4.1%
Answers questions	15	3.9%
Peer pressure	14	3.7%
other	38	9.8%

Result: Taken in conjunction with the results of question #8 (listed above), clearly people respond to the personal interaction with a ranger or staff member more than other more passive methods.

VII. Dog management

Dog walkers a very familiar with the Voice and Sight and poop pick up regulations. The top two reasons not to pick up after your pet are no bag and diarrhea.

Question: Have you heard of the voice and sight control regulation?

Table 17

	Frequency	Percent
Yes	199	**94.8**
No	11	5.2

Result: Clearly visitors are familiar with the voice and sight control regulation

Question: Have you heard of the pick up poop regulation?

Table 18

	Frequency	Percent
Yes	**181**	**90.5**
No	19	9.5

Result: Clearly visitors are familiar with the pick-up poop regulation.

Question: When you don't pick up poop, what is the main reason?

Table 19

Reason	Percent
No poop pick up bag available.	**20.2**
Dog has diarrhea	**18.6**
Poop too far from trail	13.8
Can't find in vegetation	13.0
No trash can nearby	12.3
Don't have extra bag	12.1
Don't want to carry full poop pick up bags.	8.0
Other	7.2
Dog poop is natural to the environment.	1.6
Not required to pick up	.8

Result: The results indicate that 1) lack of bag, and 2) dog has diarrhea, as the most often-cited reasons for failing to pick up poop.

Conclusions

1. Compliance with specific Leave No Trace behaviors, including "picking up poop" and "keeping your dog under voice and sight control," appears to be predicated by something stronger than knowledge. How long someone thinks about or how much one knows had almost no effect on their likelihood to comply with a specific Leave No Trace behavior. Processing or thinking about a behavior has minimal effect on whether or not they actually do that behavior. *Consequently, further education and outreach efforts should not focus on building one's depth of knowledge about the rationale for specific Leave No Trace behaviors. Raising awareness about potential consequences of non-compliance including increased enforcement or the social desirability of compliance should be the focus of improving desirable behavior. Further, heuristic approaches that trigger individual reaction may be a more cost-effective approach for future efforts.*

2. Overall, visitors to City of Boulder Open Space appear to have a favorable level of Leave No Trace knowledge in terms of recognizing good Leave No Trace behavior. Out of six true-false Leave No Trace questions, the average number of correct responses was high in both the pre-test (5.32), and the post-test (5.46). *Consequently, education and outreach efforts should not be built on creating*

recognition of specific Leave No Trace behaviors; users already seem to know them.

3. Thirty-six percent of respondents indicated that they perceived their Leave No Trace behavior to be "somewhat" or "much" better following the Leave No Trace outreach effort. It is important to note that self-reports such as this survey are often affected by social desirability and an inclination to answer favorably.

4. People reported the fear based appeal of losing dog walking privileges had the highest likelihood of influencing their behavior. Moral appeals such as dogs hurting or scaring wildlife or other people were cited as nearly as effective. The identity appeal the dog reflecting negatively on the walker scored the lowest.

5. A majority of respondents indicated that a primary motivation for following Leave No Trace behaviors was based on intrinsic motivations to do the right thing. However, the most cited statement that would influence one's compliance with open space rules related to retaining dog-walking privileges, a very extrinsic rationale. There appears, then, to be a disconnect between what people say is their primary motivation, and their reaction when given a scenario where privileges might be lost if they fail to comply. This is not unusual; third party consequences can create a variety of undesirable feelings and reactions (e.g., embarrassment) that are not necessarily at stake when one violates their ethics, unless that ethic is very core to their persona. Dog-walking ethics are probably not a central part of most people's personal code of ethics. Therefore, they can compromise those ethics with only mild sanctions (e.g., some level of dissonance), whereas a third party reprimand creates greater discomfort.

6. More than two-thirds of respondents had at least heard of the Leave No Trace program in the open space system.

7. There were rarely any differences in Leave No Trace knowledge by activity type, age, frequency of visitation, or years or residence in Boulder County. *Consequently, there is no one group that would appear to be a better target of outreach than another.*

8. Trailhead contacts were the overwhelming choice –61%--for receiving information. Information boards, signs, and local access television were all in the teens.

9. The primary reason people do not pick up after their pet is because they did not have a bag or a second bag.

10. Bicycle riders self reported the greatest fidelity to trail with 89% reporting they always stay on trail, runners at 76%, dog walkers at 73% and hiking at 70%.

Recommendations

1. Continue the trailhead outreach program to address the most pressing issues which include stay on trail, voice and sight compliance and dog poop clean-up. Shift education efforts to focus on raising awareness about potential consequences of non-compliance and the social desirability of compliance. Heuristic approaches that trigger individual reaction such as a photograph of a ticket or a ranger issuing a ticket.

2. Increase enforcement of regulations.

3. To increase dog poop clean–up and voice and sight compliance, plastic bags and leashes should continue to be offered by staff at the trailhead.

4. For voice and sight compliance, the strictness of the rule should be reinforced--such as the dog should be in sight at all times and come on first command, regardless of circumstance. This reinforces the importance of the rules and what is acceptable among dog walkers and other visitors.

5. Explore how the Stewardship Program can encompass dog walkers to educate other dog walkers.

6. Share results and recommendations with other citizens and organizations.

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