

The Development, Analysis, and Evaluation of Student Knowledge
Retention of Leave No Trace (LNT) Principles Taught in an Outdoor
Education Course at an Environmentally-Oriented Semester
Boarding High School

**A Project Report
Submitted in Partial Fulfillment of the
Requirements for the Degree
Master of Science
In Natural Resources/Environmental Education**

University of Wisconsin-Stevens Point

By

Jeff Nemec

May 2011

APPROVED BY:

Corky McReynolds, Ph.D.

Professor of Environmental Education

ABSTRACT

The purpose of the project was to develop, analyze, and evaluate student knowledge retention of Leave No Trace (LNT) principles taught in an outdoor education course at an environmentally-oriented semester boarding high school. An initial self-reported survey and a pre-assessment established a baseline for knowledge levels. After receiving instruction on proper low-impact behavior and practices, students completed a post-assessment to determine increases or decreases in their level of LNT knowledge. Scores increased 9% overall. After having difficulty with questions pertaining to more complicated LNT principles, students showed improvements in the post-assessment results. This could be attributed to instructional efforts focused on the challenging principles. However, increased LNT knowledge doesn't necessarily equate to adherence. Greater review of assessing and upholding LNT followership should continue in outdoor instruction and recreation opportunities at the school.

ACKNOWLEDGEMENTS

I would first like to thank the University of Wisconsin-Stevens Point and Conserve School for the unique opportunity to live, work, and educate while in the Northwoods. I'd also like to thank my Conserve School colleagues for an enjoyable two years. Lastly, I'd like to thank Daisy for the fun, food, friendship, guidance, and direction.

TABLE OF CONTENTS

Abstract.....	iii
Acknowledgements.....	iv
Chapter I – Introduction.....	1
A. Statement of the Problem.....	1
B. Importance of the Project.....	1
C. The Subproblems.....	2
D. Significance of the Study.....	2
E. Limitations.....	3
F. Definitions of Terms.....	3
G. Assumptions.....	4
Chapter II – Literature Review.....	5
A. The Value of Low-Impact Education Programs.....	5
B. Leave No Trace (LNT), a Low-Impact Educational Program.....	7
C. Efficacy of Low-Impact Education.....	8
D. Developing and Conducting a Low-Impact Educational Program.....	10
E. Developing and Administering Surveys for Low-Impact Knowledge Assessments.....	12
F. Analyzing Low-Impact Knowledge Surveys and Assessing Results.....	16
G. Evaluating Low-Impact Knowledge Assessment Survey Results.....	19
H. Drawbacks of Low-Impact Education Analysis and Recommendations for Improvement.....	21
I. Summary.....	23
Chapter III – Methodology.....	24
A. Subproblem One.....	24
B. Subproblem Two.....	25
C. Subproblem Three.....	26
D. Subproblem Four.....	26
E. Subproblem Five.....	26
F. Summary.....	27

Chapter IV – Results	28
A. Subproblem One.....	28
B. Subproblem Two.....	31
C. Subproblem Three.....	33
D. Subproblem Four.....	40
E. Subproblem Five.....	41
Chapter V – Conclusion and Recommendations	42
A. Conclusion.....	42
B. Recommendations.....	42
Bibliography	45
Appendices	47
A. Field Instructor Lesson/Activity Preparation Form.....	48
B. Leave No Trace Values Clarification.....	54
C. CS2 Instruction Survey, Results, and Course Outline.....	55
D. LNT Knowledge Assessment (Pre/post-test).....	62
E. Evaluation of Knowledge of Leave No Trace Principles.....	65
F. Leave No Trace Quiz Answers.....	69
G. Letter to Conserve School Director of Outdoor Programs.....	73
H. Revised Leave No Trace Knowledge Assessment.....	75
I. Leave No Trace Assessment Results.....	77

CHAPTER I

INTRODUCTION

Statement of the Problem

The project will develop, analyze, and evaluate student knowledge retention of Leave No Trace (LNT) principles taught in an outdoor education course at an environmental semester boarding high school.

Importance of the Project

The purpose of the project is to examine student knowledge retention of LNT principles taught in an outdoor-oriented physical education class at Conserve School, an environmental semester boarding high school located in northern Wisconsin. All students must take the course as part of the school's current accreditation process. Known as field instruction, the course introduces students to a variety of outdoor activities and skills. Course content includes hiking/backpacking, canoeing, cross-country skiing, navigation, and wilderness survival. Students are taught the theory behind each activity and have the opportunity to practice each activity either in class or on their own personal time. Keeping with the mission of the school to "inspire young people towards environmental stewardship," the outdoor slant of field instruction must have the teachings of LNT, a low impact educational program, as an underlying edict. This is to promote and adhere to responsible outdoor recreation.

The Subproblems

Subproblem One:

The first subproblem will be to develop and conduct a low-impact education program at an environmentally-oriented semester boarding high school.

Subproblem Two:

The second subproblem will be to develop and administer pre and post-assessment of LNT principles following exposure to low-impact education.

Subproblem Three:

The third subproblem will be to analyze pre and post-assessment results.

Subproblem Four:

The fourth subproblem will be to evaluate pre and post-assessment results.

Subproblem Five:

The fifth subproblem will be to determine drawbacks to the analysis of LNT educational programs and offer suggestions for improvements.

Significance of the Study

Outdoor recreation can negatively impact the natural resources visitors are trying to enjoy. Given the increasing popularity of outdoor recreation, resource degradation, habitat disturbances, and crowding all pose a land management problem. Educational programs like LNT provide a vehicle for promoting awareness of recreational impacts and encouraging visitors to become more knowledgeable about how to reduce these impacts (Marion & Reid, 2001). Using seven minimal impact principles, the LNT initiative seeks to strike a balance between preserving resource

integrity and user enjoyment without being overly intrusive through regulations and limitations. Outdoor recreationists are then better equipped to make the right decisions socially, ethically, and environmentally.

Conserve School has partnered with the Center for Outdoor Ethics, the entity that sponsors the LNT program. The Center is a nationally-known non-profit organization recognized as a leader in low-impact education. As a partner, Conserve School receives LNT booklets and material that can be used for educational purposes. The partnership embodies the mission and direction of Conserve School.

Since LNT is a vital component of the school's culture, the current students' level of competence of low-impact principles must be assessed. Although some students may be more knowledgeable than others, the goal is to get everybody on the same learning curve. This not only benefits individual students but outdoor recreation at Conserve School is also improved.

Limitations

The project will be specific to Conserve School, field instruction course (outdoor education requirement at Conserve School), and LNT principles.

Definitions of Terms

Leave No Trace- a national and international program designed to educate and assist outdoor enthusiasts with their decisions about how to reduce their recreational impacts

Conserve School- a semester school for high school students focused on the theme of environmental stewardship

Field Instruction- Conserve School physical education requirement that teaches student proper skills for outdoor recreation

Assumptions

- Conserve School will allow the use of LNT assessment results in the project.
- The assessments will take place during field instruction.
- A LNT lesson program will be held as part of field instruction.

CHAPTER II

LITERATURE REVIEW

Low-impact education is imperative to any manager or educator involved with outdoor recreation. The review of the literature discusses the value of low-impact education, the development of low-impact educational programs like LNT, and the design of an effective low-impact educational program. The literature review also covers the development and use of low-impact knowledge assessments, the process in analyzing and evaluating results, and offers suggestions in improving LNT research.

The Value of Low-Impact Education Programs

Land managers have the increasingly difficult task of balancing resource protection and recreation provision. Often times, the two management mandates conflict. Research has shown that resource degradation is an inevitable consequence of natural area visitation (Marion & Reid, 2001). For instance, an uneducated hiker can trample vegetation in a sensitive area. Managers work to eliminate these avoidable actions and impacts while minimizing unavoidable actions and impacts (e.g. the number of visitors in a national park).

In managing both resource protection and recreational provision, direct and indirect management techniques are required. Direct management includes regulations and limitations. In many backcountry settings, users must apply for a permit and there are limits to how many permits can be issued. Similarly, no fires in certain areas are enforceable by law and there are limits to how large the fires should be (i.e. within a fire

ring). However, direct management uses a lot of human resources through constant observation and monitoring. Although it might prove to be the most visible way to modify behavior, direct management is inefficient and some people can feel like their freedoms are being challenged. If used properly, indirect techniques through site management and low-impact education can supplement necessary but more stringent regulations. Through proper trail design and upkeep, site management can protect resources. However, the process also takes up energy and expenses. With a low-cost, high reward, and limited intrusiveness, low-impact education could prove to be the best approach. The value of low-impact education has positive ramifications beyond its straightforwardness.

Low-impact education is important because many visitors are unaware and unknowledgeable of the repercussions of their recreational practices. According to Bradley (1979), most recreational impacts are not from malicious acts but are a result of insensitivity to the consequences of one's actions and from a lack of knowledge of proper low-impact behavior. Low-impact educational programs are designed to equip visitors with information that make them both cognizant of their actions and able to make the proper decisions. Marion and Reid (2007) call the process a "self-directed modification of personal behavior." Through behavior modification, not only do these educational programs like LNT indirectly improve the state of the surrounding resources, they also deepen the visitors' connection and appreciation for the area.

Leave No Trace (LNT), a Low-Impact Educational Program

Leave No Trace Center for Outdoor Ethics is a national non-profit educational program established in 1994. Tracing its roots from a 1970s United States Forest Service (USFS) initiative, the LNT program provides a thorough educational response to resource and experiential impacts. National Outdoor Leadership School (NOLS) was instrumental in the establishment of the LNT program. Through an initial partnership with the USFS, NOLS developed educational principles, materials, and training courses backed by sound science, literature, and review (Marion & Reid, 2001). The National Park Service (NPS), Bureau of Land Management (BLM), and United States Fish and Wildlife Service (USFWS) along with many local and state entities as well as outdoor recreation industry now support the LNT efforts. The LNT provides a unifying message in the many angles of land management.

The mission of LNT Center for Outdoor Ethics is “to promote and inspire responsible outdoor recreation through continued education, research, and partnerships” with a focus on non-motorized recreation (www.lnt.org). Rather than a strict set of rules, the LNT program has developed seven principles that guide visitors toward proper judgment and decision making within specific contexts (Marion & Reid, 2007). By becoming aware of potential impacts, visitors are equipped in choosing the right practice to avoid or minimize their impact that could degrade the quality of natural and cultural resources as well as recreational experience of others. The Center has a committee that continuously reviews the procedures and updates the statuses of programs.

The organization offers online resources, booklets, and workshops. Their website provides information on upcoming courses, partnerships, and programs. The site also provides resources like research, principles, and curriculum. Using research findings and local expertise from both users and land managers, LNT has developed skills and ethics booklets related to a specific region or situation. For instance, there are individual LNT booklets on the Rocky Mountains, Deserts/Canyons, and Alaska Wildlands as well as LNT booklets for rock climbing, sea kayaking, and horse use. LNT workshops range from a half-day awareness course to a two-day Trainer course and a four-day Master Educator course. LNT Trainers can lead awareness workshops while the Master Educators can instruct Trainer courses. Regardless of workshop duration, the seven principles provide the foundation for each course.

Efficacy of Low-Impact Education

Using the broad scope of programs like LNT, low-impact education is communicated to millions of protected area visitors through a diverse array of media. The most common mediums used to communicate low-impact messages include personal contacts by way of park rangers, information provided at visitor centers and trailheads, and audio/video presentations. However, how effective are these programmatic efforts? Framed another way, for the benefit of resources and recreation, are visitors retaining low-impact messages and modifying their behavior accordingly? Marion and Reid (2007) compiled a review of research that looked at the effectiveness of low-impact educational programs. They found that low-impact educational efforts altered visitor knowledge and behavior in reducing impacts of resources and towards

other visitors. Despite a strong listing of studies, the authors felt that research on low-impact education effectiveness was still limited. Further studies need to build upon what constitutes an effective low-impact educational program and the methods behind it.

To be effective, managers and educators should continue to focus their efforts on changing undesirable recreational behavior. Unskilled (i.e. burning garbage) and uninformed actions (i.e. camping next to a water body), and to some extent, careless actions (i.e. littering) can be addressed through education while unavoidable actions must be minimized and illegal actions dealt with by law (Hendee & Dawson, 2000). Educators can target the undesirable actions by describing the nature and significance of ensuing impacts (i.e. natural, cultural, recreational) and persuading visitors of the need to learn and practice behaviors that avoid or minimize impacts (Marion & Reid, 2001). This gets at the theoretical grounding behind low-impact education. In their research, Marion and Reid (2007) discussed how moral development, reasoned action and planned behavior, decision making, and persuasion play into proper outdoor recreational habits. The theories deal with targeting individuals and adapting educational messages depending on the stages of moral development, understanding the intentionality behind action and behavior, processing the psychology that goes into making decisions, and guiding persuasiveness through influence and tone. Such theory provides credibility to studies and the field.

Particularly illuminating in the Marion and Reid study is discussion over an adaptation of McGuire's model of information processing (1985). A visitor is first

exposed to an educational low-impact message that seeks to influence attitude and behavior. The visitor then processes the message for comprehension. The 'make or break' step is the concept of "yielding." The visitor makes the decision whether or not to accept the low-impact message. If the visitor does accept the message, the hope is that he/she will retain the message and change his behavior to avoid or reduce future impacts. However, some messages may prove to be too complicated or conflict with the individual's attitude which renders the efforts unsuccessful. Managers and educators have the critical task in passing on knowledge through proper messages and delivery. Designing and implementing effective low-impact educational efforts are imperative.

Developing and Conducting a Low-Impact Educational Program

In designing an effective low-impact education program, the process should first be guided by specific objectives (Hendee & Dawson, 2000). It's important to identify certain problems and the users that are the primary cause of the problems. For instance, leaving salt licks on vegetation is a problem specific to horse users and education efforts should be directed towards these users. It also helps to know your specific audience and their traits. Surveys can help determine the low-impact knowledge base of your audience and their reception to the messages. Based on surveys, studies have shown that new recreationists are open to low-impact information (Daniels & Marion, 2005) while more experienced recreationist may not be (Fazio, 1979; Manfredo and Bright, 1991). Reemphasizing and repetition of low-impact objectives reach more visitors through a widespread message but also may be too general or not catchy enough for the receptivity of certain audiences.

Second, the content and delivery of an educational message should be clear, concise, and consistent. With low-impact education, there is always concern about information overload. A low-impact educational program should keep it simple by targeting a few specific behaviors that have been a problem in an area. For instance, it's critical for users to know that a cathole should be dug 200 feet from a water body. In directing a message towards users to adopt proper behavior, it's just as important expressing "why" over the "how" (Daniels & Marion, 2005). Studies have shown ecological reasons are more persuasive than sociological reasons in altering recreational behavior (Christensen & Cole, 2000; Hendricks *et. al.*, 2001). By digging a cathole the appropriate depth and distance, visitors are more likely to keep foreign pathogens from entering water bodies which benefits the ecology of the area. Furthermore, not only should educators offer the right message but a consistent message that is current and up to date. LNT is an evolving process that can change which is evident in the increasing disapproval of camping close to water sources and having fires in the backcountry. Mixed or outdated messages on complicated issues confuse visitors and dissuade them from coming to terms with the right message.

Third, timing and techniques of low-impact messages are important. Offering low-impact advice and direction in the preplanning phase of a recreational experience usually proves most effective in altering peoples intended behavior. The reinforcement of certain behaviors near the time of a decision is also effective. For instance, a user is apt to follow a message from a sign at the top of a mountain to stay on trail to protect fragile vegetation. Combining techniques especially personal contacts like a summit

ranger only help in recreational impact mitigation. Other mediums like audiovisual presentations reinforce the low-impact message. Using multiple media contributes to both the widespread repetition of low-impact messages and the specific messages tailored to certain groups

Lastly, personnel must be well-trained and committed to the messages they're promoting. Their presentation must be professional and credible. Source credibility and consistency is strongly related to effectiveness of persuasion (Manfredo & Bright, 1991). Further, educators and managers must be knowledgeable about the theory behind low-impact education. Improved understanding of the theoretical paradigms could help managers and educators develop more persuasive message content and delivery systems (Marion & Reid, 2007). This can only benefit low-impact educational programs and the resources and recreational provision they're sustaining.

Workshop and course material provided by LNT is respected in equipping managers and educators with the appropriate teaching techniques. Through the Center for Outdoor Ethics, managers and educators can obtain a multitude of different activities and methods in teaching low-impact education. One can adapt the material to satisfy their teaching needs and requirements.

Developing and Administering Surveys for Low-Impact Knowledge Assessments

To gain a better understanding of your audience and if there is sufficient time, a low-impact knowledge survey or assessment can provide important feedback. A survey provides a baseline for the level of the audience's knowledge. A follow-up survey or assessment after an educational experience provides additional information. The

process shows an increase or decrease in knowledge over time. Characteristics to consider when conducting a survey are demographics, user-type, and experience.

Fazio (1979) conducted some of the first tests to determine the effectiveness of education methods in improving visitor knowledge of low-impact principles. His study in the Selway-Bitterroot Wilderness looked at user characteristics, sources where the user received low-impact information, and media channels that could be most effective in passing on low-impact principles. A twenty-question knowledge assessment was used to gather the data. For each question, users were asked to list where they had obtained the information needed to answer. Another study in Rocky Mountain National Park looked at the different means of media channel effectiveness. Visitors completed a questionnaire to determine their level of knowledge regarding low-impact skills. They were then exposed to several interpretative discussions, brochures, and a slide show while a control group was not. Five weeks later, participants completed a post-test questionnaire sent by mail. A third study analyzed mailed agency messages for a prospective wilderness visitor.

Dowell and McCool (1986) evaluated the effects that a minimum impact camping program had on a group of Boy Scouts from Missoula, Montana. The scouts were given a booklet emphasizing low-impact skills as part of a pre-test exposure. A week later, the scouts were then given either a 20-minute slide show presentation, a booklet discussing the importance of practicing low-impact behaviors, or both. A test to measure knowledge, skills, and behavioral intentions was given immediately following the

education program and again one month later. The test consisted of multiple choice, true-false, and likert-scale questions on low-impact principles.

Using a low-impact knowledge quiz, Cole *et al.* (1997) assessed the ability of the wilderness visitors to retain message content from trailside bulletin boards. The messages encouraged USFS recommended low-impact practices. Different treatments were exposed to a number of messages ranging from two low-impact principles to eight low-impact principles. Based on the difference in knowledge between control groups that were not exposed to the messages, the study established an approximate quantifiable level of newly acquired knowledge comprehension. Users were also split into two categories: hikers and horseback riders.

In another study, the City of Boulder (Colorado) Open Space Program partnered with the Center for Outdoor Ethics to develop a “front-country” LNT initiative that applied to an urban/suburban park and its open space visitors (Jones, 1999). Focus groups of different users—runners, walkers and hikers, dog walkers, equestrians, mountain bikers, leaders of local environmental and recreation groups—were used to define the highest priority management challenges. Message content and message delivery mediums were also determined. Six important points were identified: ‘trash your trash’, ‘leave it as you find it’, ‘share the trail’, ‘manage your dog’, ‘stick to trail’, and ‘pick up pet waste’. From the information, the initiative focused on these messages through trailhead contacts, distribution of brochures, signs, news releases, and interpretative programs. Participants in the survey were asked to answer questions on the six principles.

Confer *et al.* (2000) examined LNT knowledge among various user groups at an Eastern wilderness area. Participants completed a twelve item true-false LNT quiz. Based on survey results and classifications, five groups were identified: wilderness users, scenic area users, campground users, horse users, and surrounding landowners. Participants were also asked to list their magazine subscriptions. The goal of the study was to identify and target groups with low LNT awareness and knowledge in order to focus communication efforts through certain user-group magazines.

Newman *et al.* (2003) tested Appalachian Trail hikers' knowledge of minimum impact skills and practices. The study used a ten item true-false quiz and two "fill in the blank" questions. Participants were asked where they had received the information needed to answer the questions. The study also identified visitor characteristics such as gender, race, education level, income, and occupation. Hikers were classified into four categories: overnight, section, thru, and day users. The sampling for the study was taken at twenty-two geographical segments along the trail.

Daniels and Marion (2005) administered surveys as part of a longitudinal study evaluating the efficacy of a 16-hour, two-day LNT trainer course. A pre-course survey was used as a baseline to track improvements in short and long-term knowledge, ethics, and low-impact behavior. After the trainer course, a post-course survey was administered. A follow-up survey four months later assessed comprehension and retention as well as any instruction passed on to others. The knowledge section of the survey consisted of twenty-five questions in which the participant was asked to identify the most acceptable LNT behavior or idea from four possible answers. The ethics section

used 16 Likert-scale items to identify the respondent's level of agreement or disagreement with statements about ecological or LNT principles. The behavior section asked the respondent to choose one of three responses that most closely corresponded to their behavior on a recent camping trip. The teaching section looked at how the participant was able to reach out to others with LNT after he/she had taken the course.

The LNT Center for Outdoor Ethics program developed a twenty-five question survey that can be accessed on their website (www.lnt.org). The questions are based on the seven principles of Leave No Trace: plan ahead and prepare, travel and camp on durable surfaces, dispose of waste properly, leave what you find, minimize campfire impacts, respect wildlife, be considerate of other visitors. The principles are supported by relevant scientific research and literature and input from land managers from different federal agencies and experts in outdoor recreation.

Analyzing Low-Impact Knowledge Surveys and Assessing Results

Analyzing the results of low-impact knowledge survey or assessment should elucidate the knowledge level of the audience and the effectiveness or ineffectiveness of the educational program. Certain users may score higher than other users. Increases or decreases in knowledge could reveal strength and weaknesses to the educational program.

Using the data, Fazio (1979) constructed a graph highlighting wilderness-related knowledge of different user groups surveyed in the Selway-Bitterroot Wilderness Area. Outfitters, group leaders, and backpackers had the highest mean-knowledge scores while hunters and day users had the lowest scores. Of the communication sources in

which the user acquired information needed to answer questions, signs, brochures, and magazines proved reliable while newspapers and television did not. The Rocky Mountain study found that an audio-visual slide show was the most effective medium to communicate low-impact educational messages. Contact with agency personnel also helped facilitate the process. In the third study, Fazio found that 100% of USFS districts and 97% of NPS parks sent back information on low-impact practices and behavior.

Dowell and McCool (1984) found that there were significant knowledge gains from both the test results immediately following the course and one month later compared to a control group who had received no instruction prior to testing. There was no significant difference of scores between groups exposed to three different media exposures. However, although above post-test scores, there was a significant decline in retention scores—especially in behavior intention—one month following the course.

In Cole's study, wilderness users exposed to the bulletin board messages answered 41% of the answers correctly compared to 16% from the control group who had not seen the messages. The study found that hikers who were most likely to stop and spend time looking at the message had a higher mean score. As the number of messages increased, attention to the messages increased. However, the ability to retain what the messages content declined. Visitors exposed to eight messages did not acquire any more new low-impact knowledge than those exposed to just two messages.

In the Boulder study, over six-hundred visitors to the open space were surveyed. Of the visitors, 52% answered four of the five knowledge questions correctly compared to 37% of visitors who were not familiar with the program. Participants who had heard

of the program were then asked about their behavioral intentions based on the knowledge questions. Answers ranged from 95% of the participants saying they'd "trash their trash" to 78% of the participants saying they'd pick up animal waste.

The Confer study found that the respondents' average score was 48%. Wilderness users scored the highest on the LNT knowledge quiz while horse users and surrounding landowners scored the lowest. Readers of consumptive outdoor recreation and equine sports magazines had lower LNT scores than did readers of non-consumptive outdoor recreation and environmental magazines.

The Newman study determined that the overall mean score of correct LNT knowledge from all AT hikers surveyed was 82%. Scores varied substantially on individual items. For instance, 99% of participants were correct in answering that walking in a single file and staying on the main path is best in minimizing impact. However, only 48% of participants knew to disperse travel and camp spread out in a minimally used area. There was no statistically significant knowledge differences based on hiker categories although certain questions were more regionally specific. For instance, participants from southern regions scored lower on questions pertaining to camping at least 100 feet from trail and temporary fire rings compared to participants from northern regions. Books, magazines, visitor center, and ranger stations proved to be the most popular and effective sources of information on minimum impact skills and practices.

The Daniels and Marion study found that scores for each of the three sections increased immediately following the course but decreased slightly over four months

after the completion of the course. More than half of the knowledge and behavior items and half of the ethics items showed significant improvement from pre-course measures to the follow-up assessment. Age, reported LNT experience, and backpacking experience affected the participants' pre-course knowledge and behavior scores. Younger, less experienced respondents gained the most from the course. After the program, participants often shared their LNT skills and ethics with others both formally and informally. There was no correlation between change in knowledge and change in behavior but there was a significant correlation between a change in ethics and change in behavior.

Evaluating Low-Impact Knowledge Assessment Survey Results

Based on the results, evaluating the low-impact educational program will offer room for improvement. Message content and delivery could be assessed in conjunction with the needs of certain visitors. Certain complicated low-impact practices and behaviors could also be better defined.

Fazio (1979) concluded that low-impact educators can prioritize informational campaigns by identifying certain individual characteristics. Specifically, educators should determine how to tailor communication messages to specific target groups. Although easy to hand out, brochures were minimally effective in addressing backcountry recreational behavior. The third study found that agencies should spend more time initiating contact and communicating with visitors in the preplanning stages of a recreational experience.

With the drop in knowledge and behavioral intention in the second half of their study, Dowell and McCool emphasized the importance of reinforcing low-impact messages. Avenues need to be established to offer periodic follow-ups. A hands-on experience like a camping trip that ingrains newly acquired information would be helpful. The experience and proper behavior practice should reinforce low-impact knowledge.

Cole's study provides evidence of informational overload. Certain wilderness users spent more time looking at a sign emphasizing LNT practices but this didn't translate into processing more information. The study showcased that there is a threshold to how much a visitor can retain. It also potentially highlights bias against horse riders given that they're less likely to stop at a sign. Different users may need different mediums to interpret messages.

With the results from Confer's study, low-impact education should focus its message on less-knowledgeable user groups. Mass communication in the form of magazines would be a good outlet in reaching the appropriate audience. The assessment of certain users' knowledge like horseback riders may also be too narrow in comparison to hikers. Certain user groups may only be concerned with low-impact practices within their own realm and may not know or feel the need to know about broader implications. The study suggests activity specific low-impact knowledge tests to get better representation.

Newman (2003) concluded that most hikers on the AT are relatively well-informed about a variety of minimum impact skills and practices. To make educational

efforts more effective, LNT messages could focus on practices that visitors are least knowledgeable like camping/traveling techniques in pristine areas or camping 100 feet from a trail. Books, magazines, visitor center, and ranger stations that are the most effective sources of information on minimum impact skills and practices could help target certain regional hikers about specific skills and behavior.

The Boulder study found that knowledge levels of those who were familiar with the program were significantly higher than those who were not. Looking at the responses, the study found that there is a good chance that some behavioral change took place. This was based on behavioral intentions as a result of the knowledge questions.

Daniels and Marion (2005) concluded that ethical appeals may be more important than information alone in promoting appropriate low-impact behaviors. The study suggests that a low-impact educational program should focus more on fundamental belief systems, including morals that help us define good and proper behavior. The course should also emphasize the needs and reasons for certain practices, and their benefits to the environment, the individual, and other visitors.

Drawbacks of Low-Impact Education Analysis and Recommendations for Improvement

Despite a study indicating that campfires and camping near lakes have decreased substantially in eight different wilderness areas through educational efforts (Christensen and Cole, 2000), having gained knowledge of proper low-impact behavior doesn't guarantee its practice. Cognitive and social factors also play a role in determining action. Harding *et. al* (2000) identified major factors that could alter low-impact compliance.

First, a recreationist may misinterpret certain environmental cues that are critical for following LNT principles. For instance, the recreationist believed he/she was camping in a high-use site when in actuality it was low-use. Second, a recreationist may retrieve the wrong information or none at all in trying to spur his/her memory in choosing the right low-impact behavior. For example, being so accustomed to trail travel, the recreationist incorrectly allows his/her group to walk single file through a pristine area. Third, our judgments and decisions might not always match up with proper low-impact behavior. Even though a recreationist is well-trained in LNT, bad weather or fatigue could play a factor in non-compliance. Similarly, social pressures can play a role in decision making. One's behavior can be dictated by a group. It seems educators and managers should address factors beyond knowledge and ethical retention of LNT principles.

In terms of evaluating low-impact education, there are many methodological challenges (Marion and Reid, 2006). Control groups should be necessary in studies but are difficult with different visitor attributes amongst groups. Since knowledge doesn't necessarily mean compliance, reporting on behavior is important. However, it's difficult to locate individuals to participate and submit anything regarding their behavior. Additionally, the truthfulness of their responses can't be tracked. Unobtrusively observing actual behavior would prove the most accurate assessment but this also proves difficult, time-consuming, and a borderline instance of privacy invasion. Perhaps the best way to assess LNT knowledge gains and behavioral changes is observing how resource conditions improve in certain areas that have adopted strong low-impact educational messages.

SUMMARY

The literature review provided information for teaching content to be used in field instruction at Conserve School. It also gave direction and inspiration in establishing LNT knowledge assessments. There are many benefits to knowledge assessments but there are also drawbacks. Although knowledge and awareness of LNT may be improved through low-impact education, individual adherence to principles does not necessarily follow. Knowledge assessments are an important first step in analyzing and evaluating individual's ability to understand low-impact concepts but studies need to branch out into correlating increased or decreased content retention with behavior changes and resource alteration.

CHAPTER III

METHODOLOGY

SUBPROBLEM ONE - Develop and conduct a low-impact education program at an environmentally-oriented semester boarding high school.

LNT is a critical part of field instruction. All skills and activities taught in field instruction have underlying LNT components. LNT provides the foundation for responsible outdoor recreation. Since field instruction is a physical education requirement, it must also meet the National Association for Sport and Physical Education (NASPE) standards. Teaching LNT principles upholds standard five through “self-initiated behaviors that promote personal and group success in activity settings” (NASPE, 2004). It also addresses responsible personal and social behavior including “safe practices, adherence to rules and procedures, etiquette, cooperation and teamwork, ethical behavior, and positive social interaction” (NASPE, 2004 from Morley *et al.*, 2008). Finding correspondence with national physical education requirements enhances LNT’s visibility and credibility in field instruction.

During field instruction, it was determined that one week would be set aside to teach LNT principles. LNT would be covered in-depth after lessons on cross-country skiing and snowshoeing. A lead field instructor would be assisted by another field instructor during the second lesson. The goal was to initiate critical thinking on how to adhere to and adopt LNT principles and behaviors.

Two lesson plans would be developed for the program. Since all students required the same instruction, no group had a different lesson. Each class received the same content and instructions. However, field instructors wanted to initiate a self-learning component with the lessons. Rather than immersing them in lecture, students would gather their own information on LNT and have the means to present on LNT topics. The instructors and the other classmates would be the observers/"learners" with the students presenting the concepts.

SUBPROBLEM TWO - Develop and administer pre and post-assessment of LNT principles following exposure to low-impact education.

An initial survey describing individual's outdoor experiences and skill level would be developed and administered during the first field instruction class. Students would self-report on their outdoor ability. Included in the survey would be a Likert-scale question determining the student's familiarity with knowledge of LNT.

Students would first take a pre-assessment based on the seven LNT principles a week before the LNT program. The assessment would establish a base-line knowledge level in order to track improvements following the program. The pre-assessment results would also be compared to the self-reported results in the initial field instruction survey.

A post-assessment, identical to the pre-assessment, would then be administered two weeks after the LNT program. The post-assessment would highlight improvements or deficiencies in relation to the pre-assessment. The post-assessment would also be used to compare the four groups and the reported expertise-level with LNT.

Conserve School was made aware of the project and the use of the survey and assessments. After speaking with the Assistant Head of School, it was determined that the project was no different than any traditional assessment used in other core classes. As long as student confidentiality was maintained, Conserve School had no problem with using the data for the project.

SUBPROBLEM THREE - Analyze pre and post-assessment results.

Spread sheets, graphs, and percentages would be used to analyze and showcase the data. Microsoft Excel would be used in creating the data sets. Group, self-reported, and individual question scores would be specifically compared

SUBPROBLEM FOUR - Evaluate pre and post-assessment results.

Based on the results, the LNT program would be descriptively evaluated. Improvements and deficiencies in LNT knowledge scores would be reported. Group, self-reported, and individual question scores would be evaluated.

SUBPROBLEM FIVE - Determine drawbacks to the analysis of LNT educational programs and offer suggestions for improvements.

A report to the Director of Outdoor Programs would be submitted. The report would detail the findings of the project and the benefits of LNT training. The report would also suggest ways to better integrate and improve LNT's place in lessons and campus outdoor life as a whole.

SUMMARY

Projected timeline of the methodology used to conduct the research:

- 1) Develop and implement a low-impact educational program
 - a. January 2011-early February 2011
 - i. Develop a lesson program
 - ii. Receive feedback on the lessons from Director of Outdoor Programs and peers
 - b. Late February 2011
 - i. Implement lesson program during Field Instruction
- 2) Develop and administer low-impact knowledge assessments
 - a. January 2011
 - i. Develop and administer initial field instruction assessment that surveyed the level of outdoor experiences the students had achieved; included in the survey was the level of familiarity with LNT principles
 - b. February 2011
 - i. Develop a twelve-question LNT knowledge assessment
 - ii. Use a validity team to review the assessment
 - iii. Administer LNT knowledge assessment
 - c. Early March
 - i. Administer the same LNT knowledge assessment
- 3) Analyze the low-impact knowledge assessment results
 - a. March-April 2011
 - i. Construct graphs to highlight data analysis
- 4) Evaluate the low-impact knowledge assessment results
 - a. March-April 2011
 - i. Descriptive evaluation of findings
- 5) Determine drawbacks of low-impact knowledge assessment and offer improvements
 - a. May 2011
 - i. Submit a report to Director of Outdoor Programs highlighting findings

CHAPTER IV

RESULTS

SUBPROBLEM ONE - Develop and conduct a low-impact education program at environmentally-oriented semester boarding high school.

A rough lesson plan was first drawn in a field instruction planning session. Field instructors agreed that background on LNT and introducing the seven LNT principles were essential to the lesson. LNT booklets and online resources were helpful in preparing and organizing material for teaching the lesson. The literature review for this project also proved helpful in creating the lesson. After consultations with other field instructors, the authority of resource concept would be covered. Compared to a hard-line enforcement approach, the authority of the resource makes an uninformed recreationist think and respond to how their actions impact the environment. For instance, a ranger would give an overview of the situation through small talk, explain the implications of the actions, and politely inform the recreationist on how to improve the situation. Covering authority of the resource would prepare students in approaching family, friends, and strangers on how to better adhere to low-impact principles in a non-confronting manner. The lesson outline was then submitted to the Director of Outdoor Programs at Conserve School.

Once the material was decided upon, two lesson plans were created using a template established from one of the practicum courses as part of the UWSP graduate fellowship in residential environmental education (see Appendix A). Both lesson plans

were prepared for an hour and forty minute class. There were four groups of eleven students each. Two groups had afternoon field instruction Monday/Thursday and two groups had instruction Tuesday/Friday. The first lesson was used during Monday/Tuesday classes and the second lesson was used during Tuesday/Friday classes. The first lesson covered the background, history, and importance of LNT. Students then watched a ten minute video on the seven principles of LNT. The movie was produced by the National Park Service. After answering questions and commenting on the video, students were asked to either 1) choose one principle and create a poster presentation or 2) prepare a realistic skit incorporating all LNT principles, practices, and behaviors. For each class, seven students chose a principle. Two students worked on skits that embraced “good” LNT practices while two students were to showcase “bad” LNT practices. Students spent a majority of the class period working on their presentations. The goal of the assignment was to research the principles in-depth using online resources and LNT publications and then present the findings to the class through an illustrated poster or a skit. Covering the principle concepts was important; however, the instructors emphasized the equal importance of explaining why the principle was socially, ecologically, and ethically beneficial. Students used the remaining class time to research, ask questions, and create their presentations. During the last ten minutes of class, the instructors had the students discuss LNT violations that they could tolerate. A handout from NOLS was used (see Appendix B). It was generally agreed upon that no LNT principles should be violated. However, many students felt they could live with campers wearing and using brightly colored clothes and tents, a lack of archeological

artifacts, and individuals taking breaks on trail. Many students could not tolerate water contaminated with fecal bacteria and toilet paper stuffed under rocks. Although not part of the research, it was interesting to gain perspective on the students' view of LNT considerations.

The students presented their posters and skits to classmates and other field instructors during the second LNT lesson. Presentations lasted between 3-6 minutes and the skits lasted between 8-12 minutes. Students were asked to speak about why their principle was important, what behavior is necessary to meet the principle, and how the principle has social, ecological, or ethical ramifications.

Field instructors asked specific questions when they felt there were deficiencies in the content. Students were also asked to clarify on complicated or ambiguous situations related to their principle. What exactly is a mound fire? Who has the right of way on the trail when encountering pack stock? How does one go to the bathroom on the beach? After the presentations were finished, students went outside to witness LNT principles and behaviors in practice. Students paced off 200 feet from a water source to get a general idea of how far away one should be when going to the bathroom, cleaning dishes, or bathing. The class also discussed the proper place of pitching a tent. Students then were familiarized with hanging a bear bag and the significance of a bear barrel to store food. To end class, instructors demonstrated the concept of the authority of the resource and the techniques for addressing it. Students acted out their own skits to showcase proper procedure in dealing with uninformed or negligent outdoor

recreational behavior. Scenarios included were reducing the size of a fire, approaching someone collecting seashells on the seashore, and feeding animals.

Students were scored on their presentations and participation in class. Field Instruction is a pass/fail course. Students exceeding expectations receive a 2 on a lesson, students meeting expectations score a 1, and students who are below expectation score a 0 and a fail the lesson. Thirty-eight students scored a 2 on the lesson. However, six students scored a 1. The instructors agreed that five students had average presentations. One student was completing his poster during the presentation day and also received a 1. The finished posters were displayed in the school's athletic facility.

SUBPROBLEM TWO - Develop and administer pre and post-assessment of LNT principles following exposure to low-impact education.

During the first day of field instruction, the field instructors gathered information regarding the outdoor experiences of students (see Appendix C). Students explained their experiences with outdoor skills and activities (i.e. camping, backpacking, canoeing, navigation, winter recreation). Familiarity with LNT knowledge was included in the initial survey. A Likert-scale question was used for measuring LNT understanding. The information was to aid instructors in understanding their audience's experiences and capabilities with outdoor recreation. It also provided direction in planning the course content and established a level of standards with students

For the project, a LNT-specific assessment was created (see Appendix D). The assessment consisted of twelve multiple-choice questions. The assessment was based on surveys used in past LNT research. An online multiple choice LNT quiz created by the Center for Outdoor Ethics was an influential model for creating the assessment (see Appendix E). In order to keep the length realistic, the assessment condensed principle concepts together. Rather than having individual questions for principle 1 (Plan and Prepare), the overarching concepts were comprised in one question. With five questions, all the answers applied as correct. None of the answers applied for one question. Before administering, the survey was sent to three colleagues for review. Two responded and agreed the assessment was relevant and useable. One of the individuals, a history teacher at Conserve School, also provided more information (see Appendix F). The Conserve School administration had to agree with the use of the assessment. After reviewing, the Assistant Head of School at Conserve School was comfortable with the project since student confidentiality would be upheld.

One week before the first LNT lesson, the pre-assessment was administered to the four groups in their respective field instruction classes. Not only did the assessment results provide data to compare to the initial self-reporting activity, the cumulative responses to the assessment questions also guided class content. The instructors gained insight into what LNT concepts needed more emphasis. The implications of concepts like littering was understood but certain methods of travel and camping required greater attention and detail. When are wildlife least sensitive to disturbance? How does one travel and camp in a pristine area? What is the only acceptable waste left in the

backcountry? Despite the commitment to reinforce the common issues, more time and effort were dedicated to complicated issues.

The same assessment was again administered to the four groups two weeks after the second LNT lesson. The results were to be compared to the initial self-reporting exercise and the pre-assessment responses. Both assessments were then returned after data analysis was completed. Students generally agreed the assessment was straight-forward. However, some students voiced concern over the wordings of questions 11 and 12.

SUBPROBLEM THREE - Analyze pre and post-assessment results.

Out of the forty-four students surveyed, forty-two submitted useable data. One student did not rate themselves on the initial survey. Another student did not submit a post-assessment. As a result, their completed information was discarded and not included in the analysis. Both students were in Group 1. As a result, Group 1 had nine students compared to Groups 2, 3, and 4 which each had eleven students. All ratings and percentage points were rounded up to two significant digits. Although a student may have selected a correct answer on certain questions, there potentially could have been a better answer. Despite answering correctly, the student had to choose the best answer and was otherwise marked incorrect.

The initial field instruction survey determined whether an individual self-reported as a beginner, intermediate, or expert with LNT knowledge. The score was scaled 1 to 5 (1=beginner, 3=intermediate, 5=expert). Twenty-two individuals scored

themselves as having intermediate knowledge of LNT, two individuals scored themselves as having beginner knowledge of LNT, and three individuals scored themselves as being an expert with LNT knowledge (Figure 1). The mean score was 3.12 (Figure 2). Group 3 had the highest reported score with a 3.64 rating while Group 2 had the lowest score with a 2.64 rating.

LNT Familiarity (1=lowest, 5=highest)	Self-reported Score
1	2
2	6
3	22
4	9
5	3

Figure 1. Student self-reported score of LNT familiarity (n=42).

Group	Score
1 (n=9)	3.0
2 (n=11)	2.64
3 (n=11)	3.64
4 (n=11)	3.18
Overall (n=42)	3.12

Figure 2. Group mean scores of self-reported score of LNT familiarity.

The twelve-question pre-assessment yielded an average score of 79% (Figure 3). Group 1 had the highest score with 81%. Group 2 had the lowest score with 78%. All forty-two students answered question 7 correctly. Only 43% of the students correctly answered question 4. At 27%, Group 2 struggled with question 8 and Group 3 had difficulty with question 4.

Question	Group 1 (n=9)	Group 2 (n=11)	Group 3 (n=11)	Group 4 (n=11)	Overall (n=42)
1	100%	91%	100%	100%	98%
2	78%	64%	91%	82%	79%
3	56%	64%	64%	64%	62%
4	56%	45%	27%	45%	43%
5	100%	91%	100%	91%	95%
6	100%	100%	100%	91%	98%
7	100%	100%	100%	100%	100%
8	44%	27%	64%	64%	50%
9	89%	100%	100%	100%	98%
10	100%	100%	73%	73%	86%
11	78%	91%	64%	64%	74%
12	67%	64%	64%	82%	69%
Overall	81%	78%	79%	80%	79%

Figure 3. Pre-assessment group scores.

Students who self-reported as a 4 had the highest score at 81% (Figure 4).

Students who self-reported as a 2 scored the lowest at 75%. Students who rated themselves a 2 or 3 struggled with questions 4 and 8. Only one of three students who self-reported as a five correctly answered question 3.

Question	1 (n=2)	2 (n=6)	3 (n=22)	4 (n=9)	5 (n=3)	Overall (n=42)
1	100%	83%	100%	100%	100%	98%
2	50%	50%	91%	67%	100%	79%
3	50%	67%	68%	56%	33%	62%
4	100%	17%	41%	56%	67%	43%
5	100%	100%	91%	100%	100%	95%
6	100%	100%	95%	100%	100%	98%
7	100%	100%	100%	100%	100%	100%
8	50%	33%	45%	67%	67%	50%
9	100%	100%	95%	100%	100%	98%
10	50%	83%	95%	78%	67%	86%
11	100%	100%	59%	78%	100%	74%
12	50%	83%	64%	78%	67%	69%
Overall	79%	75%	79%	81%	80%	79%

Figure 4. Pre-assessment scores based on self-reported scores of LNT familiarity.

In the post-assessment, the average score was 88% (Figure 5). Group 1 scored the highest at 93%. Group 4 scored the lowest at 85%. Group 1 had trouble with question 4 with only 44% of the students answering correctly. Group 4 had difficulty with question 11 with only 45% of the students answering correctly.

Question	Group 1 (n=9)	Group 2 (n=11)	Group 3 (n=11)	Group 4 (n=11)	Overall
1	100%	100%	100%	100%	100%
2	100%	73%	73%	100%	86%
3	89%	82%	91%	64%	81%
4	44%	73%	91%	64%	69%
5	100%	91%	100%	100%	98%
6	100%	91%	100%	73%	90%
7	100%	100%	100%	100%	100%
8	100%	73%	55%	82%	76%
9	100%	100%	100%	100%	100%
10	100%	100%	100%	100%	100%
11	89%	100%	73%	45%	76%
12	89%	91%	73%	91%	86%
Overall	93%	89%	88%	85%	88%

Figure 5. Post-assessment group scores.

Scores improved 9% from pre-assessment to post-assessment (Figure 6). At 12%, Group 1 showed the greatest improvement. At 5%, Group 4 had the smallest improvement. There were score declines with different groups on different questions. Group 1's score decreased 12% on question 1, Group 2's score decreased 9% on question 6, Group 3's score decreased on question 2 and 8, and Group 4's score decreased on question 6 and 11. Most significant was the 8% decline overall with question 6.

Question	Group 1 (n=9)	Group 2 (n=11)	Group 3 (n=11)	Group 4 (n=11)	Overall (n=42)
1	0%	9%	0%	0%	2%
2	22%	9%	-18%	18%	7%
3	33%	18%	27%	0%	19%
4	-12%	28%	64%	19%	26%
5	0%	0%	0%	9%	3%
6	0%	-9%	0%	-18%	-8%
7	0%	0%	0%	0%	0%
8	56%	46%	-9%	18%	26%
9	11%	0%	0%	0%	2%
10	0%	0%	27%	17%	14%
11	11%	9%	9%	-19%	2%
12	22%	27%	9%	9%	17%
Overall	12%	11%	9%	5%	9%

Figure 6. Post-assessment group percentage improvements or deficiencies compared to pre-assessment.

Students who self-reported as a 2, 3, or 5 scored the highest with 89% (Figure 7).

Students who self-reported as a 1 scored the lowest at 83%.

Question	1 (n=2)	2 (n=6)	3 (n=22)	4 (n=9)	5 (n=3)	Overall (n=42)
1	100%	100%	100%	100%	100%	100%
2	50%	83%	82%	100%	100%	86%
3	50%	83%	86%	78%	67%	81%
4	50%	50%	68%	89%	67%	69%
5	100%	100%	95%	100%	100%	98%
6	100%	83%	91%	89%	100%	90%
7	100%	100%	100%	100%	100%	100%
8	100%	83%	77%	67%	67%	76%
9	100%	100%	100%	100%	100%	100%
10	100%	100%	100%	100%	100%	100%
11	50%	83%	82%	67%	67%	76%
12	100%	100%	91%	56%	100%	86%
Overall	83%	89%	89%	87%	89%	88%

Figure 7. Post-assessment scores based on self-reported scores of LNT familiarity.

Students who self-reported as a 1 had score declines with questions 4 and 11 (Figure 8). Students who self-reported as a 2 had score declines with questions 6 and 11. Students who self-reported as a 3 had score declines with questions 2 and 6. Students who self-reported as a 4 had a score declines with questions 6, 11, and 12. Students who self-reported as a 5 had score decline with question 11. Ratings of 1, 2, 4, and 5 had difficulty with question 11. Ratings of 2, 3, and 4 had difficulty with question 6.

Question	1 (n=2)	2 (n=6)	3 (n=22)	4 (n=9)	5 (n=3)	Overall (n=42)
1	0%	17%	0%	0%	0%	2%
2	0%	23%	-9%	33%	0%	7%
3	0%	16%	18%	22%	34%	19%
4	-50%	33%	27%	33%	0%	26%
5	0%	0%	4%	0%	0%	3%
6	0%	-17%	-4%	-11%	0%	-8%
7	0%	0%	0%	0%	0%	0%
8	50%	50%	32%	0%	0%	26%
9	0%	0%	5%	0%	0%	2%
10	50%	17%	5%	22%	33%	14%
11	-50%	-17%	23%	-11%	-33%	2%
12	50%	17%	27%	-22%	33%	17%
Overall	4%	14%	10%	6%	9%	9%

Figure 8. Post-assessment percentage improvements or deficiencies based on self-reported scores compared to pre-assessment.

SUBPROBLEM FOUR - Evaluate pre and post-assessment results.

Group 1, which was 3rd out of 4 groups with their self-reported LNT knowledge scores, had the highest pre and post-assessment scores (81% and 93%). Group 1 also showed the greatest improvements with 12% score increase from pre and post-assessments. Group 3, which had the highest self-reported score, was 3rd out of the 4 groups with pre, post, and improvement percentages. Group 2, which had the lowest self-reported score was second in pre, post and improvement scores. Students who self-reported as a 4 and 5 had the highest scores at 81% and 80% respectively. Students who self-reported as a 2 scored the lowest at 75%. On the post-assessment, individuals who had self-reported as either a 2, 3, or 5 scored the highest with 89% correct. Individuals

who self-reported as a 2 showed the greatest improvement from pre to post-assessment with 14% increase in scores.

Overall, there was a 9% improvement in scores from the pre to post-assessment. Answers to questions 4 and 8, the questions that posed the greatest difficulty to students in the pre-assessment, both showed a score increase of 26% in the post-assessment. However, there was an 8% decrease overall in scores in regards to question 6. Students had initially scored 98% overall during the pre-assessment but scores dropped to 90% in the post-assessment. Correct answers to questions 1, 5, 8, and 11 only increased 2-3%. However, questions 1, 5, and 8 already had high correct response rates (95-98%) before the post-assessment. Gains of 2% from 74% to 76% with question 11 resulted in the second lowest score on a question in the post-assessment (questions 4 at 69% and 8 at 76% had the lowest scores although this was after an improvement of 26%).

SUBPROBLEM FIVE - Determine drawbacks to the analysis of LNT educational programs and offer suggestions for improvements.

A formal letter was submitted to the Director of Outdoor Programs (see Appendix G). The letter informed the director on the findings of the project, the need to enhance LNT education in field instruction and outdoor life, and the possible avenues to witness behavior alteration based on improved low-impact awareness. The letter also discussed measures to improve LNT initiatives on campus.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

When looking at the group self-reported LNT knowledge scores and the scores on the assessment, it seems students either overestimated or underestimated their actual LNT knowledge. However, when looking within the self-reported scores and the scores on the assessments, the results reflect what could have been expected. Students who self-reported a high level of LNT knowledge scored higher on the assessments. Students who self-reported a low level of LNT knowledge scored lower. There were greater improvements in knowledge scores with students who were less familiar with LNT, specifically individuals who self-reported as a 2. Being less familiar with the concepts, these students could have been more open and receptive to the information. Despite the gains seen with individuals who self-reported as a 2, individuals who self-reported as a 1 had the lowest improvement scores. Perhaps these individuals weren't able to grasp the concepts. There were also fewer improvements with students who already had a higher level of LNT. These students could have been less receptive to receiving more information.

Recommendations

Students voiced concerns over some of the wording of certain questions. Question 3 and its correct answer could have been stated more clearly. The notion of washing clothes immediately upon returning home was a poor example of mitigating

the spread of invasive species and should be reworded if the assessment was to be administered again. Question 12 and the concept of uphill traffic getting the right of way on trail was also unclear and confusing to some. Question 4 may have proved difficult because of the specificity of the question. Individuals needed to understand what the question was asking in order to answer correctly. Question 8 was straightforward but the answer may have been complicated to follow for some individuals. Students may have also struggled with “all of the above” or “none of the above” type answers to questions. The question was marked wrong if “all of the above” or “none of the above” despite circling one correct answer. In another longer assessment, these questions could be eliminated for increased clarity. An improved assessment could also be used (see Appendix H).

Some students also had a tendency to answer a question right on the pre-assessment but get it wrong on the post-assessment (see Appendix I). Two of the three students who had a perfect score on the pre-assessment did not score perfect on the post-assessment. There was no way to determine what caused this situation but perhaps it was a product of not returning the pre-assessment back to the students before they completed the post-assessment. These students did not have an assessment they could review for correct answers. The students who scored perfectly may have fortunately chosen the right answer but went back on the answer because of mixed information or perceptions.

Although each class received the same learning material and direction, the lessons differentiated based on the content covered by the students. Assessment scores

could have been dictated by the quality of the student provided information. Out of the six students who received the minimal grade for passing the lesson, three of the students were from group 1. Not only could this have dictated their own scores on the LNT assessment but this could have been a variable in the overall scores as these students were teaching material to their classmates. To compensate for the variable, the instructor could have controlled all the learning content for the classes. However, this creates another variable based on the instructor's efforts creating the lesson plan and effectively implementing it.

In terms of improvements to the LNT program, more outdoor experience could have been beneficial. Simulating hands-on and practical LNT application outdoors makes the content more relevant and applicable. Although the indoor time was valuable in terms of students researching and presenting principles, an outdoor lesson could be more effective. A derivation of an outdoor lesson could include expressing certain principles during an extended walk on the trails. Students could still participate in the lesson and stimulate self-learning through certain LNT exercises and activities outdoors.

The project could have been improved by looking in more detail at the certain experiences of students as gathered in the initial field instruction survey (refer to Appendix C). An individual who self-reported as a 4 or 5 with familiarity of LNT principles but with limited outdoor experiences may be overestimating their comprehension level. There was no way to assess the validity of LNT self-reporting other than looking at outdoor experiences.

BIBLIOGRAPHY

- Attarian, A. (1996). Integrating Values Clarification into Outdoor Adventure Programs and Activities. *Journal of Physical Education, Recreation, and Dance*. 67(8): 41-44.
- Bradley, J.A. (1979). A Human Approach to Reducing Wildland Impacts. In R. Ittner, D.R. Potter, J.K. Agee, and S. Anshell (eds) *USDA Forest Service Proceedings Recreational Impacts on Wildlands*. 222-6.
- Confer, J.J, A. J. Mowen, A.R. Graefe, and J.D. Absher. (2000). Magazines as Wilderness Information Sources: Assessing Users' General Wilderness Knowledge and Specific Leave No Trace Knowledge. *USDA Forest Service Proceedings Wilderness Science in a Time of Change Conference*. 15(4): 193-197.
- Cole, D.N., T.P. Hammond, and S.F. McCool. (1997). Information Quantity and Communication Effectiveness: Low-Impact Messages on Wilderness Trailside Bulletin Boards. *Leisure Sciences*. 19, 59-72.
- Christensen, N.A. and D.N. Cole. (2000). Leave No Trace Practices: Behaviors and Preferences Wilderness Visitors Regarding Use of Cookstoves and Camping Away From Lakes. *USDA Forest Service Proceedings – Wilderness Science in a Time of Change Conference*. 15(4): 77-85.
- Daniels, M.L. and J.L. Marion. (2005). Communicating Leave No Trace Ethics and Practices: Efficacy of Two-Day Trainer Courses. *Journal of Park and Recreation Administration*. 23(4): 1-19.
- Dowell, D.L. and S.F. McCool. (1985). Evaluation of a Wilderness Dissemination Program. *National Wilderness Research Conference Proceedings – Current Research*. 494-500.
- Fazio, J. (1979). *Communicating with the Wilderness User*. Bulletin Number 28. University of Idaho, College of Forestry, Wildlife, and Range Experiment Station. 1-65.
- Harding, J.A., W.T. Borrie, and D.N. Cole. (2000). Factors That Limit Compliance With Low-Impact Recommendations. *USDA Forest Service Proceedings – Wilderness Science in a Time of Change Conference*. 15(4): 198-202.
- Hendee, J.C. and C.P. Dawson. (2002). *Wilderness Management: Stewardship and Protection of Resources and Values* (3rd Edition). Golden, CO: Fulcrum.

- Jones, M. (1999). *Leave No Trace: Pilot Project Report*. Boulder, CO: City of Boulder, Open Space and Mountain Parks Program.
- Manfredo, M.J. and A.D. Bright. (1991). A Model for Assessing the Effects of Communication on Recreationists. *Journal of Leisure Research*. 23(1): 1-20.
- Marion, J.L. and S.E. Reid. (2001). Development of the U.S. Leave No Trace Program: An Historical Perspective. In M.B. Usher (ed.) *Enjoyment and Understanding of the Natural Heritage*. 81-92. Edinburgh: Scottish Natural Heritage, Stationery Office.
- Marion, J.L. and S.E. Reid. (2007). Minimising Visitor Impacts to Protected Areas: The Efficacy of Low Impact Education Programmes. *Journal of Sustainable Tourism*. 15(1): 5-27.
- McGuire, W.J. (1985). Attitudes and Attitude Change (3rd Edition). In G. Lindzey and E. Aronson (eds) *The Handbook of Social Psychology*. Vol. 2. 233-46. New York: Random House.
- Morley, L., M.R. Chase, R.W. Day, B. Lawhon. (2008). Conviction of the Heart: Implementing Leave No Trace Principles in Outdoor Recreation. *Journal of Physical Education, Recreation, and Dance*. 79(7): 29-34.
- National Association for Sport and Physical Education. (2004). *Moving Into the Future: National Standards for Physical Education* (2nd Edition). Reston, VA.
- Newman, P., R. Manning, J. Bacon., A. Graefe, G. Kyle. (2003). An Evaluation of Appalachian Trail Hikers' Knowledge of Minimum Impact Skills and Practices. *International Journal of Wilderness*. 9 (2): 34-8.
- Turner, J.M. (2002). From Woodcraft to 'Leave No Trace': Wilderness, Consumerism, and Environmentalism in Twentieth-Century America. *Environmental History*. 7(3): 462-484.
- Wallace, G.N., (1990). Using the Authority of the Resource as an Interpretive Technique. *Legacy*. 1(2): 4-9.

Appendices

Appendix A

Field Instructor Lesson/Activity Preparation Form

Goals/Learner Outcomes (*what you want your audience to do, feel, or think as a result of this lesson/activity*)

Upon completion of this lesson/activity, the audience will be better able to understand Leave No Trace (LNT) principles and explain their importance.

Lesson/Activity Objectives (*measurable, for goals above—how you will know that you accomplished your goals*)

- Students will satisfactorily prepare a presentation on LNT

Theme for this lesson/activity: Leave No Trace (Lesson 1)
Introduction (Grabber or POW) LNT is a fundamental environmental ethic of outdoor recreation.
Link to Body: Body (include learning preferences, teaching methods) Subthemes (main points)/individual activities: <ul style="list-style-type: none">- Importance of LNT<ul style="list-style-type: none">o Eliminates and/or minimizes impact in outdoor recreationo Benefits and protects the resources that form the basis of recreationo Upholds resource integrity and recreational provision for future generations- Development of LNT<ul style="list-style-type: none">o Came into fruition during the 1970s as a result of excessive recreational impact on natural resourceso Center for Outdoor Ethics was established in 1994o All 4 federal land agencies support and promote LNT- Highlighting seven LNT principles (show short NPS LNT movie)- How it relates to field instruction

- Activities should integrate LNT
- Adhering to LNT during solos, exploration week, etc.

Activities

- Creating posters and short skits based on the seven LNT principles
- Independent research with online and LNT material

Learning Preferences and Teaching Methods

- Visual (LNT movie), auditory (LNT lecture), physical (creating posters and skits)
- Have students teach their peers through presentations

Link to Conclusion:

Conclusion

How will you wrap up the lesson/activity?

Discussion of the inherent values of the seven principles.

Field Instructor Lesson/Activity Preparation Form

Name: Jeff Nemec

Lesson/Activity title: Leave No Trace

Lesson/activity date: Late February 2011

Teaching location: LRC

Topic: LNT

Audience: Conserve School students

Duration of lesson/activity (how long is it designed to last?)

1 hr. 40 min.

How will you assess this lesson/activity?

Assessments will be completed during the second LNT lesson through poster and skit presentations.

What teaching resources (supplies, biofacts, etc.) do you need?

Whiteboard, smartboard, computer for video, poster paper, crayons/markers

How you will relate this to your audience's lives:

Eliminating or reducing environmental impact wherever one is

Link to the mission/theme/topic for the other lessons/activities of the day:

Back up activities if you have extra time and/or extension activity:

Discussing practices or behavior that one could or couldn't tolerate in the backcountry

Phenology or anticipated teachable moments:
Teaching objectives for today (measurable personal objectives that relate to your own ability): Facilitate class smoothly and answer questions properly
Safety/logistics considerations:

Things to think about: Questioning Strategies: Knowledge, Comprehension, Application, Analysis, Synthesis, Evaluation
How you will increase intrinsic motivation: Create a strongly positive climate, Increase feedback, Activate and engage positive emotions, Set Goals, Eliminate threat
How you will address higher Maslow/Bloom's taxonomy: Purpose, meaning, self-actualization/applying, analyzing, evaluating, creating
What specific activities you will use for each phase of Kolb's experiential learning cycle: Direct experience, comprehension (knowing about), using, thinking about

Field Instructor Lesson/Activity Preparation Form

Goals/Learner Outcomes *(what you want your audience to do, feel, or think as a result of this lesson/activity)*

Upon completion of this lesson/activity, the audience will gain a clear understanding of the seven LNT principles. Students will also become aware of practical LNT application in the outdoors and learn the concept of the authority of the resource.

Lesson/Activity Objectives *(measurable, for goals above—how you will know that you accomplished your goals)*

- Students will satisfactorily present their LNT research and answer questions accordingly.
- Students will satisfactorily present authority of the resource skits.

Theme for this lesson/activity: Leave No Trace

Introduction (Grabber or POW) Leave No Trace is an encompassing component in responsible outdoor recreation activity.

Link to Body:

Body (include learning preferences, teaching methods)

Subthemes (main points)/individual activities:

Students will present their LNT findings

- 6-8 minute presentation
- Detail their principle
- Answer questions sufficiently

Students will gain practical LNT application

- Distinguishing 200 feet from a water body source in order to use the bathroom and wash
- Proper campsite location
 - o Flat, durable surface
 - o Removed from trail
 - o No danger trees in the vicinity
- Importance of hanging a bear bag
 - o Preventing wild animals from getting an appetite for human food

<ul style="list-style-type: none"> - Authority of the Resource <ul style="list-style-type: none"> o Understand the use of non-confrontational methods in approaching someone not adhering to LNT principles 	
Link to Conclusion: Conclusion How will you wrap up the lesson/activity? <ul style="list-style-type: none"> - LNT can be applied in both the backcountry and the frontcountry. Minimize your impact for the benefit of current and future generations so that everyone can enjoy the resources and recreation intricately tied to the natural world. 	
Field Instructor Lesson/Activity Preparation Form	
Name: Jeff Nemec	Lesson/Activity title: LNT
Lesson/activity date: Late February 2011	Teaching location: LRC and outdoors
Topic: LNT	Audience: Conserve School students
Duration of lesson/activity (how long is it designed to last?) 1 hr. 40 min.	

How will you assess this lesson/activity? <ul style="list-style-type: none"> - In a pass/fail course, students score a 2 if they exceed expectations with the lesson demands. Students score a 1 if they meet expectations (still passing). Students score a 0 if they're below standards
What teaching resources (supplies, biofacts, etc.) do you need?
How you will relate this to your audience's lives: LNT is used in your own outdoor practices as well as with others.
Link to the mission/theme/topic for the other lessons/activities of the day:
Back up activities if you have extra time and/or extension activity:
Phenology or anticipated teachable moments:

Teaching objectives for today (measurable personal objectives that relate to your own ability):

- Satisfactorily direct the lesson

Safety/logistics considerations:

Things to think about:

Questioning Strategies: Knowledge, Comprehension, Application, Analysis, Synthesis, Evaluation

How you will increase intrinsic motivation:

Create a strongly positive climate, Increase feedback, Activate and engage positive emotions,

Set Goals, Eliminate threat

How you will address higher Maslow/Bloom's taxonomy: Purpose, meaning, self-actualization/applying, analyzing, evaluating, creating

What specific activities you will use for each phase of Kolb's experiential learning cycle:

Direct experience, comprehension (knowing about), using, thinking about

Appendix B

LNT Values Clarification

(Select five which you can live with, and five which you absolutely cannot tolerate. Be prepared to discuss your selections with the group.)

- _____ Fire rings in most clearings
- _____ Trailside litter
- _____ Half burned garbage and trash in campsites
- _____ Multiple trails across most meadows
- _____ Water contaminated with fecal bacteria
- _____ Many obvious impacted campsites
- _____ Developing trails through passes, along creeks, around lakes, etc.
- _____ A lack of archaeological artifacts
- _____ Names carved in trees
- _____ Many, highly developed campsites (tables, benches, etc.)
- _____ Noisy groups
- _____ Large groups
- _____ Toilet paper scraps stuffed under rocks
- _____ Heavy stock trampling on trails
- _____ Fire scars on the ground
- _____ Brightly colored garments, tents, etc.
- _____ Hikers taking breaks in the middle of the trail
- _____ Food scraps left behind at campsites
- _____ Wildlife which is frequently harassed
- _____ Evidence of soap in streams
- _____ Fish viscera in water sources and along streambanks

developed at NOLS by Morgan Hite

Appendix C

CS2 Field Instruction Survey

Name: _____

Beginner

Intermediate

Expert

(Circle number that applies)

Knowledge of Leave No Trace Principles 1 2 3 4 5

Winter Camping Yes No

If yes, explain your experience (number of trips, length of trip, location, kind of trip: summer camp, family):

Backpacking Yes No

If yes, explain your experience (number/length of trips, location, kind of trip: summer camp, family):

Camping Yes No

If yes, explain your experience (number/length of trips, location, kind of trip: summer camp, family):

Cross Country Skiing Yes No

If yes, explain you experience (if you had to enter a ski event would you place yourself in the beginner, intermediate, advanced, or competitive bracket):

Snowshoeing Yes No

If yes, explain your experience

Mountain Biking Yes No

If yes, explain your experience (Have you ridden singletrack trails? Bike maintenance?)

Canoeing Yes No

If yes, explain your experience (number/length of trips, location, kind of trip: summer camp, family):

Navigation, fire building, and/or survival skills Yes No

If yes, explain your experience

Of the outdoor recreation activities covered above list any that you would feel competent/experienced enough in to teach your peers.

What do you want to personally gain and/or specifically learn from field instruction this semester?

Please share any anxieties or fears you have about participating in Field Instruction. All answers will be confidential (not shared with your peers).

List any outdoor talents, accomplishments, and/or certifications you have.

What would you like the Field Instructor Teachers to know about you before the start of Field Instruction?

Results of CS2 student self-reported outdoor experience

Survey Results

	L N T	Winter Camp	Backp ack	Camp	XC Ski	Snows hoe	Mou ntain Bike	Canoe	Fires	Surviva l	Navigatio n	Coul d Teac h	Anxieti es or Fears	Certs. Or Talent s	Fis to Know
Group 4	3	None	Some	Some	Little	Little	None	Some	None	None	None	No	Yes	None	Yes
	1	None	None	Some	Some	Some	None	Some	None	None	None	Yes	Yes	Yes	Yes
	4	None	None	Some	Some	Some	None	Some	Lots	Some	Some	Yes	Yes	Yes	Yes
	5	None	None	Lots	None	None	Some	Lots	Some	Some	Some	Yes	None	Yes	Yes
	3	Lots	Little	Lots	Little	None	Little	Lots	Little	Little	Little	No	None	Yes	Yes
	3	None	None	Some	Little	None	None	Lots	Some	None	Lots	Yes	None	None	Yes
	2	None	None	Some	None	Some	None	Some	Little	Little	Little	No	Yes	None	Yes
	4	None	Some	Some	Little	None	Lots	Some	Some	None	None	Yes	None	None	None
	3	None	None	Little	None	None	None	Lots	None	None	None	Yes	Yes	None	None
	3	None	None	Some	Some	Lots	None	Some	None	None	None	No	Yes	Yes	None
	4	Some	Some	Lots	Some	Lots	Some	Some	None	None	None	None	None	None	None
Group 1	3	None	Lots	Lots	None	None	None	Lots	None	None	None	No	None	None	Yes
	4	None	None	Lots	None	None	None	Lots	None	None	Some	Yes	Yes	None	Yes
	5	Lots	Lots	Lots	None	None	None	Lots	Lots	Lots	Lots	Yes	None	Yes	Yes
	3	None	Lots	Lots	Little	None	None	Some	Some	Some	Some	Yes	None	Yes	Yes
	2	None	None	None	None	Lots	None	Some	None	None	None	No	None	None	Yes
	3	None	Some	Lots	None	None	None	Lots	None	None	None	Yes	None	None	Yes
	3	None	None	Some	None	None	Some	None	Some	Little	Some	Yes	None	Yes	None
	3	None	None	Little	None	None	None	Lots	None	None	None	No	None	None	Yes
	3	Some	Some	Some	None	None	None	Some	Some	None	None	No	Yes	None	Yes
	3	None	Some	Lots	Lots	Lots	Some	Lots	Some	Lots	Some	Yes	None	Yes	None
	N / R	Lots	Lots	Lots	Lots	Lots	Lots	Lots	Some	Little	Some	Yes	None	Yes	Yes
Group 3	4	Some	Lots	Lots	Lots	Some	Lots	Lots	Lots	Lots	Lots	Yes	None	Yes	None
	2	None	None	Some	None	None	None	Lots	None	None	None	Yes	Yes	None	Yes
	5	None	None	Lots	Lots	Some	Some	Lots	Lots	Lots	Lots	Yes	None	Yes	Yes
	3	None	Lots	Lots	Little	None	None	None	None	None	None	No	Yes	Yes	Yes
	3	None	None	Lots	Some	Little	None	Little	Lots	Lots	Little	Yes	Yes	None	Yes
	4	None	None	Lots	None	Little	None	Some	None	None	None	No	None	Yes	None
	4	None	None	Some	None	None	Some	Some	None	None	None	Yes	Yes	Yes	None
	4	None	Some	Lots	Lots	Lots	None	Lots	Some	Some	Some	Yes	None	None	Yes
	5	None	Lots	Lots	Some	Some	Lots	Lots	Lots	Lots	Lots	Yes	None	Yes	Yes
	3	None	Lots	Lots	None	Little	None	None	Lots	Lots	Lots	Yes	Yes	Yes	Yes
	3	Some	Some	Some	Some	Some	Lots	Some	Some	Some	Some	Yes	Yes	Yes	Yes
Group 2	3	None	Some	Some	Some	None	Some	Some	Lots	Some	Some	No	None	None	None
	3	Some	None	Lots	Lots	Lots	Some	Some	Some	None	None	Yes	None	None	None
	3	Some	None	Lots	Lots	None	Lots	Lots	Some	None	Little	Yes	None	Yes	Yes
	3	None	Lots	Lots	None	None	None	Some	None	None	None	Yes	Yes	Yes	Yes
	3	None	None	Some	None	None	Lots	Some	None	None	None	Yes	Yes	Yes	Yes

	1	Mpme	Some	Lots	None	None	None	Lots	None	None	None	No	None	Yes	Yes
	3	None	None	Lots	Some	Some	Some	Little	Some	Some	Little	Yes	Yes	None	Yes
	4	None	None	Lots	None	None	Some	Some	None	None	None	Yes	Yes	None	None
	2	None	Some	Lots	Some	Lots	None	Lots	Some	Little	Some	No	None	None	Yes
	2	None	None	Lots	Some	Lots	None	Some	None	None	None	No	Yes	Yes	Yes
	2	None	Some	Some	None	None	None	Some	None	None	Some	No	Yes	None	Yes

Field Instruction Class Outline

Spring 2011

What is Field Instruction?

Field Instruction is your physical education class at Conserve School. You will receive a half (0.5) credit for this class. It will take place primarily outdoors. During field instruction you will be introduced to a variety of outdoor skills and activities according to the seasons and weather. You will learn the theory behind each skill or activity and have the opportunity to practice each skill or activity. You will also have opportunities to practice environmental stewardship through community service, as well as increase your comfort in the outdoors by spending time recreating and enjoying nature.

- Monday, Tuesday, Thursday, and Friday Field Instruction
 - Monday, Tuesday, Thursday, and Friday Field Instruction will be run by the Field Instruction teachers.
 - During this time you will receive instruction on the theory behind various outdoor skills and activities, and you will have the opportunity to practice these skills and activities.
 - Some possible skills and activities include:
 - Hiking, trail biking, canoeing, cross-country skiing, snowshoeing, etc.
 - Wilderness survival (fire building, outdoor cooking, water purification, travel, shelter, etc.)
 - Water safety and other safety skills specific to the Conserve School campus
 - Navigation (compass, map-reading, basic GPS)
 - A solo experience on the Conserve School campus
 - Leadership and teamwork (communication, conflict resolution, followership, service leadership)
 - Other skills and activities as appropriate for the seasons and weather
 - **Group A has Field Instruction on Tuesday from 2:20-3:55 and on Friday from 12:25-2:00.**
 - **Group B has Field Instruction on Tuesday from 12:25-2:00 and on Friday from 2:20-3:55.**
 - **Group C has Field Instruction on Monday from 2:20-3:55 and on Thursday from 12:25-2:00.**
 - **Group D has Field Instruction on Monday from 12:25-2:00 and on Thursday from 2:20-3:55.**
- Wednesday Field Instruction

- Wednesdays will be run by both the Field Instruction teachers and the Programs and Projects Group.
- During this time you will have the opportunity to contribute to the Conserve School community and possibly local communities through community service.
- **Groups A, B, C, and D all have Wednesday Field Instruction from 12:15-3:55.**

Who are your Field Instruction teachers?

Your Field Instruction teachers (along with the 4 members of the Programs and Projects Group and the 3 members of the Operations Group) are all graduate students in the College of Natural Resources at the University of Wisconsin – Stevens Point. We are in the Graduate Fellowship in Residential Environmental Education Program, and in May 2011 we will receive an MS in Natural Resources with an emphasis on Residential Environmental Education.

Field Instruction Teachers:

- Ryan Kolb (Ryan.Kolb@conserve-school.org)
 - Hometown: Milwaukee, WI
 - College: University of Wisconsin – Madison, BS in Geology
 - Outdoor Interests: Backpacking, Camping, Snowshoeing, Canoeing.
- Jess Kavanagh (Jess.Kavanagh@conserve-school.org)
 - Hometown: Ladysmith, WI
 - College: University of Wisconsin – Stevens Point, BS in Biology, minored in Adventure Education
 - Outdoor Interests: Rock Climbing, Mountain Biking, Whitewater Kayaking, Backpacking, etc.
- Jeff Nemecek (Jeff.Nemecek@conserve-school.org)
 - Hometown: Rouses Point, NY
 - College: Connecticut College, BA in Environmental Studies and Philosophy
 - Outdoor Interests: Hiking, Nordic and alpine skiing, ice hockey, trail work, Sylvania.
- Elliott Schofield (Elliott.Schofield@conserve-school.org)
 - Hometown: Lake Tahoe, NV
 - College: University of Wisconsin – Stevens Point, BS in Biology
 - Outdoor Interests: Downhill Skiing, snowshoeing, mountain biking, hiking, canoeing, camping, swimming, hunting, and photography.
- Katie Connolly (Katie.Connolly@conserve-school.org)
 - Hometown: St. Paul, MN
 - College: University of Wisconsin – Stevens Point, BS in Biology and Wildlife Ecology
 - Outdoor Interests: Hunting, fishing, canoeing, geocaching, camping, swimming, hiking, backpacking, birding, plant identification.

- Anita Olson (Anita.Olson@conserveschool.org)
 - Hometown: Erickson, NE
 - College: Hastings College
 - Outdoor Interests: Horseback riding, cattle wrangling, art, rodeos

What are our expectations of you?

- Come to class.
- Be on time.
- Be prepared. (*Bring your journal and a writing utensil to every class, and check your email regularly!*)
- Participate. (*We want to see you try 😊*)
- Follow the Conserve School Code. (*Compassion, Honesty, Justice, Respect, Responsibility*)

What can you expect from us?

- The same things that we expect from you.
- A “pass” or “no pass” grade at the end of the semester. A “pass” will allow you to earn 0.5 credits.
- The support you need to get that passing grade!

How will you be graded?

- You will receive either a “pass” or “no pass” grade at the end of the semester. This grade will be based on assessments conducted on a variety of skills throughout the semester. In your assessments, you will be given a skill level of “satisfactory” or “unsatisfactory” for each skill.
- As we prepare for Exploration Week, you will be expected to reach a “satisfactory” skill level on 80% of the skills covered.
- If and when you receive an “unsatisfactory” rating on a skill assessment, you will be given opportunities for more instruction and practice.

Good luck this semester 😊

Appendix D

LNT Knowledge Assessment (Used for both pre/post-test)

Name: _____

1. In planning and preparing for a trip, what should you do?
 - A. Familiarize yourself with the area and issues concerning the area.
 - B. Plan for inclement weather, hazards, and emergencies.
 - C. Give a trip itinerary to a family member or a close friend.
 - D. All of the above.

2. What should occur at least 200 feet away from a body of water?
 - A. Campsite location.
 - B. Depositing waste in cathole (6-8 inches deep) or snow (1-2 feet deep).
 - C. Personal bathing, washing dishes with biodegradable soap, straining leftover food.
 - D. All of the above.

3. The only acceptable waste to be left in the backcountry is/are...
 - A. Burned garbage.
 - B. Toilet paper/hygienic products.
 - C. Human waste.
 - D. Apple cores, banana peels, orange rinds

4. Wildlife are **least** sensitive to disturbance from recreationists...
 - A. In late summer.
 - B. When raising young.
 - C. In the winter.
 - D. During the nesting season.

5. In naturalizing your campsite, what should be done?
 - A. Leave any unused wood you have cut for the next campers.
 - B. Leave any makeshift shelters.
 - C. Leave fire pit full of ash.
 - D. Disperse unused wood fuel, disassemble shelters, clean and spread ash from fire pit.

6. Criteria for campfires should include using ...
 - A. Dead, brown, and down tree limbs.
 - B. Existing fire ring.
 - C. For essential heat and warmth.
 - D. All of the above.

7. When traveling through a **popular area**, visitors should...
 - A. Stay on the trail even when it's wet and muddy.
 - B. Camp at designated sites.

- C. Be respectful of other visitors.
 - D. All of the above.
8. A **pristine area** should require a group of visitors to...
- A. Disperse travel but camp in a central location.
 - B. Travel together in a single file but camp separately.
 - C. Disperse travel and campsites.
 - D. Travel together in a single file and camp repeatedly at the same spot.
9. What items are acceptable to be taken from the backcountry?
- A. Wildflowers.
 - B. A deer antler.
 - C. A pottery shard from an archaeological site.
 - D. None of the above.
10. What should you do to avoid dangerous encounters with bears?
- A. Keep all food in your tent at night.
 - B. Carry a firearm with you.
 - C. Bury your garbage and leftover food in the ground.
 - D. Put your food and garbage in a bag and hang it.
11. Which contributes to **stopping** the spread of invasive species?
- A. Transporting firewood.
 - B. Taking a boat from one distinct area to another without washing it.
 - C. Brushing off tents/tarps at camp and cleaning clothes immediately after getting home.
 - D. None of the above.
12. Being considerate to other visitors includes...
- A. Taking breaks off trail and camp where you can't be seen.
 - B. Yielding to faster and downhill travel.
 - C. Stopping and remaining on the downhill side of the trail when encountering packstock.
 - D. All of the above.

Questions and their applicable LNT principle

1. Plan ahead and prepare (Principle 1)
2. Dispose of waste properly (Principle 3)
3. Dispose of waste properly (Principle 3)
4. Respect wildlife (Principle 6) **provided from quiz produced by the Center for Outdoor Ethics (see Appendix E, question 21)**
5. Be considerate of other visitors (Principle 7)
6. Minimize campfire impacts (Principle 5)
7. Travel and camp on durable surfaces (Principle 2)
8. Travel and camp on durable surfaces (Principle 2)
9. Leave what you find (Principle 4)
10. Respect wildlife (Principle 6); Dispose of waste properly (Principle 3) **provided from quiz produced by the Center for Outdoor Ethics (see Appendix E, question 18)**
11. Leave what you find (Principle 4)
12. Be considerate of other visitors (Principle 7)

Appendix E

Evaluation of Knowledge of Leave No Trace Principles

Acquired from <http://www.Int.org/training/educationaltraining.php>

Please answer the following questions as they relate to the most appropriate Leave No Trace practices in a **backcountry** setting.

1. Which of the following actions does **not** demonstrate consideration for other visitors?
 - A. Camping in an open meadow.
 - B. Taking breaks off-trail
 - C. Selecting campsites out of sight and hearing of other campers.
 - D. Camping in small groups.

2. Which of the following kinds of vegetation are the most likely to resist or recover from human trampling?
 - A. Forbs (erect-stemmed, broad-leaved plants)
 - B. Tree seedlings
 - C. Mosses
 - D. Grasses

3. What is the best way to dispose of human waste (feces)?
 - A. Deposit human waste in a small hole
 - B. Dig a large, deep hole and have everyone use it.
 - C. Deposit human waste on the ground away from campsites.
 - D. Deposit human waste on the ground and cover it with rocks.

4. For a group of twenty on a backcountry hike, it is best to...
 - A. Camp in small groups on separate campsites, and do not hang out or eat together.
 - B. Have the whole group camp on one site.
 - C. Split up and camp on separate campsites, but designate routes to a central area to eat and socialize.
 - D. Take the whole group into a remote area where others won't see the impacts.

5. The primary argument for leaving a deer antler instead of keeping it as a souvenir is...
 - A. So scientists can learn about deer behavior.
 - B. To avoid disturbing fragile ecosystems.
 - C. To allow others to enjoy the object.
 - D. So that its nutrients can return to the soil.

6. When camping in **popular** or high-use areas...
 - A. Concentrate use on existing trails and campsites.
 - B. Scatter your activity beyond established campsites to permit their recovery.
 - C. Find a vegetated area to pitch your tent.
 - D. Disperse your group over a wide area.

7. How should dirty dishwater be disposed?
 - A. Use it to put out the campfire.
 - B. Strain out food particles and scatter the dishwater.
 - C. Pour it into a stream.
 - D. Throw it in the bushes away from the eating area.

8. Of the learned responses that wildlife may exhibit around visitors, which is least desired?
- A. Avoidance
 - B. Attraction
 - C. Indifference
 - D. Fear
9. When cooking, it is best to...
- A. Cook only what you need and pack out the wrappers.
 - B. Eat the leftovers and bury the wrappers.
 - C. Burn all your leftovers.
 - D. Eat leftovers the next day and burn the wrappers.
10. When you are hiking on a trail with beautiful wildflowers, you should...
- A. Walk away from the trail and take a flower no one can see.
 - B. Stay on the trail and take only one flower.
 - C. Pick only dry, wilted flowers and leave the healthy plants alone.
 - D. Never pick even one flower
11. The best time to visit a popular backcountry or wilderness area is...
- A. Late in the season.
 - B. During the week rather than on weekends.
 - C. Early in the season.
 - D. Any of the above.
12. If campfires are permitted, how should you gather wood?
- A. Saw downed logs into manageable lengths.
 - B. Break dead branches from trees.
 - C. Gather pieces of wood from the ground that can be easily broken.
 - D. Saw dead limbs from a fallen tree.
13. When traveling through **pristine** or remote areas, an advisable LNT practice is to...
- A. Travel in large groups to ensure group safety.
 - B. Walk around mud puddles and downed trees.
 - C. Travel away from visitor-created trails.
 - D. Always use preexisting trails.
14. What should you do with the ashes from your campfire?
- A. Bury the ashes in the ground.
 - B. Throw the ashes into a fast moving stream.
 - C. Scatter the ashes away from camp.
 - D. Leave the ashes in the fire pit.
15. When selecting a campsite, you should choose a site...
- A. In an open area.
 - B. Close to a water source.
 - C. Near the trail.
 - D. Away from lakes, streams, and trails.

16. When planning your food supply, you should...
- A. Leave food in original packaging and put it in stuff sacks or plastic bags.
 - B. Re-pack dried or freeze-dried food into lightweight plastic bags.
 - C. Minimize smells by ensuring food is in airtight cans or bottles.
 - D. Take only fresh food.
17. If you use an existing rock fire ring for your campfire, you should...
- A. Collect extra firewood to leave for other visitors.
 - B. Dismantle the ring after you're finished.
 - C. Move rocks and logs close to the ring to sit on.
 - D. Leave the fire ring free of excess ashes, burned wood and trash.
18. What should you do to avoid dangerous encounters with bears?
- A. Keep all food in your tent at night.
 - B. Carry a firearm with you.
 - C. Bury your garbage and leftover food in the ground.
 - D. Put your food and garbage in a bag and hang it.
19. When walking through an open gate on a trail, you should...
- A. Head towards the closest ranger station to report the open gate.
 - B. Prop the gate open so it doesn't close accidentally.
 - C. Close the gate behind you.
 - D. Leave the gate as you found it.
20. The only waste that is acceptable to leave in the backcountry is...
- A. Human waste.
 - B. Toilet paper.
 - C. Orange peels.
 - D. Burned garbage.
21. Wildlife are **least** sensitive to disturbance from recreationists...
- A. In late summer.
 - B. When raising young.
 - C. In the winter.
 - D. During the nesting season.
22. What is the best procedure for traveling off-trail through a **pristine** area?
- A. Give everyone compass headings and a map with the route marked on it.
 - B. Have the group walk in single file.
 - C. Create trail markers out of natural materials so that everyone can follow the same route.
 - D. Disperse over a wide area.
23. While hiking, what should you do when you encounter horseback riders?
- A. Ask the horseback riders to yield.
 - B. Get off the trail on the downhill side.
 - C. Get off the trail on the uphill side.
 - D. Stay on the trail; you have the right-of-way.

24. Which of the following actions should be taken when breaking camp?
- A. Brush off tents and ground tarps to avoid transporting non-native plant species.
 - B. Leave any leftover wood you have cut for the next campers.
 - C. Leave any makeshift furniture you have created.
 - D. Rake your site to clear debris.
25. What should you do when you see wildlife approaching your campsite?
- A. Put food on the ground to feed the animal.
 - B. Make lots of noise to scare the animal away
 - C. Be quiet and try not to startle the animal.
 - D. Sneak up close to the animal to get a good look.

Answers:

1	A
2	D
3	A
4	A
5	C
6	A
7	B
8	B
9	A
10	D
11	D
12	C
13	C
14	C
15	D
16	B
17	D
18	D
19	D
20	A
21	A
22	D
23	B
24	A
25	C

Appendix F

Leave No Trace Quiz Answers

1. What is the best size for a group that goes hiking?

No more than 10 in designated wilderness areas. This is a good number for all hikes. If you are in an area considered fragile and remote, then the group should be smaller. If you are hiking with a large group, split into smaller ones and stay about 30 minutes apart on the trail. [\[back to quiz\]](#)

2. Name five surfaces which can withstand foot traffic very well.

Rock, gravel, sand, compacted dirt, snow, ice, pine needles and dry grass are all durable surfaces. Avoid loose, wet or thin soils. Be particularly careful when hiking above tree line where plants are very fragile. One boot scrape may destroy a layer of soil that has taken centuries to create. [\[back to quiz\]](#)

3. When you encounter mud in the middle of a trail what should you do?

Wear gaiters and check the depth of the mud before walking through it. Do not detour around the mud. This erodes the sides of the trail and makes the situation worse. If there are loose rocks or downed branches handy, then consider using these as stepping stones. If possible, avoid trails during rainy periods. [\[back to quiz\]](#)

4. How can you help minimize the effects of hiking boots on the trail?

Wear the lightest boot possible. Boots should not have a deep tread or lugs. Always walk on durable surfaces. [\[back to quiz\]](#)

5. What's the hiker's etiquette for crossing private land?

If you know beforehand you will cross private land, you should seek permission. Leave any gates (either open or closed) as you found them. Otherwise do nothing that will leave any evidence of your presence. [\[back to quiz\]](#)

6. After eating, which food scraps can be disposed of in the woods?

None! It is never appropriate to leave behind any food, seeds, peels, cores, etc. While these items are natural and will eventually decompose, no one appreciates finding someone else's garbage out in the woods -- and it is not visually attractive. Also, food scraps attract annoying insects, can be harmful for wildlife and will habituate animals to humans. [\[back to quiz\]](#)

7. You are hiking next to a babbling brook when nature calls. What do you do?

Seek out a flat area or depression with no evidence of flooding or animal activity ***at least 200 feet from any water***. Sunny spots hasten decomposition. Avoid spraying leaves and plants as your urine can burn the leaves and makes them attractive as food to animals. [\[back to quiz\]](#)

8. When hiking how do you dispose of solid human waste and toilet paper?

Your main objective is to keep waste away from water, animals and people. Buried feces and toilet paper break down slowly. You should dig and use a cathole with this in mind. Also, pay attention to the points

mentioned in answer #7. In fragile areas, frozen or very hard ground, or areas with heavy human use, you should pack out the waste and the toilet paper (use double-bagged, heavy-duty zipper lock bags). Certain environments, such as in the desert, above tree line or river travel, may require additional techniques. Be sure to find out before you go. [\[back to quiz\]](#)

9. What is a cathole? How do you prepare and use a cathole?

A cathole is used for solid human waste. It is a small hole about 6-8" deep. It is dug with a trowel. A trowel is a small hand shovel and should be part of everyone's backpacking equipment. Try to remove a solid plug of earth and set it aside while you do your business. Afterward use a stick to thoroughly mix the toilet paper and waste in the hole. Replace the plug of earth. The stick you used for mixing should be stuck into the hole with the clean end sticking out of the ground as a signal to everyone else that this area has been used. [\[back to quiz\]](#)

10. What natural substances can you use instead of toilet paper?

Non-irritating leaves are best (maple and hobblebush are good -- beech and oak can be scratchy -- **avoid leaves of three!**). Snow can also be used. [\[back to quiz\]](#)

11. How far from water should you set up camp? How far from a trail?

The general rule of thumb is 200 feet for both. Water should never be closer than 200 feet. The distance from a trail should be far enough that you cannot be seen and a low-volume conversation cannot be heard. If you are camping in grizzly bear country, you will need to move farther away and take additional precautions. [\[back to quiz\]](#)

12. While hiking you are looking for a place to spend the night. You find a beautiful meadow. Where should you pitch your tent?

You do not camp in the meadow. The ecology is too fragile. Find a spot on a durable surface in the tree line next to the meadow. Enjoy the view and leave it unspoiled for others to enjoy. [\[back to quiz\]](#)

13. You camp in an established campsite. It has one main fire ring and several others scattered around. Does this situation require you to do anything special?

In established campsites it is okay to have one and only one fire ring. This concentrates impact in one location. For the future enjoyment of others all secondary fire rings should be dismantled and made to look as natural as possible. Any rocks or unburned wood should be scattered in the woods out of sight (the farther away the better). [\[back to quiz\]](#)

14. What are the best surfaces on which to camp?

See question #2 for answer. [\[back to quiz\]](#)

15. In an established campsite where should people set up their tents?

Set up in areas of high impact and use. Do not extend the site beyond its already established boundaries. [\[back to quiz\]](#)

16. You are hot and tired and need to get to your destination before dark. The trail you are on descends sharply with lots of switchbacks. You can see the trail not far below where you are. Is it okay to bushwhack through the woods to save time? Why?

It is never okay to cut the trail. Switchbacks are established to make your hiking effort easier, but more importantly to help fight soil erosion. Cutting across switchbacks encourages future hikers to follow your lead resulting in deep trail erosion and rutting. Always use existing trails. Never make new ones! [\[back to quiz\]](#)

17. You are camping with a group in an area that has no established campsites. How should you set up your tents?

Disperse your tents widely throughout the area and pitch them on the most durable surfaces. Do not concentrate everyone together. Try to lessen your impact by spreading out your activities. Do not create new paths. Set up your pantry and cooking areas on the most durable surfaces available. [\[back to quiz\]](#)

18. You are hiking in an area known for its Native American history. While taking a break you find a piece of pottery. What should you do with it?

Leave it where you found it. Allow others the same sense of discovery. Leave rocks, plants, animals, archeological artifacts and other objects just as you found them. It may be illegal to remove artifacts. The location and description of any artifacts you find should be reported to responsible authorities. [\[back to quiz\]](#)

19. You camp near the trail, but not in a specified campsite. You are wet and cold, so you build a small fire. Before leaving the next morning what should you do?

All evidence of your fire should be removed and scattered out of sight in the woods. A properly built fire will have burned completely to ash. No wood larger than an adult's wrist should ever be used. If you built your fire on a bed of sand or gravel, then replace or scatter it. If you dug out a plug of earth replace it. Never use rocks as a ring except in established sites as they blacken and become unsightly. Instead of building fires use your backpacking stove as much as possible for cooking and warmth. [\[back to quiz\]](#)

20. You are hiking with a group and come to a meadow with no established trail across it. You need to get to the other side. What should you do?

If there is a trail around it, then take the trail! Otherwise everyone in the group should fan out as far as possible to walk across it. This minimizes the impact. If you walk single-file, there soon will be a trail, as others follow your lead. [\[back to quiz\]](#)

21. What color clothing should you wear while hiking? Why? What color should your tent be? Why?

All clothing, tent and gear equipment colors should be in muted earth tones. The color of your equipment has no effect on the environment, but does affect the enjoyment of the outdoors by others. Visual pollution can be just as annoying as other types. [\[back to quiz\]](#)

22. After you clean up your meal what should you do with your trash?

If you are having a fire it may be okay to burn some of it (burn only paper items, never plastic or other petroleum-based products). Remaining trash, including food items and any paper which was not totally consumed in your fire, must be packed out. Remember -- **Pack It In, Pack It Out!** [\[back to quiz\]](#)

23. You are sitting quietly in your campsite when a few deer begin to approach. What should you do?

Nothing. Stay calm and still. Observe wildlife from afar. Never approach or disturb them. Never make any sudden movements. During breeding, nesting and birthing seasons give them a wide berth. You are too close to wildlife if an animal alters its normal behavior. [\[back to quiz\]](#)

24. After a day of hiking you set up camp. Should you bring any special clothing items to wear while in camp? What and why?

Always bring camp clothes. These are something light, comfortable, clean (hopefully) and dry. Lightweight camp shoes should replace your hiking boots as soon as you find a campsite. Lightweight shoes are more friendly to the earth and your feet than your boots. [\[back to quiz\]](#)

25. You have found a beautiful place to camp near a stream. What should you do? Why?

Keep going! Find another site. Remember -- camping less than 200 feet from a water source is not Leave No Trace. You will be taking care of hygiene issues near your site (going to the bathroom and brushing teeth), cooking and establishing a human presence. Environmentally it is not sound to camp near water. Also, it is disruptive to wildlife. Your presence may block their normal path to water and feeding or otherwise alter their behavior. Quick movements and loud noises are stressful to animals. [\[back to quiz\]](#)

26. You are ready to leave your campsite -- what are the last things you should do?

Police the area for any signs that someone has been there -- look for small pieces of trash, be sure signs of your campfire have been removed, check the trees for ropes and other hanging items. Your goal should be to leave your campsite in better condition than you found it. Spend as much time dismantling and restoring it as you did establishing it. [\[back to quiz\]](#)

27. In your campsite you have some cute chipmunks and squirrels which are begging for food. What should you do? Why?

Ignore them. Keep wildlife wild. If you feed wildlife you are sentencing them to death. When animals become habituated to human food they lose their instincts to hunt and gather. These behaviors are then passed onto their offspring. Eventually they cannot survive without human food. Also, wild animals which have been fed lose their fear of humans. They become very aggressive, may bite and will not hesitate to chew through your tent or backpack. Human fed animals carrying rabies become an even more serious threat. Larger animals, like bears, may need to be destroyed. Don't feed wildlife, no matter how cute they look. In many jurisdictions it is against the law! [\[back to quiz\]](#)

28. Why should you always carry a small plastic bag in your pocket when hiking and camping?

Whenever you are in the outdoors it is a good idea to pick up any trash you find. When you are away from trash cans having a small bag in your pocket makes this task more pleasant.

Thanks to Michael Salat (Conserve School history teacher) for the information.

Appendix G

Letter to the Director of Outdoor Programs

Conserve School
5400 North Black Oak Lake Road
Land O' Lakes, WI 54540

To the Director of Outdoor Programs,

As a result of LNT-focused lessons in field instruction, students' overall LNT knowledge improved 9%. Students who had lower levels of LNT familiarity showed the greatest gains. There were difficulties with some of the more complex LNT concepts like proper camping and travelling in a pristine area or when is wildlife least sensitive to disturbance but it seemed students had a solid grasp of the material. In the future, it would be more suitable to spend more time outdoors teaching LNT. Practicality and applicability of LNT is better determined outdoors. It would also be appropriate to touch on LNT concepts that are straightforward (i.e. no littering, clean up your campsite) and focus more attention on the complex issues (i.e. popular v. pristine site camping and traveling).

Given that we're a partner and sponsor of the Center for Outdoor Ethics, Conserve School should consider bringing in a trained individual to teach LNT principles to incoming and established staff members. LNT is a fundamental environmental ethic to outdoor recreation and all staff members should have a solid foundation in the principles. An afternoon awareness workshop or a two-day trainer course may prove beneficial. Additionally, LNT principles and practices could be discussed at a staff meeting/outing or during planning for Exploration Week. Conserve School should be consistent in teaching the same low-impact outdoor etiquette to all students. Being on the same page with other staff members in terms of LNT behavior would be imperative.

Conserve School should also consider the role of impactful practices such as the use of campfires. Although an enjoyable social experience, fires take up resources that are beneficial to the surrounding area. A cap should be considered on the number of fires during individual Exploration Week trips. Similarly, the use of fires during solos should be minimized. Fire building skills should still be taught but campfires should not be over-emphasized in the school community.

Another instance of LNT that Conserve School should address is defecating in the campus woods during solos. Do we want to offer more outhouses to centralize waste or are we tolerant with up to sixty-students defecating at different locations around campus? Research and information should be gathered on the extent of the impact and process of human waste decomposition. In addition, the unsightly dog defecation on campus could be addressed.

LNT is part of the cultural framework of Conserve School. In enhancing our environmental footing and educational capabilities, LNT should be a focal point of outdoor programming. All field instruction lessons should have a LNT component. Solos and exploration week should also emphasize minimal impacts. Students could be assessed on their adherence to low-impact principles during these outdoor experiences. LNT teaching and visibility improves the environmentally-responsible paradigm Conserve School is trying to emulate.

Respectfully,

Jeff Nemec

Appendix H

Revised LNT Knowledge Assessment

Name: _____

1. In planning and preparing for a trip, what should you do?
 - E. Familiarize yourself with the area and issues concerning the area.
 - F. Plan for inclement weather, hazards, and emergencies.
 - G. Give a trip itinerary to a family member or a close friend.
 - H. All of the above.

2. What should occur at least 200 feet away from a body of water?
 - E. Campsite location.
 - F. Depositing waste in cathole (6-8 inches deep) or snow (1-2 feet deep).
 - G. Personal bathing, washing dishes with biodegradable soap, straining leftover food.
 - H. All of the above.

3. The only acceptable waste to be left in the backcountry is/are...
 - E. Burned garbage.
 - F. Toilet paper/hygienic products.
 - G. Human waste.
 - H. Apple cores, banana peels, orange rinds

4. Where/when are wildlife allowed to be disturbed by recreationists?
 - A. Near trails and roadways
 - B. In the late fall.
 - C. Around campsites.
 - D. Never.

5. In naturalizing your campsite, what should be done?
 - A. Leave any unused wood you have cut for the next campers.
 - B. Leave any makeshift shelters.
 - C. Leave fire pit full of ash.
 - D. Disperse unused wood fuel, disassemble shelters, clean and spread ash from fire pit.

6. Criteria for campfires should include using ...
 - A. Dead, brown, and down tree limbs.
 - B. Existing fire ring.
 - C. For essential heat and warmth.
 - D. All of the above.

7. When traveling through a **popular area**, visitors should...
 - A. Stay on the trail even when it's wet and muddy.
 - B. Camp at designated sites.
 - C. Be respectful of other visitors.
 - D. All of the above.

8. A **pristine area** should require a group of visitors to...
 - A. Disperse travel but camp in a central location.
 - B. Travel together in a single file but camp separately.
 - C. Disperse travel and campsites.
 - D. Travel together in a single file and camp repeatedly at the same spot.

9. What items are acceptable to be taken from the backcountry?
 - A. Wildflowers.
 - B. A deer antler.
 - C. A pottery shard from an archaeological site.
 - D. None of the above.

10. What should you do to avoid encounters with animals at your campsite?
 - A. Keep all food in your tent at night.
 - B. Leave food around your site
 - C. Bury your garbage and leftover food in the ground.
 - D. Put your food and garbage in a bag and hang it.

11. Which contributes to **stopping** the spread of invasive species?
 - A. Transporting firewood.
 - B. Taking a boat from one distinct area to another without washing it.
 - C. Brushing off tents/tarps at camp.
 - D. None of the above.

12. Being considerate to other visitors includes...
 - A. Taking breaks off trail and camp where you can't be seen.
 - B. Yielding to faster travel and hikers traveling up elevation.
 - C. Stopping and remaining on the downhill side of the trail when encountering packstock (e.g. horses, donkeys).
 - D. All of the above.

Appendix I

LNT Knowledge Assessment Results

Group 1	LNT	Q.													Score
		1	2	3	4	5	6	7	8	9	10	11	12		
Pre	4			x					x					-2	83%
Post					x									-1	92%
Pre	3			x									x	-2	83%
Post														0	100%
Pre	2				x									-1	92%
Post														0	100%
Pre	3				x				x					-2	83%
Post														0	100%
Pre	3		x	x	x				x	x			x	-6	50%
Post					x								x	-2	83%
Pre	3												x	-1	92%
Post					x									-1	92%
Pre	3													0	100%
Post					x									-1	92%
Pre	3		x		x				x					-3	75%
Post				x	x									-2	83%
Pre	3			x					x			x	x	-4	67%
Post													x	-1	92%

Group 2	LNT	Q.													Score
		1	2	3	4	5	6	7	8	9	10	11	12		
Pre	3								x			x	x	-3	75%
Post									x				x	-2	83%
Pre	3			x		x			x				x	-4	67%
Post			x	x		x								-3	75%
Pre	3		x		x				x					-3	75%
Post														0	100%
Pre	2			x	x									-2	83%
Post				x	x									-2	83%
Pre	3								x					-1	92%
Post														0	100%
Pre	2				x				x					-2	83%
Post					x				x					-2	83%
Pre	3			x	x								x	-3	75%
Post														0	100%
Pre	4		x	x										-2	83%
Post									x					-1	92%
Pre	3				x				x					-2	83%
Post														0	100%
Pre	2	x	x		x				x					-4	67%
Post			x		x		x							-3	75%
Pre	1		x						x				x	-3	75%
Post			x											-1	92%

Group 3	LNT	Q.													Score
		1	2	3	4	5	6	7	8	9	10	11	12		
Pre	3				x				x			x		-3	75%
Post			x						x					-2	83%
Pre	4				x									-1	92%
Post									x					-1	92%
Pre	3													0	100%
Post			x											-1	92%
Pre	4			x	x						x	x		-4	67%
Post				x					x			x	x	-4	67%
Pre	4				x								x	-2	83%
Post													x	-1	92%
Pre	3				x						x	x		-3	75%
Post					x				x					-2	83%
Pre	5			x	x				x					-3	75%
Post														0	100%
Pre	5												x	-1	92%
Post														0	100%
Pre	2		x		x				x		x		x	-5	58%
Post														0	100%
Pre	3			x	x				x			x	x	-5	58%
Post			x						x			x		-3	75%
Pre	4			x										-1	92%
Post												x	x	-2	83%

Group 4	LNT	Q.													Score
		1	2	3	4	5	6	7	8	9	10	11	12		
Pre	4								x				x	-2	83%
Post							x					x	x	-3	75%
Pre	5			x							x			-2	83%
Post				x	x				x			x		-4	67%
Pre	4		x	x									x	-3	75%
Post				x										-1	92%
Pre	1			x							x			-2	83%
Post				x	x							x		-3	75%
Pre	3				x	x			x			x	x	-5	58%
Post				x			x		x					-3	75%
Pre	3													0	100%
Post														0	100%
Pre	2		x	x	x				x					-4	67%
Post												x		-1	92%
Pre	3				x		x					x		-3	75%
Post					x		x					x		-3	75%
Pre	3				x							x		-2	83%
Post					x							x		-2	83%
Pre	4				x				x		x			-3	75%
Post														0	100%
Pre	3				x									-1	92%
Post														0	100%