

Participation in Park Interpretive Programs and Visitors' Attitudes, Norms, and Behavior about Petrified Wood Theft

By

Neemedass Chandool

Thesis submitted to the faculty of the
Virginia Polytechnic Institute and
State University in partial fulfillment
of the requirements for the degree of

Master Of Science

in

Forestry

Joseph W. Roggenbuck, Chair

R. Bruce Hull

Troy Hall

August 1997

Blacksburg, Virginia

Keywords: Interpretive programs, Attitudes, Norms and Behavior

Copyright 1997, Neemedass Chandool

Participation in Park Interpretive Programs and Visitors' Attitudes, Norms, and Behavior about Petrified Wood Theft

By

Neemedass Chandool

Joseph W. Roggenbuck. Chairman

Department of Forestry

(Abstract)

The purpose of this study was to understand the relationships between participation in park interpretive programs and attitudes, norms and behavior about theft of petrified wood at Petrified Forest National Park (PFNP). The Theory of Reasoned Action guided the research. Data collection included observation of theft behavior, on-site interviews and mailback questionnaires.

Findings indicated that more time spent at interpretive centers and programs did not result in visitors' attitudes and norms about individual acts of wood theft being more negative. Also, attitudes and norms about petrified wood theft did not vary by type of interpretive programs judged most helpful in learning the park's story and in learning the park's rules and regulations. Tentative evidence suggests that the norm against taking a handful of wood was stronger among individuals who cited visitor centers as their most helpful source than it was for respondents who said the same about other national park interpretive programs. Similarly, the attitude variable that it is all right to take a piece of petrified wood as long as it is a small piece did vary for two categories of interpretive programs (other national park programs and all ranger programs). Ranger programs measured significantly higher than other national park programs. The rate of theft of petrified wood was not inversely related to the amount of interpretive programs participated in and did not vary by type of interpretation judged most helpful. Finally, attitudes and norms about petrified wood theft did not shape theft behavior. However, knowing visitors' attitudes helped to predict who would be a non-thief.

ACKNOWLEDGMENTS

I would like to thank my committee chair, Dr Joe Roggenbuck for giving me the opportunity to be at Virginia Polytechnic and State University and for his guidance throughout the process of getting the research done and writing this thesis. I would also like to thank my other committee members, Dr Bruce Hull and Dr Troy Hall for their valuable contributions. I would also like to thank Dr Jeff Marion for the use of his computer to conduct my data analysis and Yu Fe Leung for his assistance in the data analysis. Finally, I would like to thank Sue Snow, the department's secretary for always being there to help in so many ways.

I would like to dedicate this thesis to my mom who passed away in August 1996. She has always been supportive in my education and has been a great influence on me. You will be dearly missed.

TABLE OF CONTENTS

ACKNOWLEDGMENT	iii
LIST OF TABLES	vi
LIST OF FIGURES	vii
CHAPTER ONE: INTRODUCTION	1
Geologic Past	1
Geographic Areas	1
Recent Human History	2
Current Park Use and Management	2
General Management plan of the Park	3
Problem Statement	3
Sub-problems	3
Study Objectives	3
CHAPTER TWO: LITERATURE REVIEW	5
Interpretation as a Management Tool	5
Interpretation to Increase Knowledge and Favorable Attitudes	5
Interpretation to Increase Low Impact Behavior	7
Failures of Interpretation as a Management Tool	10
Summary	11
CHAPTER THREE: THE THEORY OF REASONED ACTION	12
Determinants of Attitude Toward a Behavior	15
Predicting Attitudes from Beliefs	15
Revised Model: Theory of Planned Behavior	17
General Tests of the Theory of Reasoned Action	20
Tests of the Theory of Reasoned Action in Recreation Research	21
Tests of the Theory of Planned Behavior in Recreation Research	25
Study Hypothesis	28
CHAPTER FOUR: METHOD	29
Study Areas	29
Crystal Forest	29
Long Logs	29
Study Design	31
Population Sample	31

Observed Samples	32
Observation Techniques	32
Data Collection Methods/Instruments	33
Post-visit contact	33
Questionnaire	33
Observation coding form	34
Participation and Response Rate	34
Data Analysis Procedure	35
CHAPTER FIVE: RESULTS	38
CHAPTER SIX: DISCUSSION AND CONCLUSION	50
Possible Explanations for the Ineffectiveness of Interpretation	50
Failures of the Theory of Reasoned Action	52
Recommendations for Future Research	54
Implications for Management	55
REFERENCES	57
APPENDIX A	62
APPENDIX B	64
VITA	77

LIST OF TABLES

TABLE	PAGE
1 A hypothetical person's beliefs about NPS controlled burn policy	17
2 Frequency distribution (average length of stay)	39
3 Frequency distribution (programs to learn the park's story)	40
4 Frequency distribution (programs to learn rules and regulations)	40
5 Frequency distribution (rulesum and infosum)	41
6 Frequency distribution (attitude variables)	42
7 Pearson's correlation to test for relationships between time spent at interpretive programs and number of sources helpful in learning the parks' story and the rules and regulations and attitudes toward wood theft	43
8 Respondents norms about the seriousness of taking petrified wood from the park	44
9 Pearson's correlation to test for relationships between time spent at interpretive programs and number of sources helpful in learning the park's story and rules and regulations and the norm about taking petrified wood (Q14E and Q14 I)	44
10 ANOVA to test for the relationship between the sources helpful in learning the park's story and the attitude variables (Q13F and Q13N)	45
11 Duncan's post hoc test for significant differences on attitude (Q13N) among four types of interpretive programs judged most helpful in learning the park's story	46
12 ANOVA to test relationships between sources most helpful in learning the park's rules and regulations and norm (Q14I)	47
13 Duncan's post hoc to test for significant differences between the mean scores on the norm (Q14I) among the four type of most helpful interpretive programs about the park's rules and regulations	47
14 Logistic regression analysis to indicate significant relationships between attitude and norm variables and thief variable	48
15 Classification table to compare the predicted of thieves an38 non-thieves, based on the regression model, with the actual observed values	49

LIST OF FIGURES

Figures	
1 The Ajzen-Fishbein model of the Theory of Reasoned Action	13
2 The Ajzen-Fishbein model of the Theory of Planned Behavior	19
3 Petrified Forest National Park map	30

CHAPTER ONE INTRODUCTION

Petrified Forest National Park contains significant natural and cultural resources, including some of the most valuable paleontological resources in the world. Paleontological research there has provided insight on an ecosystem dating from 230 million years ago, during the Triassic period of the Mesozoic era of the Earth's history. Petrified Forest is considered the best place in the world for studying this part of the Triassic period, making it a globally significant paleontological resource. Some scientists believe that the Triassic period is the time when all modern ecosystems were established. Petrified Forest may contain a comprehensive record of this time of transition of life on earth.

The park is also important for archeological research. This research has uncovered 10,000 years of human habitation. Some 500 archeological and historic sites exist in the park today which demonstrate prehistoric trading among cultures and the historic use of the Puerco River valley as a transportation corridor.

Another significant part of the park's ecosystem is its shortgrass prairie, which is considered the best example of its kind in northeast Arizona. In addition to this shortgrass prairie vegetation, several large mammals, including pronghorns and coyotes, inhabit the area. Some descendants of ancient reptiles such as the Painted Desert whiptail lizards and Hopi rattlesnakes are quite common.

Geologic Past

During the Triassic period of the Earth's history, the land area around what is now Arizona was unstable with much volcanic activity, ash and other volcanic debris. Deposition was rapid and resulted in burial, preservation and fossilization of the plants and animals inhabiting the area.

About 100 million years ago, the area known today as Petrified Forest National Park (PFNP) was buried deep under thick layers of sediment. By 35 million years ago the strata were thrust upward, exposing them to wind and rain. Subsequently, layers of sediment were gradually stripped away. The loss of these layers of sediment makes these Triassic deposits accessible for study, greatly increasing their scientific value (USDI, 1979).

Scientists believe that the area which is known as the park today was initially a swampy woodland. They suggest that petrified logs were washed in from higher, more densely wooded areas to the south after volcanic eruptions. This conclusion is based in part on the fact that relatively few stumps have been found on the site. Scientists have also confirmed that the petrified logs on the site are remains of *Araucarioxylon*, *Woodworthia*, and *Schildera* trees, all tall conifers (USDI, 1979).

Geographic Areas

Three distinct geographic areas are identified in the park: the Painted Desert, the Puerco River Valley and the Rainbow Forest. The floor of the Painted Desert has been

the site of recent excavation of early dinosaur bones. A few grasses and shrubs can be seen in isolated pockets on this site, but vegetation is scarce due to the prevalence of erosion. The Puerco River valley is known for various mixed shrubs and grasses that form the shortgrass prairie. This vegetation provides food and some shelter for most of the park's wildlife. At Rainbow Forest, high concentrations of petrified wood are quite common. In addition, numerous plant and animal fossils have been excavated within this geographic area.

Recent Human History

Petrified Forest was brought to the attention of the American public in the mid-1800s through the reports of the US Army expeditions. Logs collected were shipped to the Smithsonian Institution and geological surveys were conducted. The Land Office withdrew the area from homestead entry as interest grew in the area's scenic and scientific values. However, this did not stop wood theft, which reached alarming proportions with the completion of the railroad in the early 1880s.

John Muir, among others, fought to preserve parts of the American Southwest's scenic, historic and scientific areas, which included Petrified Forest. This led to President Theodore Roosevelt's signing of the Act for the Preservation of American Antiquities in 1906. Within three months of the passage of this Act, Petrified Forest National Monument was created to preserve and protect the concentrations of fossilized wood.

The National Park Service acquired the Painted Desert and a thin strip of land that connected the Monument's two units in the early 1930s. However, Petrified Forest did not gain national park status until 1962. A portion of the park was designated as a wilderness in 1970. The park's boundaries have changed several times since 1970. Today, the park accounts for 93,533 acres in Navajo and Apache counties of Arizona.

Current Park Use and Management

The park is currently managed by the National Park Service whose goals are:

- (1) To protect the paleontological resources, the prehistoric sites, the recovered shortgrass prairie ecosystem and the scenic lands for future generations.
- (2) To allow visitors to experience and understand the paleontological, cultural, ecological and scenic resources in the context of the Earth's history.
- (3) To encourage and support scientific inquiry into the Triassic period of the Earth's history (USDI, 1979).

The park's managers foresee potential conflicts in achieving these goals because of the disturbances that may be caused by visitor use and research. However, they feel that excavation, documentation and placement of fossils in a museum serve both the goals of protection and scientific inquiry. Additionally, park managers feel that if visitors are allowed to experience the petrified wood and fossils firsthand, then they may be better able to appreciate them and understand the need for protection.

General Management Plan of the Park

One major goal indicated in the park's management plan is to guide visitor use in light of the broadening perspective (paleontological and archeological) on the significance of the park's resources. This changing perspective has encouraged the park's staff to help refocus the visitor experience to make people aware that the park is more than just petrified logs and help them understand how all the park's natural and cultural resources interrelate.

The management plan also focuses on the planning issue of how to initiate and coordinate paleontological research efforts. Presently, academic institutions conduct most of the research. Park managers feel that they should be given the responsibility of caring for the park's paleontological resources and to generate information needed for resource protection and interpretation.

Another issue that the park's management plan focuses on is how to protect resources that extend beyond that park's current boundaries. A landfill has been proposed east of the park's boundary that is expected to grow and join the east boundary of the park. The park managers feel that this could lead to potential destruction of paleontological and archeological resources.

Another major issue addressed in the park's management plan is petrified wood theft. Theft of petrified wood by park visitors has been identified by Petrified Forest National Park's General Management Plan (USDI, 1993) as the park's number one resource protection problem. Park managers have tried a number of methods to reduce theft of petrified wood by visitors. However, the amount of theft has remained at an unacceptably high level. It is estimated that 12 tons of petrified wood are removed from the park each year (USDI, 1993).

Problem Statement

The general problem which this study addresses is whether interpretive programs at Petrified Forest National Park (PFNP) reduce theft of petrified wood. More specifically, the study addresses three sub-problems.

Sub-problems

1. Park managers don't know the beliefs, attitudes and norms of their park visitors about petrified wood theft.
2. Park managers don't know if beliefs, attitudes and norms shape the petrified wood theft behavior of park visitors.
3. Park managers don't know if and how interpretive programs shape theft behavior at the park.

Study Objectives Are as Follows:

1. To determine whether time spent at interpretive centers and programs influences attitudes toward wood theft.
2. To determine whether participation in interpretive programs changes visitors' norms about the severity of the

individual wood theft acts.

- 3.** To determine whether attitudes and norms about petrified wood theft vary by type of interpretive programs judged most helpful in learning the park story and park rules and regulations.
- 4.** To determine whether the rate of theft of petrified wood will be inversely related to the amount of interpretive programs participated in and will vary by type of interpretation judged most helpful.
- 5.** To determine whether attitudes and norms about wood theft shape theft behavior.

CHAPTER TWO LITERATURE REVIEW

Interpretation as a Management Tool

In the past, public land managers were thought to focus primarily on administering land with its package of natural resources. However, in recent times land management professionals have become more concerned with influencing public action or thought. As a result, managing humans has emerged as a significant component of the resource manager's job (Fishbein and Manfredi, 1992). Some examples of these new tasks include gaining support for a new policy or plan through informing and educating the public; attracting recreation and tourism to a destination by advertising and promotion; and minimizing depreciative behavior and vandalism by targeting both culprits and victims. Fishbein and Manfredi further suggest that resource managers need to redirect recreationists' behavior to minimize resource and social impacts through education, and to direct attention and appreciation through interpretation to enhance recreational enjoyment.

Park employees and interpretive specialists at Petrified Forest National Park appear to be moving toward greater management of public action and thought. This is evident in their belief that interpretive programs geared towards changing beliefs, norms and attitudes will bring about the desired reduction in wood theft. According to Fishbein and Manfredi (1992) the more land managers know about factors influencing decisions to perform or not to perform a behavior, the more likely is their ability to develop effective messages or other types of interventions to influence these decisions. Thus, for PFPN managers to develop effective interpretive programs, they need to understand factors that influence wood theft.

Interpretation to Increase Knowledge and Favorable Attitudes

Several studies have shown that interpretation can be effective in increasing knowledge or in fostering at least short term attitude change. Fieldman (1978), in an attempt to increase knowledge levels about the environment among recreating motorists at a state park in New York, used an interpretive message on a cassette tape and in a brochure. Fieldman found that both the cassette tape and brochure increased learning levels.

Maupin, Bassett, Catlin and Witter (1982) evaluated Prairie Day, an interpretive extravaganza. Prairie Day was an educationally oriented celebration of the prairie, where Missourians were invited to visit one of the state's public prairies and were treated to a day-long series of interpretive activities. Participants attending Prairie Day were asked to subjectively evaluate the program by rating their enjoyment and how much they had learned. The majority of the respondents felt the program was "very enjoyable" and felt that they had "learned quite a bit". Maupin et al. (1982) felt that participants may translate the knowledge gained at Prairie Day in an enjoyable and entertaining atmosphere into a strong positive

attitude toward prairie ecosystems and prairie preservation.

Olson, Bowman, and Roth (1984) conducted a study which attempted to raise knowledge levels and induce favorable attitudes about natural resource management policies and practices in four Ohio State nature preserves. Brochures, on-site signs, off-site presentations and on-site guided hikes were used to communicate policies about picking flowers, burning vegetation, grazing, cutting timber, camping, restricting recreational uses, picnicking, trapping and alcohol use. Of the more than 1000 visitors sampled, differences between pre-test and post-test scores on knowledge of overall preserve management concepts were greatest for brochures, followed by personal services and signs. However, attitude gains were similar for all communication strategies. In the control group, there was a decline in knowledge from pre-test to post-test.

Nielson and Buchanan (1986) conducted a study at Grand Teton National Park to compare the learning and attitude change benefits from interpretive programs on fire ecology and fire management. They found that an automated audiovisual slide program and a ranger-guided talk about fires while being in view of a recent burn significantly increased visitors' knowledge of fire ecology and support for natural fire management. However, the slide program and the ranger-guided tour and talk did not differ in effectiveness.

Sieg, Roggenbuck, and Bobinski (1987) conducted a workshop for whitewater rafting guides at the new River Gorge National River in West Virginia. The workshop focused on natural and cultural history and attempted to increase the guides' level of interpretation and subsequently the visitors' knowledge levels and intentions to visit the National Park Service's interpretive center. Sieg et al. found that the amount of interpretation provided by the guides increased significantly after the workshop. In addition, visitors also showed significant increase in knowledge levels. However, river rafters did not indicate stronger behavioral intentions to go to the visitor center after the trip.

Cable, Knudson, Udd and Stewart (1987) conducted a study to document changes in attitudes as a result of exposure to interpretive messages. This study was conducted at the Petawawa National Forestry Institute in Ontario, Canada during the summers of 1982 and 1983. The facilities at this institute included a visitor center, an outdoor exhibit loop, two self-guided interpretive trails using different forms of interpretive media and a self-guided road tour. The results of this study indicated that the percentage of visitors with favorable attitudes was greater for exiting visitors than for entering visitors for five of the seven topics evaluated in 1982 and two of the four evaluated in 1983. Cable et al. (1987) felt that these data suggest that the facility was generating some positive attitudes in the visitors, even though they did not provide information concerning changes in attitude strength or intensity.

Reames and Rajecki (1988) conducted a zoo outreach program for preschool children. They wanted to verify whether close contact with animals fostered positive attitudes about them. Seven live animals were shown and an additional five animals were discussed but no live samples were shown to the children. Attitudes were measured before and after the visit. Reames and Rajecki found that attitude scores increased for

four of the seven live animals and for one of the five animals discussed with no live specimen.

Cole, Hammond and McCool (1997) conducted a study to evaluate whether sign-based messages at a trailhead at the Selway-Bitterroot Wilderness significantly increased visitors' knowledge about recommended low-impact practices. As visitors exited the trail, they were given a quiz to test if knowledge about low-impact camping increased. Knowledge scores were compared for hikers who were and were not exposed to the messages.

The results of this study showed that visitors who were exposed to the messages correctly answered 41% of the low-impact questions, whereas visitors not exposed to the messages gave correct scores on only 16% of the questions. This difference was statistically significant. It was also discovered that when a map was included on the board it attracted people to the board but not to the messages. This study also discovered that as the amount of messages increased, the attention per message and retention decreased. Cole et al. (1997) found visitors exposed to eight messages did not acquire any more new low-impact knowledge than those exposed to two messages.

Interpretation to Increase Low Impact Behavior

Inappropriate visitor behavior (depreciative behavior) which may cause damage to natural and cultural resources is a major problem faced by many park agencies. These acts of depreciative behavior may reduce the scientific values of the resources, threaten the safety of employees and visitors, detract from the aesthetic quality of recreation experiences and divert money that might be spent on other programs to the repair and prevention of resource damage (Vander Stoep and Gramann, 1987).

Resource managers may apply direct or indirect approaches to reduce visitor-caused impacts. The indirect approach, which is often favored by both managers and visitors, focuses on the design and implementation of communications-based strategies to get visitors to voluntarily alter their behavior in ways that protect park resources (Vander Stoep and Gramann, 1987).

The previous section reviewed studies of the effects of interpretation on attitudes and knowledge. However, it is by no means given that changing attitudes or knowledge means that behavior will change. Thus, other studies have looked at the interpretation-behavior link directly. This research has demonstrated that communications methods such as brochures, signs and personally-delivered messages are often effective in changing user behavior in outdoor recreation settings (Christensen, 1981; Clark, Hendee and Burgess, 1972; Muth and Clark, 1978; Oliver, Roggenbuck and Watson, 1985; Powers, Osborne and Anderson, 1973; Roggenbuck and Berrier, 1982; Schwarzkopf, 1984).

Fazio (1974, 1979) tested the effectiveness of education media on increasing learning about low impact camping practices and observing park rules. At Rocky Mountain National Park, Fazio provided messages in a brochure, a trailhead sign and a visitor activated slide and sound exhibit. Fazio found that visitors showed significant knowledge increase when they were exposed to the slide exhibit alone, the slide exhibit plus the brochure and the slide exhibit plus the trailhead sign. The trailhead sign and the

brochure were ineffective by themselves. Fazio also found that backpackers who had seen one of the interpretive displays or programs explaining the reasons for park rules and regulations were more likely to observe the rules than those who were not exposed to the interpretive contacts.

Sutton (1976) reported what he called a classic use of interpretation to control vandalism at Channel Islands National Monument in California. His interpretive message attempted to help visitors understand their park environment so that they would be less likely to destroy it. The goal here was to ensure that visitors held proper attitudes about the resources in the park and to reduce depreciative behavior. At the end of the summer of 1976, vandalism was reduced to a minimum. This prompted Sutton to suggest that interpretation and interpretive techniques can reduce vandalism and should be incorporated in all types of recreational areas.

Oliver, Roggenbuck and Watson (1985) used informational prompts in an attempt to reduce littering and tree damage at a campground. Three interventions were used: a brochure, a brochure plus a ranger contact, and a brochure plus a ranger contact and a request for camper assistance in reporting impact behaviors to the ranger. In the control condition, where none of these treatments was applied, 82% of all campers parties left at least one piece of litter, and 38% damaged at least one tree. When the treatments were applied, impact behaviors were reduced. However, the brochure plus the personal contact was significantly more effective than the brochure alone in reducing the number of groups with littered campsites, from 67% to 41%, and groups causing tree damage, from 20% to 4%. Finally, the request for assistance in rule enforcement did not show any additional positive behavior change.

Dowell and McCool (1986) used three methods: a slide show, a booklet, and a combined booklet and slide show to increase boy scouts' knowledge, favorable attitudes and behavioral intentions about using low impact practices. When the mean differences of attitude scores between pre-tests and post-tests were compared, significant differences were found for children who had the booklet and slide show and those who received just the booklet. However, all three methods increased behavioral intentions to use appropriate low impact behavior in the wilderness.

Roggenbuck and Passineau (1986) conducted a study to assess the effectiveness of interpreter-guided field trips in changing behavior by increasing knowledge and building supportive attitudes. They discovered that a group of school children that visited a historic site at Indiana Dunes National Lakeshore showed a significant increase in strength of attitudes toward protection and conservation of park resources and about visiting parks and historic sites. In addition, the children's behavioral intentions to not litter and to recycle also increased significantly. Roggenbuck and Passineau (1986) also observed actual littering behaviors among students and discovered that when anti-littering messages were given to the children at the start of the field visit, 66% of the planted litter was picked up along the trail. This increased to collection of 90% of the planted litter when the message was coupled with role modeling of finding and picking up a piece of litter by the interpreter. Additionally, of the 350 children who were given a souvenir button in an envelope along the trail, not one envelope was found discarded.

Martin (1987) conducted a study at Mount St. Helens National Volcanic Monument to determine the effectiveness of informational interventions to reduce theft of pumice. Visitors were observed on a small loop trail in the Monument, and under the control condition (no intervention), 12.3% of visitors were observed removing at least one piece of pumice. Three types of trailhead signs were tested to see how effective they would be in reducing theft of pumice. The first was an appeal to not remove ash or pumice, the second requested visitors to report violators who were seen removing ash or pumice; and the third threatened to prosecute visitors who were caught removing pumice.

The results of this study showed that these interventions (signs) were effective in reducing the number of people who removed pumice on their visit to the monument. The first sign reduced the removal of pumice from 12.3% to 3.3%; the second reduced it to 3.9% and the third to 0.9%. Threat of punishment was the most effective, although all three caused a noticeable improvement in behavior. Martin (1987) also tested the effectiveness of an interpretive brochure that appealed to visitors for appropriate behavior and found it reduced the number of people who removed pumice from 12.3% to 3.8%. From this study, Martin discovered that visitors most likely to take pumice were women over 50 years old who wanted it as a souvenir and boys 5 to 12 years who wanted to show the pumice to their peers back home.

Jones and McAvoy (1988) evaluated knowledge, attitude and behavioral changes among program participants both immediately after and three months after a workshop on wilderness concepts, wilderness values and low impact practices. They found that knowledge gains were significant, both immediately after the workshop and three months later. Jones and McAvoy also found that favorable attitudes also increased significantly and remained high. Similarly, the intentions to use appropriate behavior also showed a significant improvement.

Johnson and Swearingen (1988) conducted a study to determine the effectiveness of signs in preventing off-trail hiking in Mount Rainier National Park. They found signs to be very effective in reducing off-trail hiking. However, they discovered that the type of text on the sign influenced its effectiveness. For example, the sign that said “off-trail hikers may be fined” reduced off-trail hiking by about 75%, whereas the sign that said “stay on paved trails and preserve the meadow” reduced off-trail hiking by 52%.

Vander Stoep and Gramann (1988) conducted a study at Shiloh National Military Park to see if pro-social behavior prompts, information and incentives would reduce impacts on historical cannon, statues and monuments. Three different treatments were tested: an awareness of consequences message; the awareness of consequences plus a resource protection message; and the awareness of consequences message plus a resource protection message plus an incentive for being a guardian of the resource. The results from this study showed significant improvements in behavior for all three treatments. The amount of serious depreciative behavior was reduced by approximately 88% across all three interventions. However, the third, more complex treatment was not any better than the first two.

Manfredo and Bright (1991) attempted to assess the effects of communication on recreationists at the Boundary Waters Canoe Area Wilderness. They looked at whether

or not a persuasive brochure focusing on proper human behavior in bear territory actually increased proper behavioral intentions, to reduce people-bear conflicts. Participants were mailed the bear brochure along with other brochures before their visit to the area.

The results from this study indicate that 75% of participants remembered the brochure after their visit. About the same number devoted some thought to the brochure's content. However, only 18% of the respondents received new information from the brochure. About 35% had some change in belief and only 8% reported actual or intended change in behavior as a result of the brochure. However, the brochure was very effective for recipients with low knowledge about bears, and the greater the perceived prior knowledge, the less the change in behavior due to the brochure.

National park and forest employees and interpretive specialists often feel that interpretive programs do change the behavior of park visitors. For example, Sutherland and Tenorio (1993) discovered that prior to 1985, many visitors to Guayabo National Monument, Costa Rica would remove forest and archaeological resources and damage ancient stone structures by climbing over them. This prompted Sutherland and Tenorio to develop guided walks, with the objectives of protecting natural and cultural resources and discouraging destructive behavior. To achieve these objectives, the interpretive messages focused on archaeology, the value of the site and understanding Costa Rican history. Apparently, cultivating an understanding of the values of the site and its resources or the presence of a guide brought about a decline in destructive behavior. Since these guided walks have been developed, the damage and looting of ruins have dropped off considerably, despite an increase in visitation.

Failures of Interpretation as a Management Tool

Roggenbuck (1992) in summarizing Lucas (1981) said that recreationists are a very diverse group of people looking for diverse recreation experiences. This makes it difficult to develop persuasive messages to address the diversity of recreationists in an effective manner. As a result, some messages have been unsuccessful as a management tool in achieving their goals. Gallup (1981) used cartoon brochures which stated reasons for rules to increase knowledge and compliance with rules and regulations. He reported slight but significant knowledge increases for visitors who were exposed to the brochures. However, rule violations were just as numerous for those exposed to the brochures and those who were not.

Lucas (1981) attempted to redistribute amount of trail use at the Selway Bitterroot wilderness by giving to visitors an informational brochure about current use of various trails in the forest. Results showed little behavior change by visitors. However, it was discovered that visitors either failed to receive the brochure, or those who did get them received them too late in the route planning process. In addition, recreationists used more criteria than just the amount of use to select trail routes, and they sometimes doubted the accuracy of the brochure's information about use.

Burde, Peine, Renfro, and Curran (1988) evaluated visitors' knowledge gain from interpretive materials and contacts at Great Smoky Mountains National Park. They found that backcountry visitors who used the park's interpretive services were no more

knowledgeable about backcountry policies than those who did not use the services. In addition, knowledge levels for both groups were high, with the exception of knowledge of backcountry fire policies.

Similarly, Burde et al. (1988) found no difference in the levels of knowledge about hypothermia and how to treat it between groups who used and groups that had not used park interpretive information. However, exposure to the Park Service literature on black bear hazards and poisonous snakes did increase knowledge levels about how to respond to these dangerous animals. Even though knowledge levels were increased, knowledge levels about appropriate behaviors remained generally low.

Summary

In summary, while the success of interpretation as a management tool has been mixed, Roggenbuck (1992) has concluded that it is often effective. He has reported the following general findings about knowledge-attitude-behavior intentions change resulting from persuasion.

1. Interpretative programs and educational workshops are often effective in increasing knowledge, favorable attitudes and positive behavioral intentions about rules, resource ecology and resource protection in park setting.
2. Messages delivered by park rangers are often no more effective than non-personal services in increasing knowledge and favorable attitudes.
3. The effectiveness of non-personal persuasive interventions are mixed, but often brochures, slide programs and cassette tapes are more effective than signs in improving knowledge, attitudes and behavioral intentions.
4. Multiple media are generally more effective than a single medium in improving knowledge, attitudes and behavioral intentions.
5. Persuasive messages are generally more effective in improving knowledge, attitudes and behavioral intentions of persons with less knowledge or experience.

A possible reason for the lack of even greater success of interpretation as a management tool is the frequent failure to anchor attitude and behavior change strategies in social-psychological theories of behavior.

Fishbein and Manfredo (1992) have concluded that the Theory of Reasoned Action will allow for the understanding of recreation-related behaviors and for developing educational or other interventions to change or maintain these behaviors. The following chapter describes this theory in detail.

CHAPTER THREE

The Theory of Reasoned Action

Overview of the Theory

The findings from the previous chapter that interpretive interventions were often successful, that certain interventions were more successful than others, that multiple interventions were usually more successful than single interpretive programs, and the recognized need for theory-based change programs guided our attempts to lower theft behavior. The conceptual model of human behavior used to guide our study was the *Theory of Reasoned Action*. This theory assumes that humans as reasoning animals systematically utilize and process information available to them (Fishbein, 1980; Ajzen and Fishbein, 1980; Fishbein and Manfredo, 1992). Ajzen and Fishbein (1980) believe that human social behavior is generally not controlled by unconscious motives or overpowering desires, nor do they believe that it can be characterized as capricious or thoughtless. On the contrary, they argue that people consider the implications of their actions before they decide to engage or not to engage in a given behavior. For this reason, they refer to their approach as a “Theory of Reasoned Action”.

As noted in *Figure 1*, the Theory of Reasoned Action suggests that behavior is shaped by beliefs, attitudes, norms, and intentions (Fishbein, 1980). More specifically, the theory suggests that:

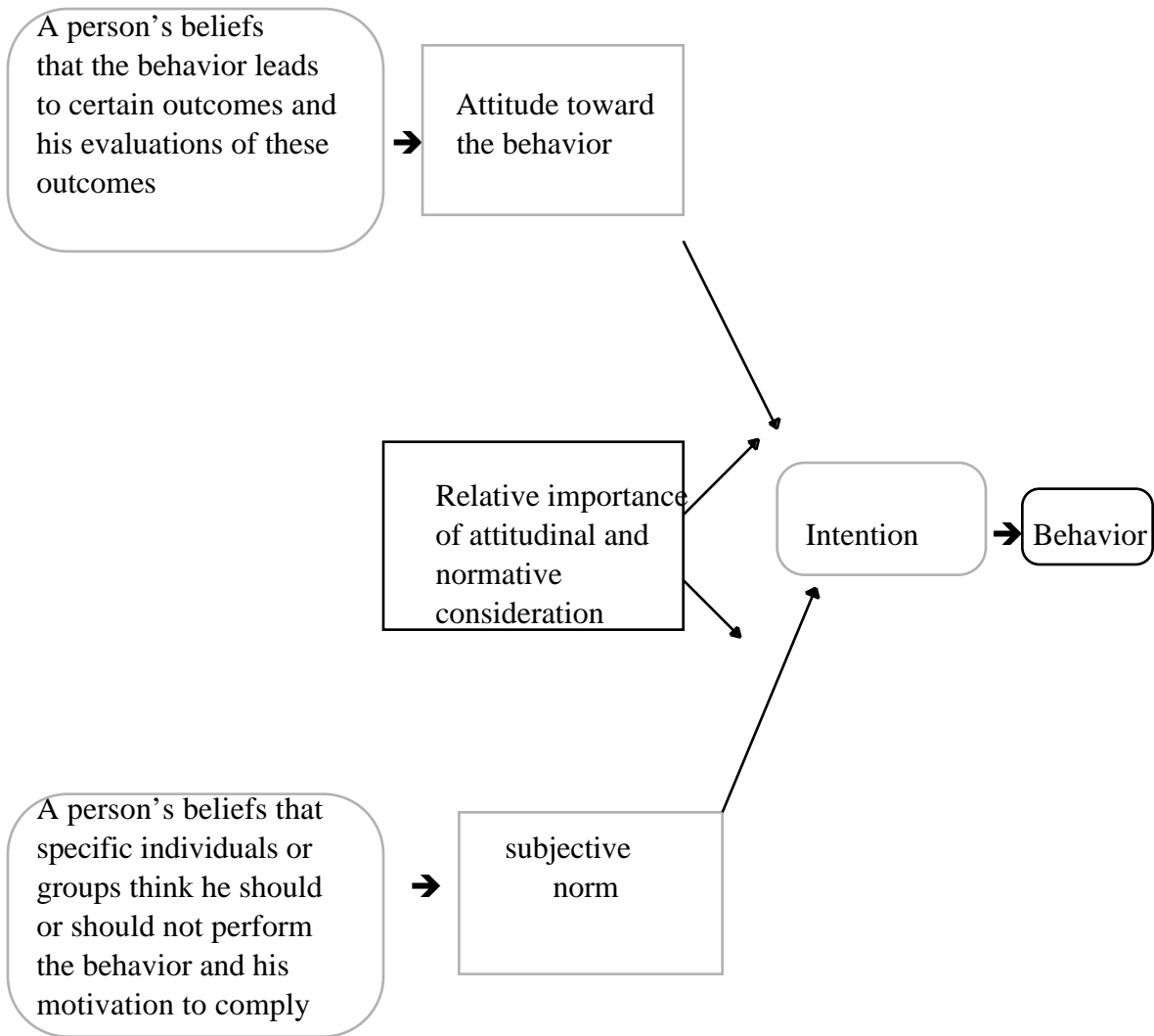


Figure 1
 The Ajzen-Fishbein Model (Ajzen and Fishbein, 1980) of the Theory of Reasoned Action

1. A weighted combination of attitude and subjective norms shape behavioral intentions and
2. Intentions often shape behaviors.

The model's conceptual framework suggest that a person's specific behavior (**B**) is determined by his/her intention (**BI**) to perform that behavior. The model also suggest that the behavioral intention can be adequately predicted by a combination of the attitude toward performing the behavior (**AB**) and the subjective norm regarding performance of the behavior (**SN**). Thus, **BI** is a function of two determinants, one personal in nature and the other reflecting social influence. This model can be represented by the formula:

$$\mathbf{B} \quad \mathbf{BI} = (\mathbf{AB}) W_1 + (\mathbf{SN})W_2$$

(W1 and W2 are empirically determined weights that determine the importance of each component).

Fishbein and Manfredo (1992) also suggested that for some behaviors and intentions, attitudinal considerations may be more important than normative ones, while the reverse may be true for other behaviors and intentions. For example, a wife may hold a positive attitude toward using birth control pills but may perceive social pressure from her church not to use the pill. To address this situation, Ajzen and Fishbein suggested that relative importance of the attitudinal and normative factors as determinants of intentions be considered. They suggested that both factors are frequently important determinants of the intention. In addition, they feel that the relative weights of the attitudinal and normative factors may vary from one person to another and from one type of behavior to another.

Attitude toward a behavior is the sum of the product of the beliefs (**bi**) that a given behavior will lead to a given outcome and the evaluations (**ei**) of the positive or negative value of the outcome, and is given by the formula:

$$\mathbf{AB} = \mathbf{bi} \times \mathbf{ei}$$

Subjective norm is the sum of the product of the perceived normative beliefs held by significant others about performing a given behavior (**nbi**) and motivation to comply (**mci**) and is given by the formula:

$$\mathbf{SN} = \mathbf{nbi} \times \mathbf{mci}$$

According to the Theory of Reasoned Action, a person's intention to engage in a behavior is a function of two determinants, one personal in nature and the other reflecting social influence. The personal factor, "*attitude towards the behavior*", refers to the person's belief that performing the behavior leads to a certain outcome and the belief that the outcome is good or bad. The more one believes that by performing a certain behavior, certain positive outcome will result or negative ones will be avoided, the more favorable will be the attitude toward that behavior. Similarly, if by performing a behavior, negative outcomes result or positive ones are prevented, then the attitude will likely be negative

(Ajzen and Fishbein, 1980; Fishbein and Manfredo, 1992). The beliefs that underlie a person’s attitude toward the behavior are called *behavioral beliefs*.

The second determinant, “*subjective norm*”, is the individual’s perception of the social pressures put on him/her to perform or not to perform a behavior by persons, groups, or institutions that he/she cares about (Ajzen and Fishbein, 1980; Fishbein and Manfredo, 1992). Stated another way, one’s subjective norm with respect to a particular behavior is a function of his or her normative beliefs that significant individuals or groups think he or she should or should not perform the behavior, plus the person’s motivation to comply with those individuals or groups. This suggests that a person will feel social pressure to perform a behavior if he or she is motivated to comply with individuals or groups or believes that the behavior will be approved by significant others. Similarly, if one feels that performing a behavior will not meet the approval of a significant group like one’s peers, then he or she will be less likely to perform the behavior. These beliefs underlying a person’s subjective norm are referred to as *normative beliefs*.

Determinants of attitude toward a behavior

Ajzen and Fishbein (1980) suggest that we form beliefs about an object by associating it with various characteristics, qualities and attributes. Because of these beliefs, we acquire favorable or unfavorable attitudes toward that object depending on whether we associate that object with positive or negative characteristics. These beliefs may be attained by direct observation, indirectly by accepting information from outside sources, or generated through inference processes. Some beliefs persist, others are forgotten and new ones may be formed (Ajzen and Fishbein, 1980).

A person may hold a large number of beliefs about an object but he/she can attend to only a relative small number of these beliefs at any given time. These beliefs attended to at a given time are referred to as *salient beliefs* and are determinants of the person’s attitude. Ajzen and Fishbein suggest that in order to understand why a person holds certain attitudes toward an object, it is necessary to access his/her salient beliefs about that object.

Predicting attitudes from beliefs

Ajzen and Fishbein (1980) have argued that a person’s attitude toward a behavior is determined by the set of salient beliefs he/she holds about performing the behavior. They also argued that to understand a person’s attitude toward a behavior, one needs to know how that person evaluates the consequences of that behavior. The first step in predicting attitude from beliefs is to evaluate the perceived positive and negative outcomes of the behavior. As an example, support for a controlled burn policy in National Parks might be measured with the following scale:

Outcome evaluation scale														
Good	(+3)	:	(+2)	:	(+1)	:	(0)	:	(-1)	:	(-2)	:	(-3)	Bad
extremely			quite		slightly		Neither/nor		slightly		quite		extremely	

The next step is to measure the strength of the person's beliefs that a given outcome will follow from the behavior. For example, the belief that the likelihood that wildlife will be killed by a controlled burn policy might be measured in the following way suggested by Ajzen and Fishbein (1980):

- not at all certain (0)
- slightly certain (+1)
- quite certain (+2)
- extremely certain (+3)

Ajzen and Fishbein's Theory of Reasoned Action suggests that a person's attitude toward a behavior can be predicted by multiplying the person's evaluation of each of the behavior's consequences by the strength of his/her belief that performing the behavior will lead to that consequence, and then summing the products for the total set of salient beliefs. A person's attitudes toward this behavior will correspond to the favorability or unfavorability of the total set of consequences, each weighted by the strength of the person's beliefs that performing the behavior will lead to each of the consequences (Ajzen and Fishbein, 1980).

To illustrate, a visitor could be asked to evaluate the six consequences listed in Table 1 using the seven-point good-bad scale presented earlier. Table 1 shows the results of a hypothetical case. Column 1 indicates the person's outcome evaluations and column 2 the belief strengths using the scale suggested by Ajzen and Fishbein. Column 3 is the product of the outcome evaluations, and belief strengths of each consequence. The Theory of Reasoned Action suggests that we sum these products to be able to predict the visitor's attitude toward a behavior. In this example, the visitor's attitude toward the NPS controlled burn policy is predicted to be positive (+5).

This example indicates that attitudes are based on the total set of a person's salient beliefs, both positive and negative. The attitudes that people hold toward a behavior correspond to the favorability or unfavorability of the total set of consequences. These consequences are weighted by the strength of the person's belief that performing that behavior will lead to each of the consequences (Ajzen and Fishbein, 1980).

Table 1

A hypothetical person's beliefs about NPS controlled burn policy

controlled burn policy / consequences	outcome evaluations	beliefs strength	product
<u>1.improves conditions for wildlife</u>	+3	+3	9
<u>2.destroys natural settings</u>	-2	+1	-2
<u>3.destroys private property</u>	0	+2	0
<u>4.removes dead vegetation</u>	+2	+2	4
<u>5.destroys wildlife</u>	-2	+2	-4
<u>6.causes threats to human lives</u>	-1	+2	-2
			total = +5

To apply the Theory of Reasoned Action to predict behavior, Fishbein and Manfredo (1992) suggested that four elements (action, target, context and time) of interest should be identified. More specifically, they believed that every action occurs with respect to some target, within a given context and at a given point in time. They further suggested that a change in any one of these four elements redefines the behavior of interest. Thus, we should not expect the same attitudes or behavior across all settings and times. For example, viewing the Grand Canyon from an overlook is a different behavior than hiking in the Grand Canyon (a change in action), and visiting the Grand Canyon is a different behavior than visiting Zion National Park (a change in target). Similarly, visiting the Grand Canyon with a spouse is a different behavior than visiting with a group of friends (a change in context), and visiting the Grand Canyon in December is a different behavior than visiting in June (a change in time). Fishbein and Manfredo (1992) suggested that as determinants of behavior change, so does behavior, and the most effective intervention to shape behavior may also change.

Revised Model: Theory Of Planned Behavior

Ajzen (1988) suggested that behaviors not under volitional control may result in a weak intention-behavior relationship. This has led Ajzen to revise the model to include a variable that addresses this issue. He has added a third component called “*perceived*”

behavioral control” to address the problem (*Figure 2*). This has led Ajzen to change the name from Theory of Reasoned Action to *Theory of Planned Behavior*.

Perceived behavioral control influences a person’s intentions to perform a behavior. It accounts for the perceived ease and/or difficulty of performing the behavior, the amount of control a person believes he/she has over the behavior, and presumably reflects past experience as well as anticipated impediments and obstacles (Doll and Ajzen, 1992). For example, a person from Roanoke who plans to be at Blacksburg, Virginia, to attend a Virginia Tech football game may perceive obstacles such as getting time off from work and traffic congestion that could prevent him or her from getting to the game on time. The Roanoke resident’s perceived behavioral control will likely be less than that held by a Virginia Tech student who lives on campus, because the student has fewer travel impediments. A person who perceives many obstacles in the way of performing a behavior is less likely to form an intention to perform that behavior (Ajzen, 1986).

Ajzen and Driver (1992) suggest that in general, the more favorable the attitude and subjective norm with respect to a behavior and the greater the perceived behavioral control, the stronger should be an individual’s intention to perform the behavior. Gulotta (1994) suggested that overall perceived behavioral control can be decomposed into a number of underlying beliefs (control beliefs) which determine the direct measure of perceived behavioral control. These underlying control beliefs are referred to as *the estimate of perceived behavior control*.

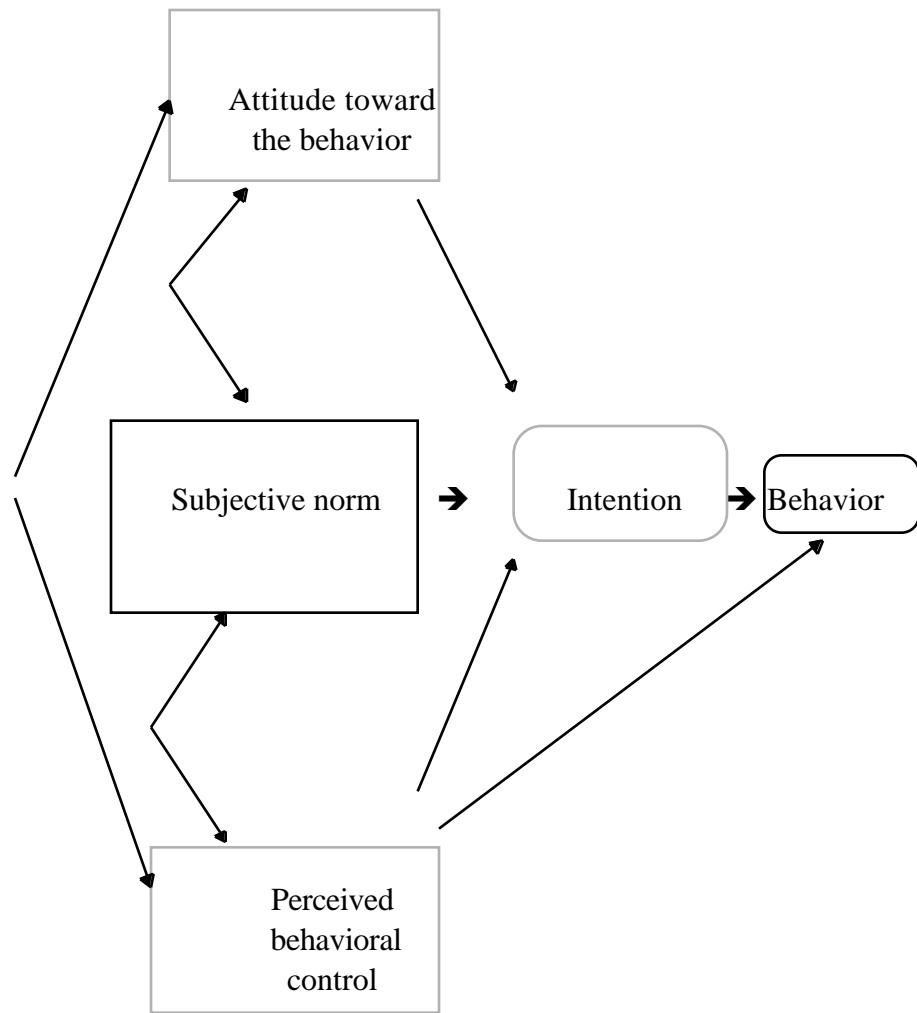


Figure 2
The Ajzen-Fishbein Model (Ajzen and Driver 1992) of the
Theory of Planned Behavior

Social and behavioral scientists have included other factors apart from attitude toward behavior and social norms to explain behavior. These factors include personality characteristics, need for achievement, demographics, and such factors as social role, status, socialization, intelligence and kinship pattern (Ajzen and Fishbein, 1980). Ajzen and Fishbein recognize the potential importance of these factors. However, they are not considered as an integral part of their theory and are referred to as *external variables* .

General Tests of The Theory of Reasoned Action

The Theory of Reasoned Action contends that behavioral intentions shape behavior, and attitudes and norms shape behavioral intentions. Considerable work has been done to test these hypothesized relationships. For example, the Theory of Reasoned Action has been used to predict and understand a range of health-related behaviors, including choice of breast versus bottle feeding of newborns (Manstead, Proffitt, and Smart, 1983), contraceptive behavior (Boyd and Wandeman, 1991), abortion decisions (Smetana and Adler, 1979), methods of childbirth (Lowe and Frey, 1983), dental hygiene (McCaul, O'Neill and Glasgow, 1988) and weight loss (Schifter and Ajzen, 1985). Past research indicates that a change in a given intention will more likely occur if the attitudes and/or norms that directly correspond to that intention are changed (Fishbein and Manfredo, 1980).

A comprehensive review of tests of Theories of Reasoned Action/Planned Behavior outside of the recreation and parks field is not possible or necessary here. However, key studies will be reviewed that describe factors that influence the strength of the hypothesized relationships between or among elements of the model.

One relationship predicted by the Theory of Reasoned Action is that behavioral intentions will influence behavior. A study by Whelpton, Cambell and Patterson (1966) indicated that the number of children women intended to have was a good predictor of the number of children women actually had. Similarly, Smetana et al. (1979) found 92% of the variance was accounted for by a person's behavioral intentions toward having or not having an abortion.

Another relationship predicted by this theory is that attitude influences behavioral intention, which influences behavior. Galper (1995) examined the motivation of weightlifters to use anabolic-androgenic steroids, and discovered that respondents' attitudes toward personal anabolic-androgenic steroid use predicted a significant 55% of the variability in the intentions to use this steroid.

A third relationship predicted is that social norms influence behavioral intention and behavior. Ajzen and Fishbein (1980) found that the belief concerning the likely outcome of a given consumer behavior and what important others may think will determine consumers' intentions and actual behaviors. For example, 40% of the variance was accounted for by a person's subjective norm toward intention to buy Miller beer (Fishbein and Ajzen, 1980).

A fourth relationship (Theory of Planned Behavior) suggests that perceived behavioral control will predict behavioral intention and behavior. When Galper (1995)

added perceived behavioral control to his model, this resulted in the attitude and perceived behavioral control components together significantly predicting 67% of the variability (an increase of 22%) in anabolic-androgenic steroid intentions.

In another study, Gulotta (1994) found attitudes, normative beliefs, perceived behavioral control, and age significantly predicting a woman's intention to raise or place her child for adoption. However, subjective norms did not contribute significantly to the model in predicting behavioral intentions.

Fishbein and Manfredo (1992) concluded that attitudes and subjective norms may both influence the formation of any given intention, but the relative importance of these two factors may vary from behavior to behavior and from individual to individual. They also suggested that for some behaviors and intentions, attitudinal considerations may be more important while for others normative considerations may predominate. Similarly, an individual's intention to perform a given behavior may be influenced more by attitudinal considerations, while another individual's intention may be influenced by normative considerations. A study by Young and Kent (1985) discussed in more detail later discovered that while men's intentions to go camping are primarily under attitudinal control, women's intentions are influenced slightly more by normative control.

As mentioned before, if one wants to change or reinforce a given intention, one must change or strengthen the attitude and/or the subjective norm with respect to that behavior. Fishbein and Manfredo (1992) suggested that whether one should change the attitude or the subjective norm depends upon the relative importance of these two components as determinants of a specific intention in a population. For example, to change a behavior under attitudinal control requires addressing the attitude component and to change a behavior under normative control requires addressing the normative component.

Tests of the Theory of Reasoned Action in Recreation Research.

The Theory of Reasoned Action has been applied in several studies of recreational behavior. Cockrell and McLaughlin (1979) applied Fishbein's model to predict the rivers that users choose to run by measuring recreationists' intentions to run rivers, beliefs about these rivers, and preferences for aspects of their trips. To test Fishbein's model, subjects' ranked intentions to run a river were predicted from their attitudes toward that river and their social norms about running that river. Similarly, subjects' ranked intention to run a river was also predicted from the rank of their attitudes toward running that river and the rank of their norms about running that river.

The results of this study indicated that for the six rivers evaluated, correlations of ranked intentions with attitudes and norms were significant for three. When ranked attitude and ranked norm values were used instead of original scores, predictions of choices were improved for five of the six trips. Cockrell and McLaughlin (1979) concluded that attitudes and norms were in some instances related to ranked intentions. Since they found that simple correlations to be greater for the attitude variable, they also concluded that attitudinal influences were stronger than normative beliefs for river runners.

Ray (1981) used an adaptation of the model of the Theory Reasoned Action to understand motivation for participation in continuing education programs by therapeutic recreation professionals. Two multiple regression analyses were performed using attitude, subjective social norm (perception of what significant others think of their participation in continuing education), and subjective personal norm (the belief by the individual whether to participate or not) as predictors of intention and then behavior. Another regression analysis was performed using past behavior to predict intention. Ray found previous continuing education activity (previous behavior) to be the most significant motivator to participate in continuing education programs ($R^2 = .37$). This can be explained by the fact that participants in the study were already involved in continuing education activity. Reinforcement by significant others (employers, certification/registration boards, peers, and friends) and subjective personal norm were the only other components in the regression equation to exhibit significance ($R^2 = .10$).

Riddle (1980) applied the current version of the Theory of Reasoned Action to examine beliefs, attitudes norms, and behavioral intentions held by male and female joggers and non-exercisers regarding regular jogging. She found non-exercisers thought jogging would require too much discipline, take too much time and make them too tired. She also found that non-exercisers indicated that it was unlikely that their referents, in particular physicians, thought they should jog regularly. In contrast, she found joggers believed that regular jogging would have positive effects and they evaluated being in good physical and mental condition more positively than the non-exercisers. Joggers also indicated that they felt it was likely that their referents, in particular physicians, thought they should jog regularly.

Riddle's study supports the Theory of Reasoned Action, since it found a strong positive relationship between the intention to jog and jogging behavior, and behavioral intention was correlated with the attitudinal and normative components of the model. Riddle (1980) concluded from her study that educators can change exercise behavior by focusing on change of beliefs and attitudes identified through the model.

Young and Kent (1985) conducted a study using the Theory of Reasoned Action to improve understanding of recreation behavior. In this study, 100 residents in a small Midwestern city were questioned about their intentions to camp, their attitudes and beliefs about going camping, and the influence of "important others" in making decisions to camp. The study behavior was described as "going camping this summer". This allowed the respondents to define camping in a variety of ways and allowed the belief outcomes to be associated with a variety of camping styles. After the camping season, each subject was interviewed to find out if they had gone camping.

A correlation coefficient of .77 ($p < .01$) was observed between intentions to go camping and whether or not they went camping. Similarly, a multiple correlation coefficient of .74 ($p < .01$) was observed between behavioral intention and attitude towards camping and subjective norm (perception of how "important others" feel about the respondent going camping). In the multiple regression, the attitudinal component had a slightly higher regression coefficient (beta weight = .45) than subjective norms (beta weight = .41). Young and Kent suggested that this implies that as a group, the

respondents' attitudes had more influence on their intention to go camping than the referents who were important to them. However, they felt that a beta weight of .41 for subjective norm is high compared to other studies. This may be because camping is generally a group activity and requires cooperation of others, thus the subjective norm factor was relatively more important in this study (Ajzen and Fishbein, 1980; Young and Kent, 1985).

This study also discovered that the relative influence of the attitudes and subjective norms on intentions depended upon demographics, personalities and other individual differences. For example, it was observed that the intentions of females were more influenced by "important others" (subjective norms) than by their own attitudes. In contrast, the intentions of males were more influenced by their own attitudes. It was also observed that those intending to camp were highly influenced by their own attitudes and only influenced slightly by "important others". However, those intending not to camp were equally influenced by their own attitudes and their subjective norms.

It was also observed that those intending not to camp thought it significantly more likely that going camping would involve being crowded and uncomfortable, while those who intended to camp were significantly more positive in their belief that going camping was relaxing. Similarly those not intending to camp rated negative outcomes of going camping much more likely than those who intended to camp. For example, those not intending to camp scored insect, unkempt or inadequate facilities and bad weather significantly more likely than those intending to camp.

In this study, four referents (family, friends, conservation groups and advertisement) were used in determining subjective norms regarding respondents' intentions to go camping. Those intending to camp were more likely than those not intending to camp to believe that these referents groups thought they should go camping. The most salient referents were family and friends compared to advertising and conservation groups. Those intending to camp also held slightly positive beliefs that all groups thought they should go camping, whereas those not intending to camp thought it unlikely that the referents thought they should camp.

Young and Kent (1985) concluded that the Theory of Reasoned Action can increase the understanding of the relationships among the determinants of recreation participation and may aid in predicting future behavior. They also feel that their study adds support to Heberlein (1973), who recommended using attitudes in attempts to understand recreation behavior. Finally, Young and Kent concluded that in some cases, the reference group plays a significant role in influencing intentions and thus recreation behavior. In this study, the beliefs of one's family were the most important in making a decision to camp.

Bright, Manfredo, Fishbein and Bath (1993) examined the Theory of Reasoned Action as a model of public attitude and behavioral intentions toward the National Park Service's controlled burn policy. More specifically, this study examined the Theory of Reasoned Action as a model which explains attitude and behavior change, and used the tenets of this theory to develop belief-targeted messages and to investigate their

effectiveness in changing the public's perception of a recreation or natural resource management policy.

This study involved a message development phase and a message administration and evaluation phase. Subjects for both phases were selected from visitors who entered Yellowstone National Park during September or October of 1989.

In the message development phase, initial measures of intention to support a controlled burn policy, the effect of referent others' opinions about supporting a controlled burn policy, the certainty of beliefs that the controlled burn policy would lead to various outcomes and an evaluation of these outcomes were obtained. These measures were obtained from a questionnaire which visitors filled out on-site. Additionally, specific salient beliefs which appeared to differentiate between positive and negative attitudes were identified. These salient beliefs were later used to develop belief-targeted messages designed to change these beliefs. The data collected from this on-site questionnaire were used to develop two messages: one intended to contradict beliefs held by visitors with positive attitudes toward supporting the controlled burn policy and one intended to contradict beliefs held by visitors with negative attitudes.

In the message administration and evaluation phase, belief-targeted messages were administered within one month of the on-site interview to subjects who agreed to receive a follow-up questionnaire. Subjects were divided into four groups. A positive treatment group which included subjects with a positive attitude were given a message emphasizing the negative aspect of the controlled burn policy. A positive control group were subjects having a positive attitude, and who did not receive any message. A negative treatment group included subjects with a negative attitude but who received a message emphasizing the positive aspect of the controlled burn policy. A negative control group were subjects having a negative attitude, and who did not receive any message.

Four hypotheses were tested in this study. The first, "the level of change in intention to support a control burn policy would be predicted by the level of change in attitudes and subjective norms" was generally supported. For the entire sample (all groups), changes in attitudes and subjective norms significantly predicted change in behavioral intentions ($R^2 = .78$). However, changes in attitude was a more significant predictor (standardized beta of .84, .76, .70, and .81 for the positive treatment, positive control, negative treatment and negative control groups respectively) of the change in behavioral intention than was the change in subjective norms (standardized beta of .10, .08, .14, and .17 for the positive treatment, positive control, negative treatment and negative control groups respectively).

The second hypothesis, that "changes in beliefs and evaluations of outcomes of a controlled burn policy were positively correlated with change in attitude toward supporting a controlled burn policy", was also supported (for entire sample, $r = .62$). Similar results were observed for the positive treatment, positive control and negative treatment groups ($r = .67, .51, \text{ and } .54$ respectively). However, the negative control group showed no significant correlation between the change in beliefs and evaluations and attitudes toward supporting a controlled burn policy ($r = .16$).

The results partially supported the third hypothesis that “beliefs targeted by the messages would show greater change in the direction intended by the message, for those groups who received belief-targeted messages than for the control groups”. A paired t-test of the belief component (measured on-site and one month later) indicated that the positive treatment group had a tendency to change and come to believe that a controlled burn policy was not appropriate (a belief targeted by the message). However, no similar findings were observed for the other groups.

Finally, the results also partially supported the fourth hypothesis that “changes in attitude, subjective norms and behavioral intentions regarding support of a controlled burn policy will be greatest for subjects receiving the belief-targeted messages and in the direction intended by the messages”. The positive treatment group showed a significantly lower positive attitude and subjective norm regarding support for the controlled burn policy, which led to a significantly lower intention to support this policy. The positive control group showed no significant changes in attitude and subjective norm from the on-site interview to the questionnaire filled out one month later. However, the attitude toward and subjective norms regarding a controlled burn policy and intention to support a controlled burn policy did not show any significant change for either of the negative groups. In addition, the negative control group’s attitude toward supporting a controlled burn policy and the intention to support such a policy were less negative than it was before.

From this study Bright et al. (1993) concluded that the Theory of Reasoned Action is a model which explains attitude and behavior changes in at least some recreational contexts. However, the results appeared to confirm the difficulty of predicting the effects of a belief-targeted message. Bright et al. (1993) also felt that a number of factors bear on the outcome of a communication strategy, including recipient characteristics such as prior knowledge and personal involvement. Perception of source of credibility may also have mediating effects on response to the content of the message (Bright et al., 1993).

Test of the Theory of Planned Behavior in Recreation Research

Ajzen and Driver (1992) believed that the Theory of Planned Behavior could be directly applied to understanding involvement in leisure-related activities. They conducted a study of college students at the University of Massachusetts, and measured attitudes, subjective norms, perceived behavioral control and intentions to engage in five outdoor recreation activities: spending time at the beach, jogging or running, mountain climbing, boating and biking. One year later the participants were asked to fill out a questionnaire indicating how often they had performed these activities.

The results of this study supported the Theory of Planned Behavior and showed how this theory can advance our understanding of the factors that determine performance of recreational activities (Ajzen & Driver, 1992). Attitudes towards a behavior, subjective norms and perceived behavioral control all contributed to prediction of intentions to engage in recreational activities (R = .50 to .86), with attitudes and subjective norms contributing significantly more than perceived behavioral control. In

addition, intentions and perceived behavioral control produced stronger multiple correlation with reported behavior ($R = .48$ to $.78$) than did the subjective norm.

This study also found that involvement in a recreation activity was correlated with attitudes, subjective norms, perceptions of behavioral control, intentions and reported behavior (correlations ranged from $.29$ to $.79$). Involvement took into account how much time participants devoted to obtain information about alternative sites for their leisure; how upset they would be if unable to engage in an activity; how often they read material about the activity; and what they thought their skill level was with respect to an activity. However, when involvement was used as a predictor in the hierarchical regression analysis, it did not make any significant contribution as a main effect or in interaction with attitude or intention. Ajzen and Driver (1992) suggested that involvement in a recreation activity may already be captured in the measure of attitude, subjective norm, and perceived behavioral control. It appears that highly involved individuals have a higher correlation between attitudes and behavior than those who are not so highly involved.

Norman and Smith (1995) applied the Theory of Planned Behavior to predict exercise behavior over a six-month period. Initially, open-ended questionnaires based on the procedures outlined by Ajzen and Fishbein (1980) were distributed to some respondents to elicit salient behavioral, normative, and control beliefs. Based on the responses received, a new questionnaire was prepared. This questionnaire attempted to measure prior behavior, desires and self-predictions, attitude, attitude variability, subjective norm, perceived behavioral control, behavioral beliefs, normative beliefs, control beliefs, demographic information and exercise behavior.

For prior behavior, respondents reported how frequently they had exercised beyond activities that formed part of their everyday life. For desires and self-prediction, respondents indicated their desire to take regular exercise and their self-prediction concerning exercise behavior. Attitude was obtained from a measure of their attitude towards taking regular exercise. Subjective norm was an indication whether important others thought they should or should not take regular exercise. To obtain a measure of perceived behavioral control, participants indicated how difficult or likely it was for them to exercise regularly or how much control they had over exercising regularly. To obtain behavioral beliefs, beliefs statements were evaluated and strength of beliefs noted. The product of the rating of beliefs and strength of beliefs were summed to produce an overall measure of behavioral beliefs. For normative beliefs, respondents reported the likelihood that each of four referents (members of family, friends, media and people that they knew exercised regularly) would think that they should take regular exercise and whether they were motivated to comply. The product of subjective norm and motivation to comply were summed to produce a measure of overall normative beliefs. For control beliefs, respondents indicated the extent to which a range of factors might prevent them from taking regular exercise. Finally, age and sex of respondents were the demographic information obtained.

The results from a second questionnaire distributed six months later indicated that, with the exception of the normative belief components, all variables from the Theory

of Planned Behavior plus prior exercise behavior correlated highly with future exercise behavior. This suggests that frequent exercisers at the time of the second questionnaire were more likely at the time of the first questionnaire to believe they would take regular exercise, to hold strong desire to take regular exercise, to have a positive attitude towards taking regular exercise, to believe that taking exercise would be under their control and lead to positive outcomes, to perceive few barriers to take exercise and to have exercised frequently in the past.

A hierarchical regression analysis was conducted on the data to assess the predictive value of the components of the Theory of Planned Behavior in more detail. Five blocks of variables were used: self-prediction and desires; attitude and subjective norm; perceived behavioral control; behavioral, normative and control beliefs; and prior exercise behavior, age and sex.

The results show that the self-prediction and desire measures, attitude and subjective norm, and perceived behavioral control components of the Theory of Planned Behavior were able to predict 38 % of the variance in exercise frequency. Prior behavior, when added to the regression equation made a significant contribution. As a result, the authors felt that prior behavior had a direct influence on future exercise behavior. Similar findings have prompted Bentler and Speckart (1979) to suggest that prior behavior be considered as an independent variable in the model. However, Ajzen (1987) has argued that prior behavior cannot be considered to be a causal factor in the same way as the other variables in the model, as it has no explanatory value. Ajzen (1988) also suggested that the addition of perceived behavioral control should allow for the mediation of the effects of prior behavior. However, this was not found to be the case in this study (Norman and Smith, 1995).

In summary, it appears that the Theories of Reasoned Action/Planned Behavior often have predictive validity in explaining the effects that changing beliefs about performing a behavior has on changing attitudes toward that behavior and subsequently, intentions to perform the behavior (Bright et al., 1993). Similarly, Ajzen and Driver (1992) have shown that leisure intentions and behaviors can be predicted with considerable accuracy from attitudes toward the behaviors, from subjective norms and from perceptions of behavioral control. Young and Kent (1985) concluded that the theories provide means for better understanding why some people participate in a recreation activity while others don't. They also concluded that these theories aid in illustrating the relationships among intentions, attitudes, beliefs, social group norms and recreation behavior. Bright et al. (1993) suggested that these theories may be used as tools to understand the relationship between belief change and attitude/behavior change. As already stated, Fishbein and Manfredo (1992) have suggested that these theories may allow resource managers to understand recreation-related behaviors and may provide insight on how to develop educational or other types of interventions which may be used to change or maintain these behaviors.

Study Hypotheses

Based on past research on the effectiveness of interpretation and the Theories of Reasoned Action and Planned Behavior, the following hypotheses guided this study regarding theft of petrified wood at Petrified Forest National Park.

H1: The more time visitors spend at interpretive centers and programs, the more negative will be their attitudes toward wood theft.

H2: The more park visitors participate in interpretive programs, the more negative will be their norms about individual acts of wood theft.

H3: Attitudes and norms about petrified wood theft will vary by type of interpretive programs judged most helpful in learning the park's story and in learning the park's rules and regulations.

H4: Rate of theft of petrified wood will be inversely related to the amount of interpretive programs participated in and will vary by type of interpretation judged most helpful.

H5: Attitudes and norms about petrified wood theft will shape theft behavior.

Chapter Four Method

Study Area

This study was part of a larger effort to study the characteristics and behavior of PFNP visitors. Data were collected during the summer months of 1993. Wood theft behavior was observed and efforts were made to describe thieves in term of socio-demographic and other characteristics at only two sites, Crystal Forest and Long Logs. Crystal Forest and Long Logs were selected as observation areas for the following reasons:

- (1) These sites contain a reasonable supply of petrified wood on the ground.
- (2) These are two of the more popular sites visited at PFNP and it appears that the majority of petrified wood theft occurs on these same sites.
- (3) Finally, the layout and location of these sites allowed research technicians to observe and survey thieves and non-thieves more easily than at other sites.

Crystal Forest

Crystal Forest is located just off the main park road, about 17 miles from the northentrance station and 10 miles from the south entrance station (**Figure 3**). A paved loop trail, 0.8 mile long, provides access for visitors to walk through the site. Petrified wood of various shapes and sizes is found within this site. Near the parking lot, much wood has already been removed, but away from that entrance area wood is abundant. A sign is located near the trailhead of this site with an anti-theft message that says “removal of petrified wood is prohibited”. In addition, visitors may encounter an occasional ranger.

Long Logs

Long Logs is located off a short spur road from the main road, about 24 miles from the north entrance station and 3 miles from the south entrance station (**Figure 3**). Long Logs is very similar to Crystal Forest, except that it has more trails and more pieces of petrified wood located near these trails and the parking lot. Two trailheads are located at the parking lot. One is the starting point for the Long Logs loop trail and the Agate House spur trail. The other trailhead is the end point of the Long Logs loop trail. These two trails are paved, but numerous informal trails cut across sections of these paved trails through areas with high concentration of small pieces of petrified wood. At the Long Logs site, visitors can see a display case located near the trailhead with information on special events or occurrences, a warning of possible prosecution for collecting petrified wood, and appeals to preserve the park’s resource. Visitors may also meet an occasional ranger on-site.

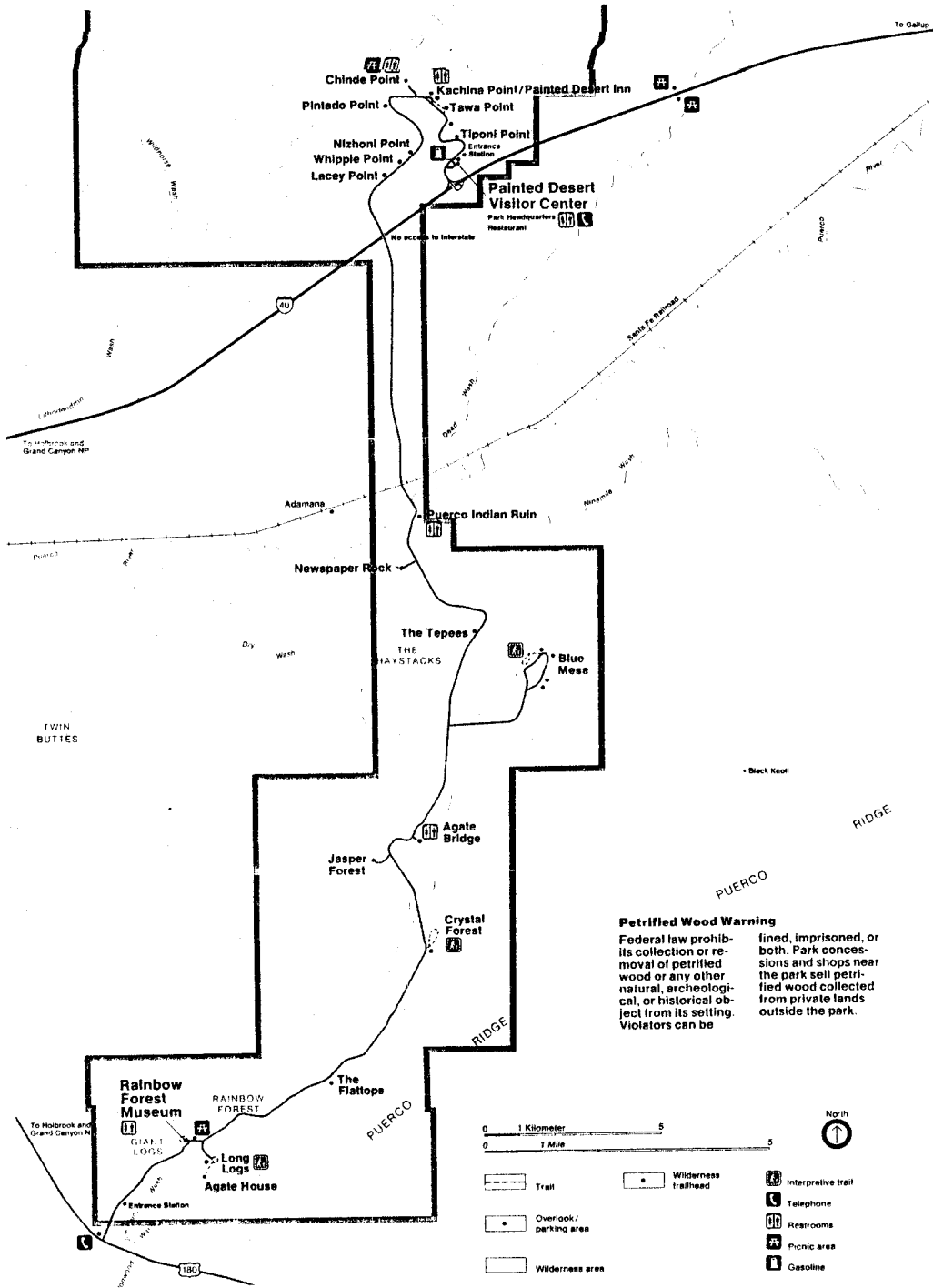


Figure 3
 Map of Petrified Forest National Park

Study Design

The study design involved a general survey of PFNP visitors as the main study population, and observation of subsets of thieves and non-thieves on site.

Population sample

A random sample of visitors was drawn from the total population of park visitors using a stratified clustering scheme. The sampling period, May 1, 1993 to August 31, 1993, was partitioned by month to yield four strata. These four strata were then divided by time of day: morning, (9.00 am to 12.00 pm), midday (12.30 pm to 3.30 pm), and evening (4.00 pm to 7.00 pm). Visitors were sampled at the two (north and south) exits to the park. This resulted in six sampling blocks per month. Budgetary constraints permitted us to sample each block only once per month. We thus attempted to complete a total of 72 hours of sampling (4 months \times 6 sampling blocks per month \times 3 hours per sampling block = 72 hours). The sampling blocks were randomly selected.

A systematic sampling interval was used to select vehicles and individuals in the vehicles within each of the sampling blocks (Knoke and Bohrnstedt, 1994). Using a standard confidence interval formula (Hays, 1988), it was determined that 100 responses per month were needed to obtain the desired degree of precision. This suggests that 400 responses would be needed, and because it was anticipated that the response rate would be about 80%, 500 individuals were selected as the desired sample size.

To determine the systematic sampling interval among cars and individuals leaving the park, the following procedures were carried out:

- (1) On the basis of past years' use, the number of vehicles exiting the park at the north and south exits for the months of May through August was estimated to be 124,828.
- (2) The combined total number of possible sampling hours for the north and south exits for the study period was 3,014.
- (3) The percentage of total time sampled at either the north or south exits points was determined to be 2.4% ($72 \div 3014$).
- (4) On the basis of the past use estimates, the number of vehicles exiting the park during the sampling blocks was determined to be 2,982 ($124,828 \times 2.4\%$).
- (5) The systematic sampling interval was determined to be 6 vehicles ($2,982 \div 500$).

These calculations determined that every 6th vehicle would be sampled. However, this was found impractical during peak periods, given the limited research staff available. Lines of cars waiting to be interviewed became too long. As a result, we doubled the number of sampling blocks covered and changed our sampling interval to 12. This interval was applied during the months of May and June. After this time, we realized that this sampling interval of 12 would not result in the desired sample size, so it was reduced to 9 for the months of July and August.

The first vehicle to be stopped for a specific sampling block was selected at random from among the first 12 or 9 cars, and then every 12th or 9th vehicle was stopped after that. A random start number was used to determine who would be interviewed first. If this number was odd, the driver of the first vehicle was interviewed, and if it was even,

the passenger in the front seat was interviewed. After the first person to be interviewed was selected, interviews subsequently alternated between driver and front seat passenger.

Observed samples

Park visitors were observed both at the Crystal Forest and Long Log petrified wood sites at PFPNP. One sub-population of these visitors consisted of those observed removing petrified wood. The other was visitors who were followed and observed not to remove petrified wood from the sites. Observation times were varied to sample all park operating hours. Observation times at Crystal Forest and Long Logs did not overlap with the sampling times of the larger park population study.

At Long Logs, thirty time blocks were randomly assigned to days and times from May 17, 1993 to June 17, 1993. Typically, two time blocks of three hours each separated by an hour were scheduled each day. A total of 90 hours of sampling were undertaken. At Crystal Forest, eight time blocks, each four hours long, were randomly assigned to days and times from June 13, 1993 to July 2, 1993. Only one time block was scheduled for each day. A total of 32 hours of sampling was undertaken.

During each observation time block, an attempt was made to identify and record every theft that occurred. All visitors observed removing petrified wood were included in the “thief” sample. The “non-thief” sample was obtained by observing the behavior of one randomly selected visitor per hour. If this person did not take petrified wood during his/her visit on site, he/she was labeled a “non-thief”. If this individual was observed removing wood, he/she was included in the “thief” sample.

Observation techniques

At Long Logs, there were two observers, one out of sight of visitors and the other posing as a park visitor. They used a two-way radio to communicate with each other. The observers recorded such information as gender and apparent age; physical description including type of clothing; time of day; number of people on site and number of people in the thief’s party; and vehicle model, type, make, color and tags for tracking purposes. This information was collected for each study subject, either thief or non-thief. A hidden and unmanned video camera was placed at the trailhead and used to estimate the amount of use and length of stay while observation was going on.

At Crystal Forest, only one observer posed as a park visitor and recorded information similar to that obtained at Long Logs. All observers tried to be as discreet as possible. They dressed as tourists, took pictures, looked through binoculars, read signs, and bent over to look at petrified wood while looking for possible theft.

Those park visitors observed at Crystal Forest and Long Logs (thieves and non-thieves) were described to the research assistants posted at the north and south entrances/exits by means of a two-way radio or cellular phone. None of the research assistants or park rangers at the entrances/exits were told whether the targeted person was a “thief” or “non-thief”. By not knowing who were thieves and non-thieves, it was expected that the research assistants would conduct the interviews in an unbiased manner. The research assistants simply asked the park ranger at the exit station to request the

targeted visitor to participate in the same post-visit interview and the mailback questionnaire completed by the general park visitors. The description of the thieves and non-thieves given by the on-site observers through their radio and telephone contact allowed the research assistants to select the right person in the car.

Data Collection Methods/Instruments

Post-visit interviews were conducted at the exit stations, and mailback questionnaires were given to study participants. The thief and non-thief sub-populations were also interviewed at exit stations (Appendix A) and handed mailback questionnaires (Appendix B).

Post-visit contact

The on-site post-visit interview forms were designed to find out length of stay; travel patterns; amount of time spent at visitor centers and other interpretive sites, gift shops, and petrified wood sites; group size; vehicle type; and home address.

Visitors were contacted during sampling hours at the entrances/exits station initially by a National Park Service (NPS) employee. The NPS employee asked the visitor if he/she was willing to participate in a study conducted by Virginia Tech for the Park Service. Visitors who agreed were then directed to pull their car over to a roadside interview station. The Virginia Tech research technicians would select the person from the vehicle based on the sampling scheme outlined above or by identifying the tagged thieves and non-thieves from coded messages.

Questionnaire

In addition to the on-site interviews, research assistants handed out a survey package containing a cover letter, a questionnaire and a postage-paid return envelope to the general park visitor sample and to the observed thieves and non-thieves. In addition, names and addresses were collected so follow-up reminders could be mailed to increase the response rates.

The mailback questionnaire (Appendix B) was designed to collect the following data:

- (1) amount of time spent at certain sites at the park;
- (2) how information about the park's story and its rules and regulations was obtained before arriving at the park and while at the park;
- (3) assessment of the most helpful park interpretation in learning the park's story and rules and regulations;
- (4) beliefs about the severity of petrified wood theft;
- (5) attitudes about theft of petrified wood and other appropriate behaviors in the park;
- (6) personal norms about the seriousness of individual acts of petrified wood theft;
- (7) reasons for not taking petrified wood;
- (8) attitudes about national parks and collecting vacation souvenirs;

(9) preferences for certain management actions to reduce damage and removal of park resources;

(10) Socio-demographic characteristic such as age, income, education, ethnic background and employment.

Three follow-up reminders were sent to participants based upon a procedure adapted from Dillman (1978). The first was a postcard reminder mailed approximately one week after the initial contact. The second follow-up reminder included another cover letter, a questionnaire and a postage-paid return envelope and was mailed about three weeks after the initial contact. The final follow-up reminder (a postcard) was mailed about four weeks after the initial contact. Both the park visitor sample and the observed sample received the same follow-up procedure, except the observed sample was sent a personalized cover letter rather than the standard cover letter in the second follow-up mailing.

Observation coding forms

A thief observation form was used to document petrified wood theft. Information recorded included selected socio-demographic characteristics of the thief (gender, age, and race), the thief's behavior (what he/she was doing, number of pieces of wood taken, where the pieces of wood were placed and how thieves acted before and after the theft), situational variables (number of people on site, location of theft, distance from other groups, and the observer), and identification information of the thief such as clothing and his/her vehicle (color, type, size, plates, number of passengers and features) for tracking him/her for the post-visit contact.

Another observation coding form was used to document the non-thieves. This form was similar to the one used for thieves except it did not include any theft information such as the thief's behavior and the situational variables mentioned above.

Participation and Response Rate

Of the 603 visitors asked by the Park Service rangers to participate in the general park survey, 456 (75.6%) agreed to be interviewed and were given a questionnaire. From these 456 who received a questionnaire, 365 (80%) returned them completed.

A total of 226 park visitors were observed, of whom 125 were thieves and 101 non-thieves. From the 226 observed, 145 agreed to be interviewed (77 thieves and 68 non-thieves). The remaining 81 visitors from the observed sample were not interviewed. Of these, 34 were not seen by the research assistants at the two exit/entrance stations, 30 slipped through the stations without being contacted, 16 refused to participate in the study, and 1 was intercepted by a park law enforcement officer before reaching the exit station. Of the 145 visitors who agreed to be interviewed, 115 (61 thieves and 54 non-thieves) returned the completed questionnaires, giving an 80% response rate. Nine of the "thieves" who filled out the mailback questionnaire were not the same individuals that were given the questionnaire at the exit station. For example, other family members filled out the questionnaire. This reduced our thief sample to 52.

Data Analysis Procedures

SPSS 6.1 was the statistical analysis package used to analyze the data. Means, modes, medians, and frequencies for many of the variables were obtained. In addition, Pearson's correlations, ANOVAs with Duncan's post hoc tests, t-tests, chi-square tests, and logistic regression analysis were conducted to address the research questions.

To address Hypothesis 1 "the more time visitors spent at interpretive centers and programs, the more negative will be their attitudes toward wood theft", we constructed various indexes to approximate time spent at interpretive programs. We created the new variables "**visitsum**" by adding items 1 and 13 of question # 1 on the contact sheet (Appendix A), and "**visittot**" by adding items 1, 8, 11, 12, 13, and 14 also from question # 1 of the contact sheet. **Visitsum** is a measure of the amount of time spent at the Park's two visitor centers, Painted Desert and Rainbow Forest Museum. We felt that these two sites offered visitors the most information about wood theft, and were thus the most ideal situation to test this hypothesis. Similarly, **visittot** is a measure of the amount of time spent at Painted Desert Visitor Center, Blue Mesa Nature Trail, Crystal Forest, Long Logs, Rainbow Forest Museum, and Giant Logs Trail. We felt that these sites would include all the relevant interpretive centers and programs.

From the mailback questionnaire (Appendix B) we also looked at question 5a which indicates the different sources which visitors may have used to learn about the park's story and question 6a which indicates different sources used to learn about the park's rules and regulations. Two more new variables were formed. The first, **infosum**, was created by totaling the number of programs circled in question 5a and is a measure of the total number of programs visitors used to learn the parks' story. The second, **rulesum**, was formed by counting the number of items circled in question 6a, and is a measure of the total number of sources that helped visitors to learn about the park's rules and regulations.

To measure attitudes about petrified wood theft, we selected the mailback questionnaire items Q13D, Q13F, Q13L and Q13N from question 13 (Appendix B). These items all focused on attitudes toward disturbing or taking petrified wood from the park and were answered with a five-point Likert type scale. Pearson's correlations were performed between each of these four items of question # 13 and the new variables: **infosum**, **rulesum**, **visitsum** and **visittot**. From these correlations we expected to determine the strength of the linear relationship between each pair of variables. From the strength of these relationships, we expected to determine if time spent at interpretive centers and programs was related to attitude toward wood theft.

To address Hypothesis 2, that "the more park visitors participate in interpretive programs, the more negative will be their norms about individual acts of wood theft" we selected items Q14E and Q14I of the mailback questionnaire (Appendix B). These two items measured visitors' norms about taking a small piece or a handful of petrified wood from the park. Pearson's correlation coefficients were computed to determine the relationship between the following variables; **infosum**, **rulesum**, **visitsum**, **visittot**, Q14E and Q14I. These correlation coefficients indicate the strength of any relationship among pairs of these variables.

To address Hypothesis 3, that “attitudes and norms about petrified wood theft vary by type of interpretive programs judged most helpful in learning the park’s rules and regulations”, we first looked at question 5b (the source of information judged most helpful in learning the park’s story), and 6b (the source of information most helpful in learning the park’s rules and regulations). We classified the responses to 5b and 6b into four categories. Item 12 became category 1 (entrance station information), items 3, 4, or 5 became category 2 (all visitor centers), items 6, 7 or 8 became category 3 (all ranger programs), and items 1, 2, 9, 10, or 11 became category 4 (other national park programs). For question 5b, the new variable formed by this categorization was labeled **program**, and for 6b the new variable was called **imprule**. ANOVAs were then performed to test for a significant relationship between the four categories of questions 5b and 6b and the two norms (Q14 E and Q14 I) and the five attitudes (Q13D, Q13F, Q13 L, Q13 N and an index attitude variable called **reattitu**) variables, followed by Duncan’s post hoc tests.

The index attitude variable, **reattitu**, was formed by adding across the four attitude variables mentioned above. We reversed the scoring for Q13L and Q13N before summing, because they suggested attitudes in favor of wood theft. The resultant index therefore had a possible range of 4 to 20. The ANOVAs allowed us to compare the means and variances of the different groups (four categories of 5b and 6b) on the attitude and norm variables, and also to find any significant differences among the means. If any significant differences were observed, then the Duncan’s post hoc tests performed would indicate which groups were different.

To address Research Hypothesis # 4, that “rate of theft of petrified wood will be inversely related to the amount of interpretive programs participated in and will vary by type of interpretation judged most helpful”, we looked at the thieves and non-thieves samples. T-tests were performed for the thieves and non-thieves on our interval or interval-like data, i.e., *visitsum*, *visittot*, *infosum*, and *rulesum*. In addition, chi-square tests were performed to test the relationships between the type of program judged most helpful (program and *imprule*) and being a thief or non-thief. The significance level of the chi-square tests would indicate whether we accept or reject the hypothesis that thieves and non-thieves have attended different types of interpretive programs.

To address hypothesis 5, “attitudes and norms about petrified wood theft will shape theft behavior”, we used our attitude index, *reattitu*, and constructed a new normative variables, Q14E (how serious a problem respondents felt it is to take one small piece of petrified wood from the park) and Q14I (how serious a problem respondents felt it is to take a handful of petrified wood from the park). We did this for the thief and non-thief samples. We then performed a logistic regression analysis for the thief and non-thief by regressing the index variables, *reattitu* and *normtot*, onto the thief variable. We used logistic index variable called **normtot**. *Normtot* was formed by adding across our two norm regression analysis because our dependent variable (thief) is categorical and has only two values (thief and non-thief). The logistic regression allowed us to do two things. First, it allowed us to determine if any significant relationships exist between the independent variables (*reattitu* and *normtot*) and the dependent variable (thief). Second,

this analysis allowed us to compare our success at predicting the category of our dependent variable (i.e., thief or non-thief) with the actual observed classification.

Chapter Five Results

H1: The more time visitors spend at interpretive centers and programs, the more negative will be their attitudes toward wood theft.

To test this research hypothesis (**H1**), we first performed descriptive statistical analysis to understand the distribution of key variables. We first looked at percent of participants who participated in various interpretive programs on sites, and among those who did, how long they spent there (Table 2).

We then conducted a frequency distribution for questions 5a (sources from which visitors learn about the park's story) and 6a (sources from which visitors learn about the park's rules and regulations) from the mailback questionnaire to determine how many different programs or sites respondents visited (Table 3 and 4). We included these variables (5a and 6a) as additional measures of time spent because they included visitor centers, ranger programs, self-guided trails and films and slide shows, all of which require visitors to utilize some time. We also completed a frequency distribution on two new variables formed: infosum and rulesum (Table 5). Infosum was formed by adding across all programs circled in question 5a and is a measure of the total number of programs visitors used to learn the park's story. Rulesum was formed by adding across all items circled in question 6a and is a measure of the total number of sources that helped visitors to learn about the park's rules and regulations. Finally, we obtained a frequency distribution on the four attitude variables (Q13D, Q13F, Q13L, and Q13N) to observe how respondents felt about wood theft (Table 6).

Table 2 indicates that the Painted Desert Visitor Center, Agate Bridge, Newspaper Rock, and Rainbow Forest Museum were the most commonly visited sites. In contrast, fewer visitors went to Blue Mesa Nature Trail, Blue Mesa Scenic Loop or Giant Logs. Blue Mesa Nature Trail was the least visited site, but on average more time was spent there per visit. From Table 2 the coefficient of variance indicates how much the time spent by each visitor varies from each other and from the mean. For example, on average, visitors spent little time on Blue Mesa Scenic Loop but its large coefficient of variance suggests that the time spent by each visitor varies considerably. In contrast, the coefficient of variance for the other sites was not as large as that of the Blue Mesa Scenic Loop, which suggest that the time spent at these sites do not vary as much. We are hypothesizing that any variation in time spent at interpretive sites will relate to variation in visitor attitudes about petrified wood protection.

Table 2. Number and percent of park visitor sample that visited interpretive sites and their average length of stay.

<u>Sites</u>	<u>N</u>	<u>Percent</u> <u>visiting</u>	<u>Mean time</u> <u>spent (in</u> <u>minutes)</u>	<u>Standard</u> <u>deviation</u>	<u>Coefficient</u> <u>of variance</u>
Painted Desert Visitor Center	286	62.7	20.5	11.9	.58
Puerco Indian Ruin	218	47.8	15.2	8.7	.57
Newspaper Rock	249	54.6	10.0	5.7	.57
Blue Mesa Scenic Loop	180	39.5	8.4	11.6	1.38
Blue Mesa Nature Trail	61	13.4	32.3	21.4	.66
Agate Bridge	271	59.4	10.1	5.1	.50
Jasper Forest	222	47.8	10.9	7.5	.69
Crystal Forest	236	51.8	16.9	12.5	.74
Long Logs	194	42.5	18.1	11.3	.62
Rainbow Forest Museum	243	53.3	20.1	11.0	.54
Giant Logs	183	40.1	19.8	11.5	.58

Table 3 indicates that 67.1% of visitors sampled learned the park’s story from the park brochure and map, followed by 44.9% for self-guided walks and 44.2% for the Painted Desert Visitor Center. In contrast, only 14.4% learned from rangers at points of interest, 11.9% from ranger talks and only 1.5% from ranger led walks.

Approximately 57% indicated the park’s official brochure with its map was helpful in learning the park’s rules and regulations. About 36% reported the entrance station and 24% the Painted Desert Visitor Center as helpful. However, only 0.4% indicated ranger led walks, 7.1% rangers at points of interest and 13.3% ranger talks as sources that helped them to learn about the park’s rules and regulations (Table 4).

These figures suggest that a large proportion of our sample used the brochure and map to learn about the park’s story and the park’s rules and regulations. Interpretive signs, the Painted Desert Visitor Center and self-guided walks ranked quite high but not as high as the brochure and map. However, only a small percentage of our sample indicated ranger contacts and programs as being helpful in learning the park’s story and the park’s rules and regulations. This is likely the case because there were not many ranger contacts, and not because the contacts with rangers were not helpful.

Table 3. Frequency distribution for the number of park visitors who said various programs helped them to learn the park’s story.

Programs	N	Percent
Brochure and map	322	67.1
Self-guided walks	206	44.9
Painted Desert Visitor Center	212	44.2
Entrance station	168	35.0
Interpretive signs	165	34.4
Rainbow Forest Museum	135	28.1
Newspaper	110	22.9
Films and slide shows	76	15.8
Painter desert inn	74	15.4
Rangers at points of interest	69	14.4
Ranger talks	57	11.9
Other	33	6.9
Ranger led walks	7	1.5

Table 4. Frequency distribution for the number of park visitors who said various programs helped them to learn the park’s rules and regulations .

Program	N	Percent
Brochure and map	274	57.1
Entrance station	173	36.0
Painted Desert Visitor Center	114	23.8
Interpretive signs	113	23.5
Newspaper	75	15.6
Self-guided walks	67	14.0
Ranger talks	64	13.3
Rainbow Forest Museum	60	12.5
Films and slide shows	36	7.5
Rangers at points of interest	34	7.1
Painted Desert inn	25	5.2
Other	19	4.0
Ranger led walks	2	0.4

Table 5 indicates the frequency with which visitors indicated between zero and eleven sources used to learn the park’s story (infosum) and the park’s rules and regulations (rulesum). Visitors commonly used between three and five sources to learn the park’s story and between two and three sources to learn the park’s rules and regulations. Approximately 92% of our sample indicated five or fewer sources used in

learning the park’s rules and regulations, whereas 69% indicated five or fewer sources used in learning the park’s story.

Table 5. Frequency distribution of park visitors’ ratings of rulesum (number of sources helpful in learning the park’s rules and regulations) and infosum (number of sources helpful in learning the park’s story).

<u>Number of sources used</u>	<u>INFOSUM</u>		<u>RULESUM</u>	
	<u>N</u>	<u>Percent</u>	<u>N</u>	<u>Percent</u>
0	2	0.5	6	1.6
1	23	6.3	66	18.1
2	45	12.4	105	28.8
3	54	14.8	82	22.5
4	79	21.7	49	13.5
5	48	13.2	28	7.7
6	47	12.9	12	3.3
7	34	9.3	9	2.5
8	10	2.7	3	0.8
9	17	4.7	2	0.5
10	5	1.4	1	0.3
11	0	0.0	1	0.3

The results of the frequency distributions of attitude items (Table 6) suggest that approximately 51% of the visitors sampled agreed or strongly agreed that it is wrong to pick up petrified wood, even if you put it back where you found it (Q13D). Approximately 97% agreed or strongly agreed that taking petrified wood reduces the beauty of the park (Q13F). About 62% disagreed or strongly disagreed that it is all right to pick up a piece of petrified wood as long as you leave it in the park (Q13L). Similarly, about 90% disagreed or strongly disagreed that it is all right to pick up a piece of wood in the park as long as it is a small piece (Q13N). This results suggest that in general, visitors hold strong attitudes in support of protecting petrified wood.

An index attitude variable, reattitu, was formed by adding across the four attitude variables mentioned above. We reversed the scoring for Q13L and Q13N before summing across them because they suggested attitudes in favor of wood theft.

Table 6. Frequency distribution on visitor attitude variables.

Attitude items	Value Label	N	Percent
Q13D	Strongly disagree and disagree	108	30.7
	Neutral	65	18.5
	Agree and strongly agree	179	50.8
Q13F	Strongly disagree and disagree	5	1.4
	Neutral	5	1.4
	Agree and strongly agree	342	97.2
Q13L	Strongly disagree and disagree	219	62.2
	Neutral	52	14.8
	Agree and strongly agree	81	23.0
Q13N	Strongly disagree and disagree	316	89.7
	Neutral	7	2.0
	Agree and strongly agree	29	8.2

Q13D: It is wrong to pick up petrified wood, even if you put it back where you found it.

Q13F: Taking petrified wood reduces the beauty of the park.

Q13L: It is all right to pick up petrified wood as long as you leave it in the park.

Q13N: It is all right to take a piece of petrified wood as long as it is a small piece.

No significant relationships were observed between any time spent at interpretive sites and attitudes about wood theft (Table 7). Thus, our results do not support the first hypothesis (**H1**), and we conclude that visitors who apparently spend more time at interpretive centers and programs do not have more negative attitudes toward wood theft.

A new variable, **visitsum**, was created by adding time spent at the two visitor centers (Painted Desert and Rainbow Forest Museum). **Visittot** was created by adding time spent at the two visitor centers and the four interpretive trails (items 1, 8, 11, 12, 13 and 14, see Appendix A).

Table 7: Pearson’s correlation to test for relationships between time spent at interpretive programs and number of sources helpful in learning the park’s story and the rules and regulations and attitudes toward wood theft.

	<u>infosum</u>	<u>rulesum</u>	<u>visittot</u>	<u>visitsum</u>
Q13D	-.042	.026	-.025	.004
Q13F	.047	.087	-.004	.038
Q13L	.030	-.036	.002	.010
Q13N	-.049	.030	.066	.009
reattitu	-.001	.042	-.039	.000

None significant at $p = .05$

Infosum: Total number of programs used to learn the park’s story.

Rulesum: Total number of sources used to learn the park’s rules and regulations.

Visittot: Total amount of time spent at the two visitor centers and the four interpretive trails.

Visitsum: Total amount of time spent at the two visitor centers.

H2: The more park visitors participate in interpretive programs, the more negative will be their norms about individual acts of wood theft.

This research hypothesis (**H2**) was tested by performing Pearson’s correlation analyses on the four participation variables already described (infosum, rulesum, visitsum, visittot) and the two norm variables (Q14E and Q14I). Table 8 provides a summary of how serious a problem respondents felt that taking one small piece of petrified wood was and how serious was taking a handful of wood. On a scale of zero (not a problem) to one hundred (an extremely serious problem) respondents scored an average of 77.2 for taking a small piece of wood and 86.3 for taking a handful of wood. These scores suggest on average that park visitors see these actions as serious violations of norms. The Pearson’s correlation coefficients between participation in interpretive programs and strength of norms are shown in Table 9. These coefficients did not indicate any significant relationships. Therefore, we conclude that the park visitors who apparently participate more in interpretive programs do not have more negative norms about individual acts of wood theft.

Table 8. Respondents’ norms about the seriousness of taking petrified wood from the park.

<u>Norms against</u>	<u>N</u>	<u>Means</u>	<u>Standard deviation</u>
Taking a small piece of wood	345	77.2	24.14
Taking a handful of wood	342	86.3	20.37

Scores could range from 0 to 100, (0 = not a problem and 100 = an extremely serious problem).

Table 9. Pearson’s correlation to test for relationships between time spent at interpretive programs and number of sources helpful in learning the park’s story and rules and regulations and the norms about taking petrified wood.

<u>Norms against</u>	<u>Infosum</u>	<u>Rulesum</u>	<u>Visittot</u>	<u>Visitsum</u>
Taking a small piece of wood	.067	.064	-.021	.008
Taking a handful of wood	.055	.002	-.065	-.072

None significant at $p = .05$

H3: Attitudes and norms about petrified wood theft will vary by type of interpretive programs judged most helpful in learning the park’s story and in learning the park’s rules and regulations.

This research hypothesis (**H3**) was tested by performing fourteen one-way ANOVAs between questions Q5b (program) and Q6b (imprule) (Appendix B) and each of the two norms (Q14E and Q14I) and the five attitude variables (Q13D, Q13F, Q13L, Q13N and the index attitude variable called reattitu), followed when appropriate by Duncan’s Post Hoc tests. We have already described the two normative and five attitudinal variables.

For Q5b, respondents were asked to indicate the one source from Q5a that was most helpful in learning the park’s story. Similarly for Q6b, visitors were asked to indicate the one source most helpful in learning the park’s rules and regulations listed in Q6a (Appendix B). We classified the twelve informational sources listed in Questions 5b and 6b into four categories based on the nature of the source. Item 12 became category 1 (entrance station information); items 3, 4, or 5 became category 2 (all visitor centers);

items 6, 7 or 8 became category 3 (all ranger programs), and items 1, 2, 9, 10, or 11 became category 4 (other national parks programs). For question 5b, the new variable formed by this categorization was labeled **program** and for 6b the new variable was called **imprule**.

Our first set of ANOVAs allowed us to determine if any relationships existed between the sources most helpful in learning the park’s story (program) and attitude and norms about petrified wood theft. The results indicated that there were no relationships between the four classes of interpretive sources judged most helpful and the two norm variables (Table 10). However, there were significant relationships between types of interpretive programs judged most helpful and one of the five attitude variables tested.

A Duncan’s post hoc test (Table 11) confirmed a difference between group 4 (other national park programs as source most helpful) and group 3 (all ranger programs as the source most helpful) for the attitude variable, “it is all right to take a piece of petrified wood as long as it is a small piece” (Q13N). Ranger programs (group 3) with a mean score of 1.87 measured significantly higher than national park programs (group 4) with a mean score of 1.49. This suggests that respondents who indicated that national park programs were the most helpful, tend to disagree more strongly that it is all right to take a piece of petrified wood from the park as long as it is a small piece than those respondents who indicated ranger programs.

As a result, we cannot fully accept our hypothesis (**H3**) because only one analysis out of seven tests run showed a significant difference. However, we could conclude that the attitude variable (it is all right to take a piece of petrified wood from the park as long as it is a small piece) apparently does vary for two categories of interpretive programs (other national park programs and all ranger programs).

Table 10. One-Way Analysis of Variance to test for the relationship between the sources most helpful in learning the park’s story (program) and the attitude (Q13F and Q13 N) variables.

attitude		sum of squares	df	mean squares	F-ratio	F-prob
Q13F	between groups	1.720	3	.573	1.750	.157
	within groups	95.984	293	.328		
Q13N	between groups	5.647	3	1.882	2.117	.098
	within groups	260.582	293	.889		

Q13F: Taking petrified wood reduces the beauty of the park.

Q13N: It is all right to take a piece of petrified wood from the park as long as it is a small piece.

Table 11. Duncan’s post hoc test to test for significant differences on the attitude that it is all right to take a piece of petrified wood from the park as long as it is a small piece among four types of interpretive programs judged most helpful in learning the park’s story.

=====

	Mean	Grp 4	Grp 1	Grp 2	Grp 3
Classes of Interpretive program					
Grp 4 national park programs	1.49				
Grp 1 entrance station	1.53				
Grp 2 visitor centers	1.69				
Grp 3 ranger programs	1.87	*			

(*) indicates significant differences (p=.05)
 For attitude measure, 1 = strongly disagree and 5 = strongly agree

Our second set of ANOVAs allowed us to test if any relationships existed between the sources most helpful in learning the park’s rules and regulations and attitudes and norms about petrified wood theft. The results of our tests indicated that there were no relationships between any of the four categories of Q6b (imprule) and the five attitude variables (Table 12). However, there was one significant relationship between type of interpretive programs judged most helpful and norms. The Duncan’s post hoc test confirmed a significant difference between group 2 (visitor center as source most helpful) and group 4 (other national park program as most helpful source) for taking a handful of wood (Table 13). The visitor centers category (group 2), with a mean seriousness score of 92.5, measured significantly higher than other national park programs (group 4) with a mean score of 84.2. As a result, we cannot fully accept our hypothesis (**H3**) because only one significant difference out of seven tests was found. However, we could conclude that the norm about taking a handful of wood does vary between two categories of interpretive programs judged most helpful (visitor centers and other national parks programs).

Table 12 One-Way Analysis of Variance to test for the relationship between the sources most helpful in learning the park's rules and regulations (imprule) and the norm against taking a handful of wood.

<u>Norms</u>		<u>sum of squares</u>	<u>df</u>	<u>mean squares</u>	<u>F-ratio</u>	<u>F-prob</u>
Taking a handful of wood	between groups	2442.892	3	814.297	2.147	.094
	within groups	116034.6	306	379.198		

Table 13. Duncan's post hoc test to test for significant differences between the mean scores on the norm against taking a handful of wood among the four classes of interpretive programs most helpful for learning the park's rules and regulations (imprule).

	Mean	Grp 4	Grp 3	Grp 1	Grp 2
Imprule					
Grp 4 national park programs	84.15				
Grp 3 ranger programs	87.63				
Grp 1 Entrance station	88.34				
Grp 2 visitor centers	92.47	*			

(*) indicates significant differences (p=.05)

Norm scores could range from 0 (not a problem) to 100 (extremely serious problem)

H4: Rate of theft of petrified wood will be inversely related to the amount of interpretive programs participated in and will vary by type of interpretation judged most helpful.

This research hypothesis (**H4**) was tested in several ways. First, t-tests were run to compare thieves and non-thieves on the number of programs visitors used to learn about the park's story (infosum), the number of programs visitors used to learn about the park's rules and regulations (rulesum), the amount of time visitors spent at the two visitor centers plus the four interpretive trails (visittot), and the amount of time visitors spent at the two visitor centers (visitsum). Crosstabulation and chi-square analyses were also performed to test for any relationships between the type of program judged most helpful for learning the park's story and learning the park's rules and regulations and

whether the respondent was a thief or non-thief. However, both our chi-square tests have more than 20% of the cells with expected values less than 5. This suggests that caution be taken in interpreting our study results.

These independent-sample t-tests found that the 52 thieves did not differ from the 54 non-thieves on any of the four tests of involvement with interpretive sites and programs. The results of the crosstabulation and chi-square analyses indicated there were no differences between thieves and non-thieves and the type of programs judged most helpful in learning the park’s story and the park’s rules and regulations. The p-values obtained from these chi-square analyses are greater than .05 which suggest that the observed and expected values do not differ significantly. Therefore, on the basis of our t-tests and our chi-square analyses, we reject our hypothesis (**H4**) and conclude the number of interpretive programs participated in, the amount of time spent at interpretive site, and the type of interpretation judged most helpful apparently do not influence whether a respondent is a thief or non-thief.

H 5: Attitudes and norms about petrified wood theft will shape theft behavior.

The logistic regression analysis indicated that there was a significant relationship between attitude (reattitu) and thief and non-thief variable (Table 14). This suggests that knowing respondents’ attitudes toward wood theft can help predict whether respondents were thieves or non-thieves. However, no significant relationship was found for the norm variable (normtot) and thieves and non-thieves. In addition, our results suggest that with our model we could predict non-thieves correctly approximately 80% of the time and thieves approximately 42% of the time (Table 15). Thus, knowing the attitudes of our respondents, we could more accurately predict who would be a non-thief. However, knowing the attitudes did not help us to predict who would be thieves, because we could expect 50% accuracy in our predictions with no attitude information. This general failure to predict thieves from attitude and norms give us little support for hypothesis 5.

Table 14: Logistic regression analysis to indicate significant relationships between the attitude (reattitu) and norm (normtot) variables and thief variable (thieves an non-thieves).

Variable	B	S.E.	Wald	df	Sig	R	Exp(B)
Reattitu	-.3026	.1388	4.7495	1	.0293	-.1456	.7389
Normtot	.0017	.0046	.1368	1	.7115	.0000	1.0017
Constant	3.5594	1.8067	3.8813	1	.0488		

Table 15: Classification table to compare the predicted breakdown of thieves and non-thieves, based on the regression model, with the actual observed values.

		Predicted		Percent Correct
		Thief	Non-thief	
Observed		T	N	
Thief	T	18	25	41.86
Non-thief	N	10	41	80.39
				overall 62.77%

In summary, we conclude from our research that:

- (1) The more time visitors spent at interpretive centers and programs did not seem to result in their attitudes toward wood theft being more negative.
- (2) Increasing amount of time spent by park visitors participating in interpretive programs apparently did not result in their norms about individual acts of wood theft being more negative.
- (3) The number of interpretive programs participated in and variation in the type of interpretation judged most helpful did not influence whether or not a park visitor was a thief or non-thief.
- (4) Visitor attitudes and norms about petrified wood theft did not vary by type of interpretive programs judged most helpful in learning the park’s story and in learning the park’s rules and regulations.

However, we have tentative evidence that:

- (a) The norm against taking a handful of wood was stronger among individuals who cited visitor centers as their most helpful source in learning rules and regulations than it was for respondents who said the same about other national park interpretive programs.
 - (b) The attitude variable that it is all right to take a piece of petrified wood as long as it is a small piece did vary for two categories of interpretive programs helpful in learning the park’s story (other national park programs and all ranger programs). Individuals who rated ranger programs as most helpful disagreed less that taking a small piece of petrified wood was wrong. This suggest that respondents who indicated that national park programs were the most helpful, tended to disagree more strongly than respondents who cited ranger programs that it was all right to take a piece of petrified wood from the park as long as it is a small piece.
- (5) Finally, our general conclusion is that attitudes and norms about petrified wood theft did not shape behavior. However, we have evidence that:
- (a) By knowing visitors’ attitudes, we can more accurately predict who would be a non-thief.

Chapter six

Discussions and Conclusions

The results of our study suggest that interpretation for the most part was not effective as a management tool to change attitude, norms, and behavior. We recommend that park managers interpret this finding with caution. Our finding is likely confounded by several theoretical, study design, and measurement problems. In addition, the Theory of Reasoned Action did not prove to be very useful in our efforts to understand and predict wood theft behavior. There are many possible reasons for these negative findings.

Possible Explanations for the Ineffectiveness of Interpretation

One possible reason why interpretation was ineffective in changing attitude may be that visitors sampled did not actually pay attention to the interpretive messages and hence were not influenced by them. Instead, they may have spent most of their time at different interpretive sites viewing scenery, purchasing souvenirs, looking at exhibits or using the bathrooms. Our measures of time with interpretation do not differentiate among how time was used at the interpretive sites.

A second reason for the ineffectiveness of interpretation may be that the interpretive message people did receive did not deal with wood theft. In some sites the interpretive signs did not mention anything about wood theft or the consequences of it. Instead, interpretation focused on history of the area or dangers along trails.

A third possible reason for the ineffectiveness of interpretation may be when messages did focus on wood theft, they did not deal with salient beliefs about the outcomes of wood theft. This was evident when signs indicated that it is illegal to remove petrified wood from the park and visitors caught committing such an act will be fined. Instead these signs should have focused on the consequences of removing petrified wood. For example, removal of petrified wood will reduce the beauty of the park or would degrade the park's main attraction.

Another possible reason why interpretation apparently did not change attitudes may be that it was not geared toward changing salient beliefs about wood theft. Ajzen and Fishbein (1980) suggested that a person may hold a large number of beliefs about an issue, object or policy, but can only attend to a relatively small number of these beliefs at any given time. These beliefs that are attended to at a given time are referred to as salient beliefs and are determinants of the person's attitude. Therefore, we need to address these salient beliefs if we expect to influence attitudes. For example, interpretive signs may indicate that if each of 10,000 visitors, take one piece of petrified wood, it would add up to a lot and this loss of wood will reduce the recreation potential of the site. As a result, it is better to leave the wood at the sites than to have it at your home.

Another reason why interpretation did not change attitudes may be that the interpretive message was not strong enough to cause any change. This may be explained by the amount of time visitors spent at the park. Visitors on average spent between 8 and 32 minutes at any one site. Not all of the sites offered interpretive messages, and those that did may require more time to analyze the information and make sense out of it.

In addition, the hot and often windy conditions at Petrified Forest National Park may make it more difficult for visitors to pay attention to the interpretive messages and to generate appropriate attitudes.

It may also be possible that some of the signs had too many messages making it difficult to remember them all. A study by Cole, Hammond and McCool (1997) found that as the number of messages increased, the attention devoted to each message and the ability to retain message content declined. This suggests that visitors may be unable to process all the information on the interpretive signs to develop appropriate attitudes.

Another possible reason why interpretation did not change attitude may be that when visitors came to the park, they may already have had favorable attitudes (ceiling effect). If they already had these favorable attitudes, no amount of interpretation would have been able to increase their opposition toward wood theft.

Another reason may be that visitors were not exposed to appropriate interpretive programs. Only 2.3% of our visitors sampled indicated ranger led walks as a source from which they learn about the park's story. Another 20% indicated rangers at interest points, and 14.7% indicated ranger talks as sources from which they learn about the park's story. In contrast, 87.9% of our visitors sampled indicated that they learn about the park's story from the brochure and map. Similarly, only 0.4% of our visitors sampled indicated ranger led walks as a source from which they learn about the park's rules and regulations. Another 7.1% indicated rangers at interest points and 13.3% indicated ranger talks as sources from which they learn the park's rules and regulations. In contrast, 57.1% indicated they learn the park's rules and regulations from the brochure and map. While the findings of past research are mixed, personal contacts with rangers and ranger programs are often more effective in influencing attitudes and behaviors. Roggenbuck (1992) has reported that the channel used to communicate a persuasive message is of critical importance in shaping the effectiveness of the message. He also indicated that recreation managers support personal contacts between rangers and visitors as the most effective form of persuasion.

Another reason may be that PFNP was not a primary destination for most of our visitors. Approximately 93% of our visitors indicated that PFNP was not their primary destination. This may suggest that visitors were less involved and were not interested enough to attend to and process the information presented to them to change their attitudes.

Another possible explanation why interpretation did not appear to change attitudes may be that visitors' responses were not their true attitudes, but what they think was expected of them. It may be possible that attitudes were changed, but this was not reflected in our data. Visitors may have simply responded in a manner that was socially desirable.

We also discovered from our study that interpretation did not change norms. Some of the reasons for this may be similar to the reasons that interpretation did not change attitudes. Roggenbuck, Williams, Bange and Dean (1991), in reviewing the sociology literature about norms, reported the following:

- (1) Norms regulate individual behavior and form the basis for evaluating the appropriateness of the behavior of others.
- (2) Social norms describe what is acceptable and shared by members of a group.
- (3) A consensus of norms evolves over time.

Interpretive programs at the park may not have specified appropriate or acceptable behavior, may not have specified support for the appropriate behavior by significant social groups, and almost certainly didn't have the necessary time for new norms to develop. Also, as in our attitude measures, our measures of norms may not have been valid or complete.

Finally another possible reason why interpretation apparently did not change attitudes may be that our measures of attitude may not have been appropriate. One of our attitude measures, "it is all right to take a piece of petrified wood from the park as long as it is a small piece" did imply an attitude toward wood theft, but the other three measures of attitude were not that specific. For example, the attitude about "taking petrified wood reduces the beauty of the park" targeted an outcome of wood theft, not the act itself. This second item would be appropriate for assessing salient beliefs.

Failures of the Theory of Reasoned Action

Our study was also mostly unsuccessful in helping us to understand and predict wood theft behavior. There may be reasons for this failure. One reason may be that the Theory of Reasoned Action was an inappropriate model for our study. Ajzen and Fishbein (1980) recommended that the theory should only be applied to behaviors that are volitional. Initially, we felt that wood theft would be a behavior that was thought out before being performed (volitional) and not an impulsive behavior. However, some of our data suggest otherwise. For example, when we asked respondents their agreement with the statement, "when I find curious or unusual objects on trips, I like to collect them", we found approximately 47% strongly agreed or agreed. More interestingly, we found a significant difference for thieves and non-thieves for this item. This might suggest that thieves picked up petrified wood without reasoning out their action, suggesting that this behavior is, at least for some, spontaneous and not volitional.

If acts of wood theft were spontaneous, then according to the Elaboration Likelihood Model, a different route will be required to persuade people to change. This model suggest two distinct routes to persuasion. The "central route" involves well thought out activity drawing from prior experience and knowledge. In contrast, the "peripheral route" require simple cues to persuade people to change (Petty, McMichael and Brannon, 1992). Since most of our visitor were first timers (75%), this may suggest that visitors had little or no prior knowledge to be able to evaluate any relevant arguments presented in the messages they received. As a result, it may have been more beneficial to persuade people to change through the "peripheral route" by using simple cues or celebrity figures.

Another reason why the Theory of Reasoned Action may not have been more useful in understanding and predicting wood theft behavior is our failure to measure key components of the model. We did not measure

social norm (what important others feel), motivation to comply with significant others, and behavioral intentions. The Theory of Reasoned Action suggests that attitudes and subjective norms shape behavioral intentions, which subsequently change behavior. In our study we equated personal norms with social norms. If we had measured social norms and motivations to comply with them, then norms may have been as powerful or more powerful in predicting theft behavior than the attitude component. Similarly, we directly measured (through observation) theft behavior, rather than behavioral intentions about theft behavior. Observation of theft behavior, is of course the most direct measure of behavior, and is appropriate here. However, past research suggests that attitude and norms often predict behavioral intentions better than behavior (Ajzen and Fishbein, 1980).

Another possible reason why we were unable to better understand and predict wood theft behavior may be that the time of the attitude and norm measure did not correspond to that of the behavior measure. We measured theft behavior on site at the time of the visit to the park but we measured attitudes and norms weeks after. Attitudes and norms may have changed after the time of the visit.

Another reason for the failure of the Theory of Reasoned Action to better understand and predict behavior may be that the thieves that we tagged may not have actually filled out the mailback questionnaire. From the returned questionnaire, we did throw out 9 of the 61 thieves observed because we could not confidently match their identity with our on-site theft records. Unique or distinguishing characteristics (like gender) of thieves were recorded on site, and mailback questionnaires were compared for similar identification characteristics. Even though we did throw out these anomalous cases, we are not absolutely sure that the remaining thieves that we give the questionnaire to actually did fill it out themselves. A spouse or another family member may have filled out the questionnaire. If this were the case, then we would not necessarily expect our attitude and norm measures to be consistent with behavior.

Another reason why the Theory of Reasoned Action failed in allowing us to better understand and predict behavior is that it is quite possible that more of our respondents were thieves. Some visitors could have taken wood without us noticing them or from other sites that we did not observe. If this were the case, then our ability to detect differences would have been diminished because some of the subjects in our non-thief sample may have actually been thieves.

Finally, the failure of the Theory of Reasoned Action to help us better understand and predict behavior may be attributed to the relatively small sample size of the thief and non-thief samples. Our sample size of 54 thieves and 51 non-thieves may be too small to be representative of our population. If we had larger and more representative samples for the thief and non-thief samples, there may have more support for the Theory of Reasoned Action. In addition, thieves were self-selected and may also add to our sample not being representative of our population. A random sample of adequate size would ensure that the population was well represented and as a result, data collected would reflect the true views of the population.

Recommendation for future research

The previous successes and even failures of the application of the Theory of Reasoned Action should be good cause for future research. In the application of this model, it is important that resource managers target salient beliefs about management policies and the outcome of certain behaviors through persuasive communication to effectively change attitudes and behaviors. The message content needs to incorporate visitors' salient beliefs and evaluations about the outcome of certain policies or behavior. This may be achieved by simply asking visitors what are the important positive and negative outcomes of policies and behaviors (Ajzen and Fishbein, 1980). This approach would ensure that we include all the important salient beliefs of visitors. This approach has been quite successful in other studies (for example, see Norman and Smith, 1995).

Future research should use an experimental design, and measure salient beliefs, attitudes and norms at two points in time. Respondents may fill out a questionnaire on entering the park and one just before exiting the park. This approach would allow us to better measure any change.

We also believe that different types of interpretive messages and different combinations of types of interpretive messages should be given to different sub-samples. For example, one sub-sample could be exposed only to ranger programs, a second sub-sample only to visitor center programs, a third sub-sample only to entrance station programs and a fourth sub-sample only other national park programs. Similarly, other sub-samples can be given any combination of the four types of programs. If some visitors are exposed to one type of program, and others are exposed to different combinations of programs, then researchers will determine which program(s) and combination of programs are the most effective and which are least effective in changing attitudes, beliefs, and behaviors. A visitor may indicate the one most important program that will help him to learn about rules and regulations, but a combination of programs may have a significantly greater effect. This may be because a combination of programs provides more knowledge for the visitors to be better able to evaluate the issue-relevant arguments presented in the communication.

In addition to ensuring that different sub-samples receive different interpretive programs, we recommend programs should focus their messages on changing negative salient beliefs and reinforcing positive ones. This we feel will bring about the desired changes in behaviors and maintain appropriate ones (Ajzen and Fishbein, 1980). This is consistent with studies conducted by Cialdini, Reno and Kallgren (1990). They found that littering was significantly more likely in a littered setting than in a clean setting.

Future research should focus on different types of messages in different situations to determine which approach is more appropriate in which situation. Past studies have shown certain trailhead signs were more effective than others in changing hiking off-trail behaviors. Johnson and Swearingen (1988) found the sanction sign ("off-trail hikers may be fined") reduced off-trail hiking by 75%, whereas the ethical appeal sign ("stay on the trails and preserve the meadow") reduced it by 52%. In other situations, role playing has been successful in changing littering behavior (Roggenbuck and Passineau, 1986).

Future studies also need to consider the specific characteristics of the audience. For example, the amount of time spent at any one park and whether this park is a primary destination could determine what kind of salient beliefs visitors hold, how crystallized are their attitudes, how accessible are their attitude, and how thoughtful they will be. Different kinds of persuasive attempts will be needed for visitors who vary on these characteristics.

Future research needs to acknowledge the different socio-demographic sub-groups within the visitor population. For example, it appears that a large number of visitors to PFPNP were foreigners. International, out-of-state and local visitors may all hold different beliefs, and as a result, messages may need to be organized and presented differently to various sub-groups to have any measure of success.

Another issue that future studies need to address is the influence of external variables. Ajzen and Fishbein (1980) suggested that personality traits and demographic characteristics, referred to as receiver factors by Ajzen (1992), are sometimes related to the behavior of interest. While they feel that it is difficult to ascertain a relationship between external variables and behavior, researchers could at least assess the influence of the suspected external variables.

Future studies should also develop different intervention strategies and messages for acts or behaviors that are willful versus those that are impulsive. For example, some visitors may pull over at the sight of a buffalo on the side of the road at Yellowstone National Park without even thinking about it, while others may think about the situation carefully, realize the potential dangers, and if they do decide to stop, will stay a safe distance away. These two sub-groups will have to be treated differently, because willful behaviors may require applying the “central route” to persuasion, while the impulsive behaviors may require the “peripheral route” to persuasion to get people to change.

Finally, we recommend using a large enough sample size. We felt that a larger sample size would provide us with more reliable and representative data. A large sample will also allow us to increase the power (the probability of rejecting the null hypothesis when it is false) of our statistical test. This would allow us to draw more accurate conclusions about the results of our test by increasing our chances of reaching a correct decision.

Implications for Management

As mentioned before, our study has been ineffective in using interpretation to change attitude and norms and mostly ineffective in applying the Theory of Reasoned Action to understand and predict wood theft behavior. Many different reasons have been discussed as possible explanations for the failure of our study. In the future, resource managers will have to address certain issues if any level of success will be achieved in using interpretation to change attitudes, norms, and behavior.

Managers need to direct their interpretive messages toward changing specific attitudes, norms and behavior. To achieve this, messages need to focus on increasing knowledge level and fostering positive attitudes and norms (Olson et al., 1984). When

desirable attitudes and norms exist, interpretive messages should be used to reinforce them and to discourage the undesirable ones.

Interpretive messages should be strong and focused to bring about the desired changes in attitude and norms. These messages should be supported by facts and not speculations, so they are more convincing to visitors. In addition, messages should focus on the specific intended behavior or outcome. They should also be simple and clear to anyone who reads them or is exposed to them.

It is important that resource managers know who their audience is if they are going to develop interpretive messages for them. For example, resource managers need to know if their audience comprises local, out-of-state and international visitors and the different countries that these foreign visitors come from. If at all possible, messages should be directed to the different visitors in ways that will achieve the desired success. For example, some messages may have to be in a different language if they are to be effective in addressing foreign visitors. Similarly, a different approach may be required for out-of-state and local visitors.

Resource managers also need to look at behaviors that are impulsive versus those that are volitional. Roggenbuck (1992) suggested that people have a variety of motives for their impacting behavior and the effectiveness of persuasion is likely to depend on the type of impact, the behavior involved and the motives for the behavior. This suggests that resource managers will have to deal with visitors whose behaviors are volitional differently to those whose behavior are impulsive if they are going to achieve any success in changing undesirable behaviors.

The credibility of the source also appear to be important. Ajzen (1992) suggested that communicators who are experts and appear trustworthy to visitors tend to be more persuasive than those who are not. Similarly, non-personal sources that are viewed as not credible are less effective than those that are viewed as credible.

Finally, resource managers need to implement interventions in close spatial and temporal proximity to the behavior of concern. For example, if the interpretive program is given a long time before or after the of the probable behavior of concern, then it will not likely be successful.

In summary, the theft of petrified wood remains a problem at Petrified Forest National Park. If it is allowed to continue at the present rate, soon there will be very little petrified wood left. There is need to control petrified wood theft if the park is to remain in an acceptable condition for future generations. Application of different types of interpretive programs and the Theory of Reasoned Action did not help us much to predict and understand petrified wood theft. As mentioned above, there may be many reasons for our failures. Given this, more carefully planned research studies are needed. Roggenbuck, Widner and Stratton, (1997) have recently reported field experimental tests of policing, erecting a symbolic fence, interpretive signs, and visitors signing a pledge and they have achieved some success. Managers should adopt these more successful approaches or a combination of these successful approaches, and continued research is needed to understand the process by which some interventions are effective while others are not.

References

- Ajzen, I. 1986. From intention to action: A Theory of Planned Behavior. In J. Kuhl and J. Beckmann (Ed.). *Action control: From cognition to behavior*. Berlin: Springer.
- Ajzen, I. 1987. Attitudes, traits and actions. In: L. Berkowitz (Ed.), *Advances in Experimental Social Psychology*. Vol 20, Academic Press, New York, 1-63.
- Ajzen, I. 1988. *Attitudes, Personality and Behavior*, Open University Press, Milton Keynes.
- Ajzen, I. 1992. Persuasive communication theory in social psychology: A historical perspective. *Theory and applications in recreation and tourism and natural resource management*. M.J. Manfredo (Ed.), Champaign, Ill.: Sagamore Press.
- Ajzen, I., and B.L. Driver. 1992. Application of the Theory of Planned Behavior to Leisure Choice. *Journal of Leisure Research*, 24(3): 207-224.
- Ajzen, I., and M. Fishbein. 1980. *Understanding Attitudes and Predicting Social Behavior*. Englewood Cliffs, N.J.: Prentice Hall, Inc.
- Bentler, P.M., and G. Speckart. 1979. Models of attitude-behavior relations, *Psychological Review*, 86: 452-464.
- Boyd, B., and A. Wandersman. 1991. Predicting undergraduate condom use with the Fishbein and Ajzen and Triadis attitude-behavior models: Implication for public health interventions. *Journal of Applied Social Psychology*, 21: 1810-1830.
- Bright, A.D., M. J. Manfredo, M. Fishbein, and A. Bath. 1993. Application of the Theory of Reasoned Action to the National Park Service's Controlled Burn Policy. *Journal of Leisure Research*, 25: 263-280.
- Burde, J.H., J. D. Peine, J.R. Renfro, and K.A. Curran. 1988. Communicating with park visitors. Some success and failures at great Smoky Mountains National Park. In: M. Legg (Ed.) *National Association of Interpretation 1988 Research monograph*: 7-12.
- Cable, T.T., D. M., Knudson, E. Udd, and D. J. Stewart. 1987. Attitude changes as a result of exposure to interpretive messages. *Journal of Park and Recreation Administration*, 47-59.
- Christensen, H.H. 1981. Bystander intervention and litter control: Evaluations of an appeal to help program. Research Paper PNW-287. Portland, Or: USDA Forest Service.
- Cialdini, R. B., R. R. Reno, and C. A. Kallgren. 1990. A focus of normative conduct: Recycling the concept of norms to reduce littering in public places. *Journal of Personality and Social Psychology*, 6: 1015-1026.
- Clark, R.N., J. C. Hendee, and R. L. Burgess. 1972. The experimental control of littering. *Journal of Environmental Education*, 4: 22-28.
- Cockrell, D., and W. J. McLaughlin. 1979. Choosing a river to run: Motives and preferences of river recreationists. Paper presented at the Leisure Research Symposium, National Recreation and Parks Association, New Orleans, Louisiana, October 29, 1979.

- 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.
- Doll, J., and I. Ajzen. 1992. Accessibility and stability of predictors in the Theory of Planned Behavior. *Journal of Personality and Social Psychology*, 63: 754-765.
- Dowell, D.L., and S. F. McCool. 1986. Evaluation of wilderness information dissemination program. In: R.C. Lucas (compiler), *Proceedings--National Wilderness Research Conference: Current Research; 1985 July; Fort Collins, Co.; Gen. Tech. Rep. INT-212*. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 494-500.
- Fazio, J.R. 1974. A mandatory permit system and interpretation for backcountry user control in Rocky Mountain National Park: An evaluation study. Fort Collins, CO: Colorado State University. Unpublished Ph.D. dissertation, 246p.
- Fieldman, R.L. 1978. Effectiveness of audio-visual media for interpretation to recreating motorists. *Journal of interpretation*, 3(1): 14-19.
- Fishbein, M. 1980. A theory of reasoned action: Some applications and implications. In: H. E. Howe and M. M. Page (Ed.), *Nebraska Symposium on Motivation, 1979*. Lincoln: University of Nebraska Press, 65-116.
- Fishbein, M., I. Ajzen, and R. Hinkle. 1980. Predicting and understanding voting in American elections: Effects of external variables. Chapter 13 In: I. Ajzen, and M. Fishbein (Ed.), *Understanding Attitudes and Social behavior*. Englewood Cliffs, N.J.: Prentice Hall, Inc.
- Fishbein, M., and M. J. Manfredo. 1992. A theory of behavior change. Influencing human behavior. In: M. J. Manfredo (Ed.), *Theory and applications in recreation and tourism*. Champaign, Ill: Sagamore Press.
- Gallup, T.P. 1981. The effectiveness of a cartoon illustrated interpretive brochure on the enhancement of campers' knowledge of rules and the decrease in rates of rule violation per campsite. State College, PA: Pennsylvania State University. Unpublished Masters Thesis, 56p.
- Galper, D.I. 1995. Understanding the motivation to use Anabolic Steroids: An application of the Theory of Reasoned Action. Unpublished Masters Thesis, Virginia Polytechnic Institute and State University, Blacksburg.
- Gulotta, C.S. 1994. Predicting a young woman's pregnancy decision: Application of the Theory of Planned Behavior. Unpublished Thesis, Virginia Polytechnic Institute and State University, Blacksburg.
- Hays, W.L. 1988. *Statistics*. Fort Worth, TX: Holt, Rinehart and Winston, Inc.
- Herberlein, T.A. 1973. Social psychological assumptions of user attitude surveys. *Journal of Leisure Research*, 5: 18-33.
- Johnson, D.R., and T. C. Swearingen. 1988. The effectiveness of selected trailside sign texts in deterring off-trail hiking, Paradise Meadows, Mt Rainier National Park. Paper presented at the International Symposium on Vandalism: Research, Prevention and Social Policy, April 20-22, 1988, Seattle, Wa. 38p.

- Jones, P.E., and L. H. McAvoy. 1988. An evaluation of a wilderness user education program: A cognitive and behavioral analysis. In: M. Legg (Ed.) National Association of Interpretation 1988 Research monograph: 13-20.
- Knoke, D., and G. W. Bohrnstedt. 1994. Statistics for social data analysis. Itasca, IL: F.E. Peacock Publishers, Inc.
- Lowe, H.R., and D. J. Frey. 1983. Lamaze childbirth intentions and outcomes: An extension of the Theory of Reasoned Action to a joint outcome. *Basic and Applied Social Psychology*, 4(4): 353-372.
- Lucas, R.C. 1981. Redistributing wilderness use through information supplied to visitors. Res. paper INT-277. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 15 P.
- Manfredo, M.J., and A. D. Bright. 1991. A model for assessing the effects of communication on recreationists. *Journal of Leisure research*.
- Manstead, S.A., C. Proffitt, and L.S. Smart. 1983. Predicting and understanding mothers' infant-feeding intentions and behavior: Testing the Theory of Reasoned Action. *Journal of Personality and Social Psychology*, 44: 657-671.
- Martin, D.C. 1987. Effects of various communicative methods for controlling visitor removal of pumice at Mount St. Helens National Volcanic Monument. Unpublished Ph.D. dissertation, University of Washington, Seattle, 156p.
- Maupin, G.T., B. K. Bassett, D. T. Catlin, and D. J. Witter. 1982. Missouri's Prairie Day: Methods and Evaluation of an Interpretive Extravaganza. *Journal of Interpretation*, 7(2): 31-40.
- McCaul, D.K., K. O'Neill, and E. D. Glasgow. 1988. Predicting the performance of dental hygiene behaviors: An examination of the Fishbein and Ajzen model and self-efficacy expectation. *Journal of Applied Social Psychology*, 18: 114-128.
- Muth, R. M., and R. N. Clark. 1978. Public participation in wilderness and backcountry litter control: A review of research and management experience. Gen. Tech. Rep. PNW- 75. Portland, OR: USDA Forest Service.
- Nielson, C., and T. Buchanan. 1986. A comparison of the effectiveness of two interpretive programs regarding fire ecology and fire management. *Journal of Interpretation*, 11(1): 1-10
- Oliver, S.S., J. W. Roggenbuck, and A. E. Watson. 1985. Education to reduce impacts in forest campgrounds. *Journal of Forestry*, 83(4): 234-236.
- Olson, E. C., M. L. Bowman, and R. E. Roth. 1984. Interpretation and nonformal education in natural resources management. *Journal of Environmental Education*, 15: 6-10.
- Petty, R.E., S. McMichael, and L. A. Brannon. 1992. The Elaboration Likelihood Model of Persuasion: Applications in Recreation and Tourism. Influencing human behavior. Theory and applications in recreation and tourism and natural resource management. In: M. J. Manfredo (Ed.), Champaign, Ill: Sagamore Press.
- Powers, R.B., J. G. Osborne, and E. G. Anderson. 1973. Positive reinforcement of litter removal in the natural environment. *Journal of Applied Behavior Analysis*, 6: 579-586.

- Ray, R.O. 1981. Examining motivation to participate in continuing education: An investigation of recreation professionals. *Journal of Leisure Research*, 13: 66-75.
- Reames, J., and D. W. Rajecki. 1988. Changing preschoolers attitudes toward animals: A Zoo program and an evaluation. In: M. Legg (Ed.), *National Association of Interpretation 1988 Research monograph*: 27-38.
- Riddle, P.K. 1980. Attitudes, beliefs, behavioral intentions and behaviors of women and men toward regular jogging. *Research Quarterly for Exercise and Sport*. 51: 663-674.
- Roggenbuck, J.W. 1992. Use of persuasion to reduce resource impacts and visitor conflicts. *Influencing human behavior. Theory and applications in recreation and tourism and natural resource management*. In: M. J. Manfredo (Ed.), Champaign, Ill: Sagamore Press.
- Roggenbuck, J.W., and D. L. Berrier. 1982. A comparison of the effectiveness of two communication strategies in dispersing wilderness campers. *Journal of Leisure Research*, 14: 77-89.
- Roggenbuck, J.W., and J. Passineau. 1986. Use of the field experiment to assess the effectiveness of interpretation. In: B. McDonald and H. K. Cordell (Ed.), *Proceedings, Southeastern Recreation Research Conference*. Athens GA: Recreation Technical Assistant Office, Institute of Community and Area Development, University of Georgia: 65-86.
- Roggenbuck, J.W., C. Widner, and D. Stratton. 1997. Reducing theft of petrified wood at Petrified Forest National Park. Final Report: Virginia Polytechnic Institute and State University, Blacksburg.
- Roggenbuck, J.W., D. R. Williams, S. P. Bange, and D. J. Dean. 1991. River float trip encounter norms: Questioning the use of the social norms concept. *Journal of Leisure Research*, 23(2): 133-153.
- Schifter, D.B., and I. Ajzen. 1985. Intention, perceived control, and weight loss: An application of the Theory of Planned Behavior. *Journal of Personality and Social Psychology*, 49: 843-851.
- Schwarzkopf, S.K. 1984. Feeding of golden-mantled squirrels by park visitors at Crater Lake National Park. Corvallis, OR: National Park Service Cooperative Park Studies Unit, Research Paper CPSU/OSU 84-9.
- Seig, G.E., J. W. Roggenbuck, and C. T. Bobinski. 1987. The effectiveness of commercial river guides as interpreters. In: *Proceedings 1987 Southern Recreation Research Conference*. Athens, GA: Department of Recreation and Leisure Services, University of Georgia: 12-20.
- Sutherland, D., and R. Tenorio. 1992. Guided walks and the protection of archaeological site. In: Sam Ham (Ed.). *Environmental Interpretation. A Practical Guide for People with Big Ideas and Small Budget*. Golden, Colorado: North American Press.
- Sutton, R.W. 1976. Vandalism in the Channel Islands National Monument. In: S.S. Alfano and A.W. Magill (Ed.), *Vandalism and Outdoor Recreation: Symposium Proceeding*, pp. 12-14. USDA Forest Service General Technical Report PSW-17.

- USDI, National Park Service. 1979. Petrified Forest National Park Draft Management Plan / Development Concept Plans / Environmental Impact Statement (NPS Publication No. NPS D-76). U.S. Printing Office, Washington, DC.
- USDI, National Park Service. 1993. Petrified Forest National Park Final Management Plan / Development Concept Plans / Environmental Impact Statement (NPS Publication No. NPS D-76A). U.S. Printing Office, Washington, DC.
- Vander Stoep, G.A., and J. H. Gramann. 1987. The effects of verbal appeals and incentives on depreciative behavior among youthful park visitors. *Journal of Leisure Research*, 19(2): 69-83.
- Vander Stoep, G.A., and J. H. Gramann. 1988. Use of interpretation as an indirect visitor management tool: An alternative to regulation and enforcement. In: M. Legg (Ed.) *National Association of Interpretation 1988 Research monograph*: 47-55.
- Whelpton, P.K., A. Campbell, and J. E. Patterson. 1966. *Fertility and family planning in the United States*. Princeton, N.J.: Princeton University Press.
- Young, R.A., and A. T. Kent. 1985. Using the Theory of Reasoned Action to improve the understanding of recreation behavior. *Journal of Leisure Research*, 17(2) : 90-106.

Appendix A
On-site Interview Forms

South Exit Contact Sheet
1993 Petrified Forest National Park Visitor Survey

Exit Information

Date: _____ Time: _____ AM / PM Contact # _____

Number of people in group: _____ Vehicle Type: _____

Entry Information

Date: _____ Time: _____ AM/PM Location: () North (I-40)
() South (U.S. 180)

1. Approximately how much time did you spend at the following areas?

Please enter the number of minutes you spent at EACH area.

- 1. Painted Desert Visitor Center -----
- 2. Painted Desert Gift Shop -----
- 3. Painted Desert Restaurant -----
-
- 4. Painted Desert Inn -----
- 5. Puerco Indian Ruin -----
- 6. Newspaper Rock -----
-
- 7. Blue Mesa Scenic Loop -----
- 8. Blue Mesa Nature Trail -----
- 9. Agate Bridge -----
-
- 10. Jasper Forest -----
- 11. Crystal Forest -----
- 12. Long Logs -----
-
- 13. Rainbow Forest Museum -----
- 14. Giant Logs Trail (behind Museum) -----
- 15. Gift Shop / Snack Bar (near South Entrance) -----

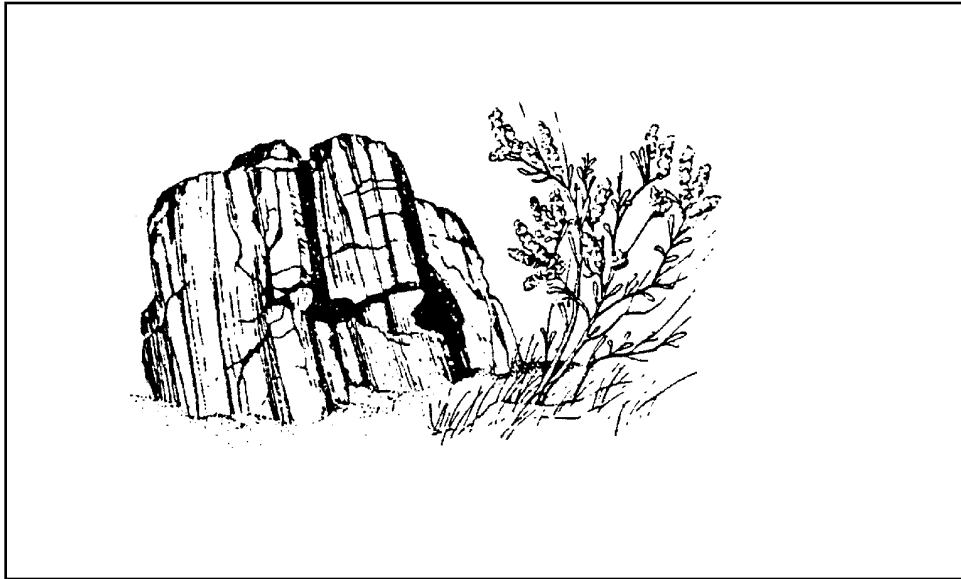
2. Please print your name and home address.

Name _____
Street Address _____
City _____ State _____ Zip Code _____

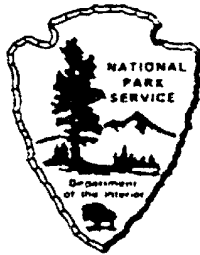
Appendix B
Mailback Questionnaire

Petrified Forest National Park

Visitor Survey 1993



Department of Forestry
Virginia Polytechnic Institute and State University
Blacksburg, VA



Western Regional Office
National Park Service
San Francisco, CA

Your Visit to Petrified Forest National Park

1. How would you describe the group you were with when you visited Petrified Forest National Park?

Please check one.

- Alone--If alone, go to Question 3.
- Family only
- Friends only
- Friends and family
- Tour group
- Other organized group (e g. school or church group, Scouts, etc)
- Other, please describe: _____

2. Please tell us the number of people in your group and the number of group members in each age category listed below.

____ Total number of people in your group

Were you traveling with any:

Preschoolers (less than 5 years old)?

- No
- Yes--If yes, how many?

Children (5 to 12 years old)?

- No
- Yes—If yes, how many?

Teenagers (13 to 19 years old)?

- No
- Yes--If yes, how many?

Anyone over 62 years old?

- No
- Yes—If yes, how many?

3. How many times have you visited Petrified Forest National Park, including this visit?

_____ Total number of visits

4. Was Petrified Forest National Park your primary destination on this trip away from home?

- Yes
- No--If no, what other park and outdoor attractions have you visited in the four-corners region (NM, AZ, CO, UT) on this trip? _____

5a. People learn about the story of Petrified Forest National Park from different sources while at the park. Which of the following park information sources did you use? Please circle all that apply.

- 1 Official Petrified Forest National Park brochure/map
 - 2 Official Petrified Forest National Park newspaper
 - 3 Painted Desert Visitor Center exhibits
 - 4 Painted Desert Inn exhibits
-

- 5 Rainbow Forest Museum exhibits
 - 6 Rangers at points of interest (overlooks, archeological sites geological sites etc.)
 - 7 Ranger-led walks
 - 8 Ranger talks
-

- 9 Films or slide shows
- 10 Self-guided walks
- 11 Interpretive signs
- 12 Entrance station information
- 13 Other, please specify: _____

5b. Which of the above information sources was most helpful in learning the Petrified Forest National Park story? Write the number corresponding to the most helpful source.

_____ Most helpful

6a. People learn about the park's rules and regulations from many sources while at the park. Which of the following park information sources helped you learn about the park's rules and regulations? Please circle all that apply.

- 1 Official Petrified Forest National Park brochure/map
 - 2 Official Petrified Forest National Park newspaper
 - 3 Painted Desert Visitor Center exhibits
 - 4 Painted Desert Inn exhibits
-

- 5 Rainbow Forest Museum exhibits
 - 6 Rangers at points of interest (overlooks, archeological sites, geological sites, etc.)
 - 7 Ranger-led walks
 - 8 Ranger talks
-

- 9 Films or slide shows
- 10 Self-guided walks
- 11 Interpretive signs
- 12 Entrance station information
- 13 Other, please specify: _____

6b. Which of the above information sources was most helpful in learning the park's rules and regulations? Write the number corresponding to the most helpful source.

_____ Most helpful

7. Did you receive any information about the park before arriving?

No

Yes--If yes, from what source(s)? Please check all that apply.

Magazine

Book

Travel guide

 Highway map or sign

Tourist brochure

Auto club

 Friends/Relatives

Wrote/Called park for information

Other, please specify: _____

8. Approximately how much time did you spend at the following areas? Please enter the number of minutes you spent at EACH area.

Minutes

_____ Painted Desert Visitor Center

_____ Painted Desert Gift Shop

_____ Painted Desert Restaurant

9a. On this trip to Petrified Forest National Park, did you purchase any items from either of the gift shops (Painted Desert Gift Shop or the Rainbow Forest Gift Shop) in the park? Do not include any items purchased from shops outside the park.

No

Yes--If yes, please tell us how much you spent on the following items.

\$ _____ Clothing (T-shirts, hats, etc.)

\$ _____ Native American jewelry

\$ _____ Petrified wood

\$ _____ Books, magazines, travel guides, etc.

\$ _____ Film

\$ _____ Glassware

\$ _____ Other, please specify: _____

9b. On this trip to Petrified Forest National Park, did you purchase any petrified wood from souvenir or rock shops outside of the Park?

No

Yes

10. To what extent did you find each of the following to be a problem during your visit to Petrified Forest National Park? Please circle the appropriate number.

	How much of a problem?				
	Not at all	Slight	Moderate	Serious	Very Serious
Litter along the road	1	2	3	4	5
Litter along the trails	1	2	3	4	5
Vandalism	1	2	3	4	5
Not enough law enforcement rangers	1	2	3	4	5

Inadequate visitor center information	1	2	3	4	5
Poorly maintained trails	1	2	3	4	5
Not enough hiking trails	1	2	3	4	5
Petrified wood for sale in the park	1	2	3	4	5

People collecting petrified wood	1	2	3	4	5
Too many people at the Painted Desert Visitor Center (northern 1-40 end)	1	2	3	4	5
Too many people at the Rainbow Forest Museum (southern end)	1	2	3	4	5
Waiting at the entry/exit station	1	2	3	4	5

Too many people on petrified wood nature trails	1	2	3	4	5
Not enough signs to help understand the park features	1	2	3	4	5
Not enough rangers to answer questions about the park	1	2	3	4	5
Too many people hiking off the trails	1	2	3	4	5

Developed areas too close to major natural features	1	2	3	4	5
Too many rock shops just outside the south entrance station	1	2	3	4	5
Not enough wheel chair accessible trails	1	2	3	4	5
Not enough interpretive/nature trails	1	2	3	4	5

	How much of a problem?				
	Not at all	Slight	Moderate	Serious	Very Serious
Not enough scheduled ranger talks	1	2	3	4	5

Lack of a campground at the park 1 2 3 4 5

Your Feelings About National Parks

11. We would like to have an understanding of your general feelings about national parks. Please circle the number that best describes how much you agree or disagree with EACH of the following statements.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I get greater satisfaction out of visiting national parks than other vacation destinations.	1	2	3	4	5
I find a lot of my life is organized around national park use.	1	2	3	4	5
One of the major reasons I now live where I do is that it has opportunities for visiting national parks.	1	2	3	4	5
I seldom take the time to visit national parks.	1	2	3	4	5
Visiting national parks is one of the most satisfying things I do.	1	2	3	4	5
National parks play a central role in my lifestyle.	1	2	3	4	5

Your Feelings About Vacation Souvenirs

12. The following statements relate to your interest in vacation souvenirs. The statements may seem similar to each other, so please read each one carefully and respond to each one as honestly as you can. Please circle the appropriate number.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I like to collect souvenirs of my visits so I can remember my travels better.	1	2	3	4	5
Objects I collect during my travels impress my friends.	1	2	3	4	5
When I visit a place, I try to collect a keepsake that captures the meaning of that place	1	2	3	4	5
When I find curious or unusual objects on trips, I like to collect them	1	2	3	4	5
<hr/>					
I collect items when I travel to let people know more about me.	1	2	3	4	5
I usually don't buy things in gift shops because they seem so artificial	1	2	3	4	5
I take photographs mostly to help me remember the places I visit	1	2	3	4	5
When an object catches my eye, I often experience an immediate desire to possess it even though I have no real use for it	1	2	3	4	5
<hr/>					
When I travel I carefully search for authentic objects that truly represent the places I have visited.	1	2	3	4	5
I like to collect souvenirs from my travels to show others about the places I visited.	1	2	3	4	5
I like to keep objects that remind me of special places I have been.	1	2	3	4	5
When I visit places on vacation, I often pick up knickknacks that grab my imagination.	1	2	3	4	5
<hr/>					
I like to return from my travels with some unique souvenir.	1	2	3	4	5
I like to relive experiences through the objects I collect when I travel	1	2	3	4	5
An important reason for taking photographs of the places I visit is so I can tell others about my trip.	1	2	3	4	5
When something I see catches my fancy, I often feel an irresistible urge to collect it	1	2	3	4	5

Attitudes About Park Behavior

13. We would like to know your feelings on some general park issues. Please circle the number that best describes how much you agree or disagree with EACH of the following statements.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
It is all right to pick wildflowers in a national park	1	2	3	4	5
It is wrong to walk off trails when trails are provided.	1	2	3	4	5
It is all right to walk off the trail to get a closer look at Indian rock art.	1	2	3	4	5
It is wrong to pick up petrified wood even if you put it back where you found it	1	2	3	4	5
Seeing souvenirs made out of petrified wood in the park gift shops encourages people to collect a piece of petrified wood from the park	1	2	3	4	5
Taking petrified wood reduces the beauty of the path	1	2	3	4	5
I don't think I could tell a piece of petrified wood from an ordinary rock.	1	2	3	4	5
It is all right to collect fossils from a national park.	1	2	3	4	5
Being able to buy petrified wood in the park gift shop reduces the temptation to take a piece from park grounds.	1	2	3	4	5
It is wrong to sell petrified wood in the park even though it does not come from the park	1	2	3	4	5
It is all right to enter prehistoric Indian pueblo and pit house ruins in national parks	1	2	3	4	5
It is all right to pick up petrified wood as long as you leave it in the park	1	2	3	4	5
It is wrong to remove Indian arrowheads from the park	1	2	3	4	5
It is all right to take a piece of petrified wood from the park as long as it is a small piece.	1	2	3	4	5
Seeing polished petrified wood in the visitor center encourages people to collect a piece from the park grounds.	1	2	3	4	5
It is all right to collect ordinary rocks while visiting the park	1	2	3	4	5
It is all right to hike/climb to the top of the buttes or ridges near the park's petrified wood areas	1	2	3	4	5
It is all right to climb or sit on logs of petrified wood	1	2	3	4	5

15. We are interested in what are the most important reasons visitors have for not taking petrified wood from the park. Please tell us how important each of the following reasons were in influencing you not to take petrified wood from the park. Please circle the appropriate number.

	How important?				
	Not at all	Somewhat	Moderately	Very	Extremely
I want petrified wood to be there for future generations.	1	2	3	4	5
I fear I will be caught by a park ranger.	1	2	3	4	5
I want national parks to be preserved in their most pristine condition.	1	2	3	4	5
Other people that I care about wouldn't like me to take petrified wood.	1	2	3	4	5

I want to follow park rules.	1	2	3	4	5
I want to set a good example for others.	1	2	3	4	5
I don't want petrified wood.	1	2	3	4	5
I don't want to be caught and fined for taking a piece of petrified wood.	1	2	3	4	5

I want to leave the petrified wood there for others to enjoy.	1	2	3	4	5
My religious beliefs prevent me from taking a piece of petrified wood	1	2	3	4	5
I want to leave the petrified wood there for my family and friends to enjoy.	1	2	3	4	5

16. If a scientific study determined that an unacceptable level of park resources were being damaged or removed from the park, how would you feel about each of the following management actions? Please circle the number that shows how much you support or oppose EACH action.

	Strongly Oppose	Oppose	Neutral	Support	Strongly
Support					
Provide more aggressive enforcement of park rules and reguladons.	1	2	3	4	5
Require people to stay on the paved paths	1	2	3	4	5
Have more signs telling people what the rules are.	1	2	3	4	5
Put up fences around important park resources	1	2	3	4	5
<hr/>					
Put up a low railing along foot trails. 5		1	2	3	4
Put up more signs that help educate visitors on the rules and the reasons behind them.	1	2	3	4	5
Have more rangers patrol the sites that are experiencing high levels of resource damage and/or theft.	1	2	3	4	5
Provide more information in the visitor center on the rules and why it is important to follow them.	1	2	3	4	5
<hr/>					
Allow only ranger-guided walks in petrified wood areas.	1	2	3	4	5
Prohibit visitors from picking up petrified wood.	1	2	3	4	5
Build boardwalks with railings to keep people on the trails.	1	2	3	4	5
Search vehicles as they leave the park.	1	2	3	4	5
<hr/>					
Increase the penalties for damaging and/or stealing park resources.	1	2	3	4	5
Provide park visitors with more information on appropriate park behavior.	1	2	3	4	5
Ban the sale of petrified wood in the park.	1	2	3	4	5

Some Information About You

17. Your age? _____ Years
-
18. Gender?
 Male
 Female
19. What is the highest educational level you have attained? Please circle the highest grade completed.
- | | | | | | | | | | | | | | | | | |
|----------------|---|---|---|---|---|---|---|-------------|----|----|----|---------|----|----|---------------|-----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17+ |
| Primary School | | | | | | | | High School | | | | College | | | Graduate Work | |
20. Which of the following income levels best describes your total household income before taxes?
 Less than \$13,000
 \$13,000 to \$24,999
 \$25,000 to \$39,999
 \$40,000 to \$59,999
 \$60,000 to \$99,999
 More than \$100,000
21. What is your ethnic origin?
 Native American
 Asian or Pacific Islander
 Black
 White
 Hispanic
 Other
22. Are you currently married?
 Yes
 No
23. Do you have children under 5 years old living with you?
 Yes
 No
24. Do you have children between 5 and 17 years old living with you?
 Yes
 No
25. What is your present employment status?
 Employed outside the home
 Unemployed
 Retired
 Full-time homemaker
 Student

Vita

Neemedass Chandool was born in Trinidad and Tobago on October 26, 1957. He graduated with a diploma in Forestry from the Eastern Caribbean Institute of Agriculture and Forestry in 1981. He worked for the Forestry Division in the Ministry of Agriculture in Trinidad and Tobago from 1981 to 1990. He then attended the University of Idaho from 1990 to 1993 where he graduated with a Bachelor of Science degree in Resource Recreation and Tourism in the College of Forestry. He worked at Mount St. Helens National Volcanic Monument as an interpretative Naturalist during the 1991 and 1992 summers. He returned to the Forestry Division in Trinidad and Tobago where he worked as an Assistant Conservator of Forest from 1993 to 1996. Since 1996, he has been enrolled as a graduate student at Virginia Polytechnic and State University's Forestry Department pursuing a Master of Science degree.