THESIS

This is to certify that the

thesis entitled

COMPARISON OF CITIZEN REACTION TO A PROPOSED SLUDGE DEMONSTRATION PROJECT IN TWO MICHIGAN COUNTIES

presented by

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has been accepted towards fulfillment
of the requirements for

M.S. degree in Fisheries & Wildlife

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Date May 18, 1983

COMPARISON OF CITIZEN REACTION TO A PROPOSED SLUDGE DEMONSTRATION PROJECT IN TWO MICHIGAN COUNTIES

By

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A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

MASTER OF SCIENCE

Department of Fisheries and Wildlife

1983

ABSTRACT

COMPARISON OF CITIZEN REACTION TO A PROPOSED
SLUDGE DEMONSTRATION PROJECT IN TWO MICHIGAN COUNTIES

By

Thomas Richard Lagerstrom

In 1981, Kalkaska County residents forced the Michigan Department of Natural Resoucres (MDNR) to withdraw a plan to test the feasibility of applying municipal sewage sludge to state forest lands. Montomorency County was later substituted, and little public opposition was detected. The purpose of this research was to assess the human aspects of this issue and determine the important factors that relate to attitude/behavior formation.

Residents in both counties placed highest value priorities on human health concerns regarding sludge application. Environmental concerns received moderate value priorities, while economic and aesthetic concerns were considerably less important as they related to the sludge management issue. Supporters of forest application tended to have more knowledge of sludge management, placed greater importance on economic concerns, and had higher education levels. Opponents had higher mistrust of MDNR programs, a higher environmental orientation, used forest lands more frequently, and reported a greater predisposition to take action on this issue.

I would like to dedicate this thesis to the four women who have played important roles in shaping my life. To Diane and Andrea, my support and strength in the difficult times when writing and analyzing this thesis; also to my mother and grandmother who have always given me love and encouragement.

ACKNOWLEDGEMENTS

I would like to thank Dr. Ben Peyton for the opportunity to be a part of this research effort. His support and guidance throughout this effort and my Master's program have helped me to grow and broaden my skills and experiences.

Appreciation is also extended to Glenn Dudderar and Dr. Joe Fridgen for serving on my graduate committee and providing me with insights into their fields of expertise.

I want to also thank all of my other friends and fellow students who supported and encouraged me. Special thanks to Randy Champeau, Lorraine Austin, Larry Gigliotti, Pete Pasterz, and Kathy Boutin-Pasterz.

Finally, I am grateful to Karen DeFord for putting up with me and my handwriting. She did an excellent job in typing this thesis.

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INTRODUCTION

During the past decade, federal efforts to improve our nation's water quality have had dramatic effects on municipal waste water treatment systems. The clean up endeavors were mandated by the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500), which set as an objective "To restore and maintain the chemical, physical, and biological integrity of the Nation's waters." Further, it proposes as a national goal that "the discharge of pollutants into the navigable waters be eliminated by 1985" (Sec. 101, a).

The provisions of this Act saddled municipalities with tremendous new capital and technical requirements. Municipal water treatment plants were instructed to use plans and practices with the "best practicable" treatment technology by 1983 (Sec. 201, b and Sec. 301, b2B). This requirement set into motion an accelerated research and development effort toward the purification of wastewater that has been primarily funded by federal grants.

However, the purification process magnifies another problem associated with wastewater treatment. With increased water purity comes the problem of disposing of solids (sludge) that are removed from wastewater by sedimentation or precipitation. The advanced treatment techniques produce a much larger volume of sludge. Also, the composition of sludge is highly variable and depends on the type of

treatment process, the efficiency of treatment, and the local contributors to the wastewater (heavy industry versus rural). Its variability is further complicated by the type of storage and the handling time before disposal (Loehr et al., 1979).

In recognizing the need for effluent disposal research, Congress ordered the Environmental Protection Agency (EPA) to use federal grants to encourage the construction of facilities that provide for "... the recycling of potential sewage pollutants through the production of agriculture, silviculture, or aquaculture products, or any combination thereof" (Sec. 201 d 1). This Act has spawned intense sludge research throughout the country. However, the primary focus of most land application research had been on the technical aspects (methods, environmental impacts, and public health concerns) (Loehr et al., 1979). Torrey (1979) identified a need for a more holistic approach to sludge management, and suggested that social and economic costs need to be included in a cost-benefit assessment. Loehr et al. (1979) stated, "Equally important to the success of a land application system is its acceptance by the public. The social and economic aspects are the most difficult for the project engineer to define and evaluate" (p. 173).

Should recycling of sludge become environmentally safe and cost effective, public acceptance will still be a major consideration in its acceptance. Congress recognized this in the Federal Water Pollution Control Act, and specified that national programs shall "initiate and promote the coordination and acceleration of research designed to develop the most effective practicable tools and techniques for measuring the social and economic costs and benefits of activities which are subject to regulation under this ACT (Sec. 104, a6). Also,

in the Clean Water Act of 1977 (PL 95-217), amending the Federal Water Pollution Control Act, Congress added that the EPA "...shall develop and operate... a continuing program of public information and education on recycling and reuse of wastewater (including sludge), the use of land treatment, and methods for the reduction of wastewter volume" (Sec. 38).

Statement of the Problem

In 1980, the EPA, through the Michigan Department of Natural Resources (MDNR), provided a grant to Michigan State University to study the feasibility and effects of sludge application to upland forest types in the northern lower peninsula of Michigan. The purpose was to show that sludge could be used to treat relatively infertile, droughty soils, and to demonstrate that wastewater sludge is a valuable resource which can increase forest productivity without degrading the environment (Project Outline). Specifically to be studied are:

a) Vegetation changes in structure, composition, and biomass;

b) Nutritional changes of the vegetation;

c) Trace elements in the vegetation and small mammal populations;

d) Wildlife population responses to application;

e) Fate of trace elements and other sludge components in the soil;

f) Bioaccumulation of trace elements in upper level carnivores;

g) Groundwater quality sampling.

Initially chosen for study were four upland forest communities located on state land on the eastern side of Kalkaska County. The sites were selected because of their close proximity to each other, and

because they had well-drained soils and were easily accessible by good roads.

The sludge to be used on the sites was expected to come from Jackson, Michigan, a city of about 50,000 people, located in the southern part of the state. Jackson has a moderate industrial base, and its sludge was selected for several reasons. The sludge has a moderate loading of heavy metals from industry (which researchers wanted to monitor), and the sludge is also used in agricultural research. This would allow researchers to compare the effects of application on forest and agricultural land.

In January 1981, the MDNR chose to present the details of the forest study plan to the Kalkaska County Board of Commissioners. Shortly thereafter, the County gave its verbal approval of the project. This position would later be reversed following public protest. In March 1981, following a joint public meeting attended by more than 100 affected township residents, each of three affected township boards passed a resolution not to approve the project.

In an April 9, 1981 letter to the MDNR, Oliver Township gave the following reasons for its disapproval:

1. A very big waste of tax money.
2. No benefit to this township or county.
3. Fear of water (ground and North Branch) contamination with heavy metals.
4. MDNR had a very poor monitoring system (i.e., uncovered wells).
5. Do not trust the MDNR.
6. Fear of damage to the ecosystem.

Also, Tom Nixon of Kalkaska County Planning and Zoning stated, "We feel sludge from Jackson should be kept in the Jackson area if you wish to experiment with it." (Letter to MDNR, April 6, 1981).

As a result of the public uproar, the MDNR decided to abandon plans for sludge application in Kalkaska County and chose a new study area in Montmorency County, located north and east of Kalkaska County. They also decided to use sludge from Alpena and Rogers City, which are in counties neighboring Montmorency. These cities are considerably smaller than Jackson, Michigan, and they have a much smaller industrial base.

The proposal this time was presented to the Northeast Michigan Council of Governments (NEMCOG), which approved the project and allowed the study to proceed. The subsequent citizen reaction to the Montmorency study sites was, and has continued to be, considerably different from the Kalkaska County public reaction. As of February 1982, with two of the sites already treated with sludge, the MDNR had still not received one citizen objection to this project in Montmorency County.

In summary then, two seemingly similar northern Michigan coummunities have reacted in an almost polar manner to a sludge research proposal. The only variables that changed between counties were the source of the sludge and the methods used to gain civic and public acceptance. This study will decide if these changes were enough to calm community objections, or if other impinging variables shaped the public's reaction to this issue.

Purpose and Research Questions

The purpose of this research will be to identify and compare the important factors contributing to citizen attitudes and behaviors toward sludge application under MDNR supervision in the two affected counties.

More specifically, research questions to be studied are:

1. What variables may be inferred to explain the sludge application proposal's acceptance by Montmorency County residents and its rejection by Kalkaska County residents?

2. How do the following selected demographic variables compare between random samples of Kalkaska and Montmorency County residents?

   a) age
   b) sex
   c) education level
   d) income level
   e) occupation
   f) affiliation with organizations (local or national)
   g) usage of state forest lands

3. What relationships exist between the above demographic variables and

   a) beliefs concerning sludge treatment and its alternatives...
   b) values and concerns pertaining to sludge treatment alternatives...
   c) attitudes toward the use of sludge treatment alternatives...
   d) behaviors toward the proposed sludge treatment demonstration project...

   ... within and between Montmorency County and Kalkaska County residents?

4. How does the extent and accuracy of the belief systems compare between Kalkaska and Montmorency County residents?

5. What relationships exist among

   a) beliefs...
   b) values...
   c) attitudes...
   d) behaviors...
   e) information sources...

   ... concerning land application of sludge within and between residents of Kalkaska and Montmorency counties?

6. How does proximity (township) to the proposed sites influence public...

   a) awareness of...
   b) attitude towards...
   c) behavior towards...

   ... the sludge application project?

Importance of This Research

This research is important for several reasons. First, little study has been done on the knowledge of citizens about specific environmental problems and programs. Further, it has been proposed that agency administrators feel that "many people are uninformed, or misinformed, and that greater public knowledge would bring wider endorsement of their programs" (Bultena et al., 1977). Arbuthnot (1977) states that managers/planners must assess and understand the behavioral variables that are present in the different subgroups within a population, and then tailor programs to meet each group's individual needs.

The information gathered from this research will provide a tool with which to assess public attitudes concerning sludge treatment alternatives and identify education program needs. Also, it will define the population types that are more likely to take action, and recommend public involvement procedures.

Chapter 2

REVIEW OF RELATED LITERATURE

In the United States, the volume of municipal sludge requiring disposal is estimated to be about 17,000 dry tons per day (Kover, in Torrey, 1979, P. 154). This volume is expected to increase to 23,000 dry tons per day over the next ten years. The increased volume can be attributed largely to the implementation of natiowide secondary water treatment, as mandated by Congress.

At present, the disposal methods that are primarily being used include: ocean dumping, landfilling, incineration, and land application. In 1976, these disposal methods constituted the following percentage of our national sludge production (Bastian, in Torrey, 1979, p. 116)

Disposal Method	Percentage Use
Ocean dumping	15%
Incineration	35%
Landfilling	25%
Land application	
crops	20%
other	5%
	100%

Currently, each of these disposal methods is under scrutiny from a variety of social, political, or environmental forces. Ocean dumping was mandated by Congress to cease by the end of 1981. However, a

Federal Court ruling voided this Act because the Federal Government had not proven that any significant damage was caused by this practice (Hale, 1982). As a result, the future of ocean dumping is still pending.

The main objective of incineration is volume reduction and sterilization of the end product (Loehr, 1981). Incineration is currently the most widely used sludge disposal method. However, it has several major shortcomings. Incineration reduces sludge to 30 percent of its dry weight volume, leaving a highly concentrated ash that must still be disposed of in landfills (Sivinski and Morris, in Torrey, 1979, p. 117). Incineration is also very expensive due to the fossil fuels required to dry and burn the sludge. Finally, the incineration process produces air pollutants (nitrogen and sulfur oxides, heavy metals, and some toxic organics). Scrubbers can be used to reduce these pollutants and concentrate a portion of them into a liquid waste. This new waste must then be disposed of as well (Loehr, 1981).

With careful management and planning, landfills can be an environmentally safe method of sludge disposal. However, poor management or landfill design can lead to groundwater or surface water pollution, as well as odor problems and a deterioration of the area's aesthetics (Loehr, 1981). In addition, Sivinski and Morris (in Torrey, 1979, p. 117) state that the major difficulties with landfills are the "unavailability or unacceptability of land for landfills, high transporation costs to sites suitably distant from cities, and nuisance complaints... as suburban areas expand from core areas."

Recently, increased attention has been given to disposal methods which return the "wastes" to the soil in a more productive way. As a

result, agricultural and forest application of sludge are being increasingly utilized as management methods which help turn wastes into resources.

Liquid sludge contains the essential plant nutrients nitrogen, phosphorous, and potassium at levels of about one-fifth those found in commercial fertilizers (Jones, 1981). It has been estimated that between 2 to 5 percent of the United States fertilizer needs could be met by applying sludge of acceptable quality (Bernard, in Torrey, 1979, p. 167). In addition, the application of sewage sludge helps add to, or maintain, the soil's organic matter levels (Jacobs, 1981). Therefore, sludge can be used as a low grade fertilizer and soil conditioner. Another advantage of sludge as a fertilizer is its stability of production and supply. Most commercial fertilizers are derived from fossil fuels which have fluctuating prices and declining supplies.

Land application of sludge, however, is not without problems which must be carefully considered before application can take place. The nature of the wastewater treatment process concentrates most of the pollutants into the final sludge product (Loehr et al., 1979; and Vigon, in Torrey, 1979, p. 133). The major pollutants of concern in land application are heavy metals, toxic organic chemicals, nitrates, and pathogens. Quantities of each are highly variable in the sludge and are dependent on the influent wastewater characteristics, efficiency of the treatment processes, and the type of sludge treatment, storage, and handling time before site delivery (Loehr et al., 1979).

Due to the large number of variables involved, land application is not the answer for all sludge disposal situations. Loehr (1981) suggests four general factors that should be considered in the design and

operation of a land application system. These include: 1) acreage available; 2) sludge and soil characteristics; 3) climate; and 4) the type of crop grown (including non-consumable crops). Further, the Institute of Water Research (1982) recommends that "land application of sludge... is most cost-effective for smaller rural application sites available within 30 miles of the treatment plant."

No matter how cost effective a land application system is, or how well it is engineered and operated, "public acceptance is often cited as a key determinant for the success of a land application project" (Loehr et al., 1979). It is important to minimize the change of a system being rejected on "social grounds."

Public Participation

In 1971, Henning stated that "modern public administration appears to operate on a crisis basis with an immediate problem-solving orientation." To many observers of the resource management process, little has changed in the twelve years since this statement. Crisis management still prevails as managers attempt to respond to environmental emergencies or public outcry.

As a possible solution to the crisis management problem, Sewell (1971) suggests the adoption of a "holistic rather than fragmented view of the problem." More specifically, he recommends that instead of the physical dimensions being considered apart from the human dimensions, an effort should be made to consider both together. Also, he stresses the importance of involving the public more directly in the planning process.

Stamm and Bowes (1972) believe that "the present situation where the public merely reacts to fixed solutions offered by governmental agencies should *not* be tolerated in a time where the changes invoked by such solutions have far-reaching effects on the environment and the quality of life." Further, Maloney and Ward (1973) state that we must go to the people to understand environmental behaviors, to determine what they know about ecology, the environment, and pollution, to determine how they feel about the environment, and to determine what environmental commitments they are willing to make, and which ones they actually carry out. Hendee and Harris (1970) feel that "proper management... is at least part dependent on the accurate perception of user attitudes and preferences by managers."

This stated need for managers/planners to assess and involve the public in environmental management planning is often difficult to find in real life. Borton and Warner (1971) state that "improved means of communication and citizen participation have become highly sought but seldom accomplished objectives of planning programs." Bultena et al. (1977) reviewed several articles and concluded that "governmental resources agencies... historically have displayed little commitment to acquainting the public with their plans; information dissemination is often one-sided, emphasizing project benefits to the exclusion of costs and/or being selectively orientated to clientele groups that are seen as endorsing agency views."

The above statement is further verified by a study conducted by Stamm and Bowes (1972). They were able to trace most of the media coverage of a flood control project to Army Corps of Engineer sources. This provided a possible explanation of the public's ability to list

project benefits much more readily than costs, even though the impact statement listed many possible disadvantages and potential problems. The Corps was apparently able to effectively communicate the project's expected benefits, but left the public in doubt about potential harmful effects associated with the project, or how the Corps would deal with these problems.

Bultena et al. (1977) went on to suggest that under current resource planning procedures, a planning agency would most often be "cutting its own throat" by disseminating project information. That is, the information provided by the planning agency might sensitize persons to other consequences of the proposal, leading to possible resistance. They felt, however, that "this opposition should go unwelcomed only if the agency has a vested interest in the adoption of its programs."

Managers/Planners Perceptions of the Public

The perceptions that planners/managers have about the public's knowledge and ability to cooperate in the management process plays an important role in determining the approaches used by an agency in involving the public. Several studies provide insight to this aspect of the problem.

In a 1971 study, Sewell interviewed engineers and public health officials that deal with water resources in an effort to estimate their views about involving the public in planning and policy making. He concluded that professionals, particularly in the physical and natural sciences, were skeptical about involving the public. They took the

view that the public is not well enough informed or that too many opinions would make planning impossible. The alternative, the professionals felt, was to present the public with solutions conceived by planners on an accept or reject basis.

In a different situation, O'Riordan (1971) stepped into a struggle that had been stalemated for 18 months. Two neighboring communities refused to agree on "an obvious compromise" resolving a wastewater treatment issue because the councils assumed that the public would not be willing to pay the additional costs for this solution. However, councilmembers indicated that they had made "little attempt to discover just what the public did feel about the matter, nor had they ever clearly stated the relative costs of the alternative proposals in terms which the public could understand - namely, increased taxes."

In sampling the resident's opinions the author found that 80 percent of the affected population were fearful that Shuswap Lake would deteriorate if it was used for further sewage disposal. Further, 56 percent said that they would be willing to pay $50 more in taxes per year (a 12 percent increase in local taxes), to protect the lake's quality, and 20 percent said that they would pay $120 more per year.

In a Massachusetts case study (Lockeretz, 1970), a technical advisory commission tabled recommended air quality standards only to find that a considerable body of public opinion demanded standards 25 to 35 percent better than these levels. Eventually, due to the strong public concern, the commission agreed to tighten the standards, but only to a level considerably lower than the public had requested. Later, the commission's chairman stated that he did not regard the public as "competent" to testify on standards, since they didn't

understand what the numbers meant." Further, he indicated that the only opinion the commission wanted from the public was whether they desired clean air, and that it was up to the technical people to decide how to achieve that goal.

Bultena and Rogers (1974) agree with Lockeretz and state that "agency officials typically are committed to an 'expertise model' of decision making in which only persons with scientific and technical training are deemed competent to make environmental decisions." They go on to state that "there is strong professional resistance to the notion that resource decisions should reflect public attitudes."

Finally, in a study to help judge methods of involving citizens in water resource planning, Borton and Warner (1971) used a pre-post questionnaire to determine how accurately planners perceived the priorities of local opinion leaders regarding area water problems. Initially, planners anticipated that opinion leaders held uninformed viewpoints and preferred "poor" management priorities. However, after an informational campaign was completed, planners and opinion leaders held views and strategies that were almost the same. The authors state that lack of support is often due to an initial difference in viewpoints by planners and the public about what environmental problems need to be addressed, and how to solve them.

The Need for Public Assessment

From the literature cited in the above section, it appears that in many planning situations, the public is either not carefully considered, perceived to be a nuisance by planners, or believed to be

too poorly informed to help in making the management decisions. However, as shown in the studies by O'Riordan (1976), and Borton and Warner (1971), an assessment of the public helped to clarify the public's position regarding the problem and aid in its solution.

Arbuthnot (1977) states that "the success of public policy decision, educational programs and other efforts dependent upon specific individual action in the realm of environmental issues may well hinge upon our understanding of the relationships among personality characteristics, attitudes, and environmental values, knowledge and behaviors." Assessment instruments and procedures for understanding characteristics of an effected population are critically needed by educators (planners) considering public policy formation and decision-making (Baker et al., 1978). The need for assessing the public is also echoed by O'Riordan (1971 and 1976), Bultena and Rogers (1974), Maloney and Ward (1973), Arbuthnot (1977), Hendee and Harris (1978), and Sewell (1971).

There are several advantages associated with public assessment surveys. First, public assessment provides a fuller determination of public interest. This can alert agencies to possible program alterations and help resource managers to better reflect "prevailing or emergent values in the population" (Bultena and Rogers, 1974). Second, assessment allows managers to identify and weigh the affected publics' information and the levels and effect of any distortion (O'Riordan, 1976). Third, public surveys help in the understanding of, and possible modification of, critical behaviors (Maloney and Ward, 1973). Fourth, assessment helps to smooth managerial paths by demonstrating a commitment to public participation (Lowenthal, 1966). Fifth, surveys

are important not only in planning and implementing managerial programs, but they also can be used to evaluate program success or failure by engaging citizen reaction (Maloney and Ward, 1973). Finally, opinion surveys can be used to gather the views of a representative segment of a population (Bultena and Rogers, 1974). A good survey also encourages citizens to begin thinking about an issue. It is an educational tool.

With regards to this last point, Heberlein (1976) has stated public participation approaches such as public hearings and workshops often lack full representation by affected publics. Often those attending these functions have a vested interest in the issue, or will be negatively affected by the management decision. Bultena and Rogers (1974) found that their public opinion data showed different conclusions about public interest than would normally be seen in the normal public participation process.

While public opinion surveys are more representative of an affected populations' views, they also have several drawbacks (Heberlein, 1976). The development of reliable and valid survey instruments require considerable time and expense. Also, public attitudes are often unstable and subject to change because the surveyor may be assessing the attitudes of an uninformed public. An interesting twist to this, however, is that as mentioned earlier, the public is often uninformed because of inadequate information and education programs by managers/planners.

Components of Public Opinion and Participation

The dynamics of the public opinion and participation process must be examined closely for better understanding. O'Riordan (1976) states that "personality, opinion formulation and political behavior interact through the meshing of three levels of orientation, namely: the cognitive (relating to knowledge and beliefs); the affective (relating to feelings of like or dislike); and the evaluative (relating to judgements of goals and modes of action) with regard to oneself, to other actors, to the political setting and to the various roles and rules envountered in the resolution of an issue."

The next portions of this section will review the available literature regarding O'Riordan's three levels of orientation (to be referred to as beliefs, values, and attitudes/behaviors) as they relate to the environmental assessment and management process. In addition, each part will discuss the possible effects that an individual's demographic characteristics have on that level of orientation.

Beliefs

Langenau and Peyton (1982) summarize that knowledge is a complex array of beliefs, in which some beliefs are more fundamental and important than others. These important beliefs were termed "central" beliefs by Rokeach and Rothman (1965), and they form the bases on which a vertical array of related beliefs are built. Individuals have many vertical belief arrays which interconnect horizontally to link a belief array with others which have related topics. The foundational (central) beliefs of a vertical array are theorized to be more resistant to change than those in the higher orders of that array. As

a result, a change in the more foundational beliefs would be expected to also have a considerable effect on beliefs higher on the vertical array.

Bultena et al. (1977) identify "structural" factors and "personal" factors as potential constraints on a person's knowledge about environmental problems. They indicate that there are numerous structural constraints, and some of them are a result of efforts by program planners. As mentioned earlier, these might include a lack of information available to the public, neglecting various types of publics, and providing biased information to the public.

The second set of potential constraints is "personal" factors. The authors feel that a person's knowledge may reflect his location in the social structure. For example, the upper class are more likely to be exposed to a proposed program than the lower class, due to their greater organizational involvements and greater access to the mass media. Further, they suggest that older persons may have less opportunity than younger persons to become informed regarding natural resource programs. Buttel and Flinn (1978) found that a person's place of residence was the largest contributing factor in awareness of environmental problems. Thus, proximity to the problem heightens awareness in many cases. Bultena et al. (1977) state that "persons who anticipate reaping either benefits or costs of programs would appear to have more incentive to become more informed about these programs than persons who feel they are unaffected." Force et al. (1977) found that a "very important determinant of interest in the problem is the individual's remoteness to the problem and/or immunity to the consequences." The reader should note that remotenes or immunity to a

problem can act as either a stimulus or deterrent to action. Some local issues are of concern to, and acted upon by, only area residents, while in other issues, the source of controversy (e.g., an industry) may dominate the psychology of an area and actions may come from residents immune to the consequences or from outsiders.

Another aspect of public belief systems is the avenue by which individuals receive their information. In several surveys, mass media (newspaper, television, and radio) and conversation with friends appear to be the major sources of information to affected publics (Stamm and Bowes, 1972; O'Riordan, 1971; Borton and Warner, 1971; Arbuthnot, 1977). Arbuthnot went on to say that those with proven environmental behaviors (recyclers) were more likely to get their information from sources requiring relatively high personal effort (magazines and books vs. just newspapers).

Regarding the use of information that is disseminated to the public, Ableson (1972) believes that "the empirical failures in this area stem from an oversophisticated view of the typical individual. In fact, most people do not use information very well, probably because they do not know how." Further, "the advertising fraternity has long had a much more accurate instinct on how to reach the public with 'information' than has the academic fraternity - keep things simple, don't be heavy handed, tie the message to something of central concern to the individual, and rely on repetition." Zajonc (1968) gives evidence that repetitive exposure to informational stimulus produces substantial increases in the liking of it. Repetition seems to overcome the tendency of mild conflict and discomfort due to a sense of unfamiliarity with that object. Therefore, managers must keep in mind

that a population's opposition to a new plan might be caused initially by residents' unfamiliarity with the information.

In closing this discussion about information and beliefs, it must be remembered that people tend to strive for consistency in their belief systems (Heberlein and Black, 1981). When they receive new information which is in conflict with pre-existing belief systems, Langenau and Peyton (1982) suggest that a person may react in 1 of 3 ways: 1) to reject the new information and not incorporate it in their belief system; 2) to modify the information so it does not conflict with existing beliefs; or 3) to modify their existing belief systems to incorporate the new information without conflict. Further, the degree of conflict with existing beliefs, perceived credibility of the information source, and the interest level of the individual also influence the response of the individual to this conflicting information. Regarding credibility of the information source, Helmreich (1972) states that "the positive relationship between communicator credibility and attitude change has been one of the most stable replicable effects in social psychology."

Even when the planning agency does attempt to accurately inform and involve the public, the information transfer process is often subject to many problems. O'Riordan (1976) suggests that individuals tend to select and distort information, especially "when the issue is confusing, when data is unavailable or indeterminate, and when policy making institutions are uncertain of their responsibilities."

Values

"A value is an enduring belief that a specific mode of conduct or end-state of existence is personally or socially preferable to an

opposite or converse mode of conduct or end-state of existence" (Rokeach, 1973). Put another way, a value is "a conception, explicit or implicit, distinctive of an individual or characteristic of a group which influence the selection from available modes, means, or ends of action" (Kluckhohn, 1953, p. 59). Knapp (1972) suggests that values are a guiding force that determine the choices people make in living their lives.

Rokeach (1973) identifies five assumptions about the nature of human values: 1) the total number of values that a person possesses is relatively small; 2) all men everywhere possess the same values to different degrees; 3) values are organized into value systems; 4) the antecedents of human values can be traced to culture, society and its institutions, and personality; and 5) the consequences of human values will be manifested in virtually all phenomena that social scientists might consider worth investigating and understanding.

As mentioned, values, like beliefs, are organized into systems. These systems are learned organizations of principles and rules which help an individual to choose between alternatives, resolve conflicts, and make decisions (Rokeach, 1973). The organization of values into systems is probably similar to that of beliefs, with horizontal and vertical structure, and more central values (Langenau and Peyton, 1982). This interrelationship brings an interaction of different values, and as such they probably do not function as single entities.

Not only does a value reflect an individual's desire for a broad category of objects, feeling, or experiences, it also has a second aspect, a ranking or hierarchy of value categories (Nye, 1967; Rokeach, 1973; Sikula, 1971). In a situation where an individual must evaluate

alternatives, the values in the system (mind) must be assigned relative importantce (Langenau and Peyton, 1982). "A person desires one class of objects or experiences more than another" (Nye, 1967). Further, under ideal circumstances, "this process requires an individual or group to identify, evaluate, and prioritize values and supporting beliefs" (Langenau and Peyton, 1982).

Because values represent preferred outcomes or preferred ways of achieving those outcomes, they are very important determinants in an individual's personality. Dillman and Christenson (1972) state that "a person's values serve as standards against which he judges his behavior." These standards also lead us to take positions on social and environmental issues. They go on to state "the significant question is not whether or not people are concerned [about the environment], but where protection of the environment ranks on their value hierarchy."

Regarding demographic characteristics as they relate to values and concerns, Van Liere and Dunlap (1980) reviewed available literature to determine what relationships might exist. They concluded that persons that were younger and/or those more highly educated had higher scores of environmental concern. They also found a slight relationship between higher occupational prestige and environmental concern. There was little or no relationship for income level or sex when compared with environmental concern. However, because most of the 23 authors reviewed measured generalized environmental concern, Van Liere and Dunlap state that "given the widespread distribution of generalized environmental concern, we believe it would be profitable to focus attention on specific environmental issues and policies."

If managers are to understand the sources and implications of

environmental attitudes and behaviors, then, argues Pierce (1979), their value bases must be of central concern. Henning (1971) notes that environmental policy encompasses the individual's unique values that pertain to ecology, future generations, and other forms of life. Further, because individual and collective value priorities may vary over time, "values are difficult, if not impossible to describe and analyze in realistic and concrete terms relative to power and policy." As such, the task of assessing values is extremely difficult. However, because of the impact that values have on behavior, it also becomes an extremely important task.

Attitudes/Behaviors

Behavior is defined as the action or reaction of persons under specified circumstances. It can also be categorized by no action at all. Behavior is the primary target that managers/planners attempt to both influence and predict when dealing with the public's resources.

Unfortunately, however, the behavior of an individual or group is extremely difficult to predict. A complex array of values and beliefs that is unique to every individual may cause a single common behavior that was arrived at by vastly different evaluation processes. Due to the complexity of these systems, Wicker (1969) states that "research is needed on various postulated sources of influence on overt behavior. Such research may lead to the identification of factors or kinds of factors which are consistently better predictors of overt behavior than attitudes."

The above statement specifically refers to attempts by a large number of environmental researchers to predict behavior through

attitude measurement. Attitudes are defined as a person's favorable or unfavorable expression toward a class of objects (Knapp, 1972). Traditionally, an attitude is considered to have belief, value, and behavioral components (Borden and Schettino, 1979). The behavioral component of an attitude refers to an implied action or behavioral tendency toward an object.

It is the ability of an attitude to predict the behavior component that makes it so attractive to managers/planners. However, most past attempts to demonstrate an attitude-behavior relationship have failed. Wicker (1969), based on a review of attitude literature, states that research "provides little evidence to support the postulated existence of stable, underlying attitudes within the individual which influence both his verbal expressions and actions."

Wicker (1969), Schwartz and Tessler (1972), and Weigel et al. (1974) suggest that a wide variety of factors could affect the attitude-behavior relationship. They fall into two broad categories: situational and personal factors. Situational variables include actual or considered presence of certain people, normative prescriptions of proper behaviors available, specificity of attitude objects, unforeseen extraneous events, and expected and/or actual consequences of various acts. Personal factors include competing attitudes or motives, verbal, intellectual and social skills (demographics), and activity levels.

Regarding the demographic impacts on the attitude-behavior relationship, Weigel (1977) reported a pattern similar to those reported for values and beliefs. He reported that subjects exhibiting pro-ecology behavior were more liberal in their social, economic, and religious philosophies, were better educated, and were higher in

occupational status. Buttel and Flinn (1978) reported that age had a significant influence on environmental attitudes.

Knowledge about an environmental issue also has direct impacts on the attitude-behavior relationship. Tichenor et al. (1971) found that being informed about an environmental issue does not necessarily mean that a person will be more favorable towards controlling pollution. Persons that were most highly informed of local environmental issues were frequently most opposed to regulations. "Attitudes about a specific environmental measure are at least in part governed by the way persons relate those measures to their own self-interest." Bultena et al. (1977) report similar results and concluded that persons that knew more about a project held more intense attitudes, either for or against.

Ableson (1972) states that informational strategies do not always impact attitude/behavior, especially when the original attitude or behavior is strongly held. Young (1980) concluded that when additional information is provided to the public, it seems to affect approval differently depending on an individual's current knowledge level. Young states that persons with low information levels would show the greatest changes in wilderness approval when provided with additional information.

Many of the past failures in attitude research can now be better understood in the light of current research. Previous efforts primarily used broad (general) attitudes to predict specific behaviors. Several researchers have now concluded that attitude measures which are more specific to a behavior are better predictors of that behavior than are general attitude measures (Weigel, 1977; Heberlein and Black, 1976;

Weigel and Newman, 1976; and Weigel et al., 1974). Further, Weigel and Newman (1976) state that "attitude measures should be expected to predict only behaviors that are appropriate to the attitude under consideration." In other words, specific attitudes are useful only when associated with specific behaviors. These attitudes should not be generalized to other behaviors (Schwartz and Tessler, 1972).

In a recent paper, Langenau and Peyton (1982) have attempted to discount the notions of attitudes as predictive measures of behavior. They define attitudes as "mental constructs that are the culmination of the integrative process and do reflect actual predispositions to behavior." Thus, attitudes represent an individual's predisposition at a point in time. This attitude is not static, however. It is a dynamic, integrative process that continually evolves and is influenced by the personal and situational factors mentioned earlier. Langenau and Peyton have gone on to refine these factors into what they call "Four Dimensions of Orientation." The four dimensions of an attitude include: strength, accuracy, stability, and valence (pro or anti).

Wicker (1969) states that if researchers use attitudes to study overt behavior, they must show evidence that the relationship actually exists. Due to the dynamic nature of predispositions to behavior, Langenau and Peyton (1982) and Tucker (1978) argue that all possible components of the decision making process be assessed. These include an individual's demographic characteristics, beliefs, values, attitudes, and previous actions which are related to the issue.

It is through this complete diagnosis of public perception that managers/planners can best understand human resources and manage natural resources. It will allow them to effectively target

information and education programs, to facilitate the resolution of conflicting public values, and to more completely involve the public in the actual management decision process.

Chapter 3

RESEARCH METHODS

Sludge application to forest lands is a new issue in Michigan. At present, only small scale experimental disposal programs exist. These programs are studying the technical aspects and impacts of sludge application to forest lands. However, the research has generally overlooked social factors which are critical to eventual public acceptance.

The objective of this research, along with a companion study by Gigliotti (1983), is to link current technical disposal research to the human aspects which influence public opinion. To accomplish this, a survey instrument was developed to measure and compare important factors which contribute to the public's attitudes and behaviors. More specifically, this research assessed beliefs and values (concerns) regarding sludge disposal, knowledge of the specific proposal and its anticipated impact, preferred disposal methods, and demographic characteristics. Also assessed were the public's sources of information for environmental issues and the perceived accuracy of several specific sources of natural resource information.

In addition, this study asked respondents to evaluate the public participation process and their perception of their own level of influence on planning and policy. Respondents were further asked

whether present participation methods should be changed, and how much involvement an individual felt that the public should have in natural resource policy and planning.

The survey was designed to measure an individual's belief and value systems, and to assess several specific attitudes. With this detailed information, the researchers can better understand the scope of the individual's attitudinal matrix and more accurately predict behavior concerning sludge disposal alternatives. In addition, the survey was designed so that respondents would give considerable thought to important belief items and value priorities before expressing an attitude in favor of or opposed to forest application. This was intended to increase the reliability of the attitude responses.

Selection of the Sample

Kalkaska and Montmorency counties were selected because residents of both had recently reacted to proposals to apply sludge to their state forest lands. The responses of county residents to the proposals were quite different (see chapter 1). The researchers therefore felt that it would be fruitful to provide the counties with identical surveys and attempt to determine what, if any, differences exist between these populations that would account for their responses to this issue.

The general public sample (Kalkaska, N=497; Montmorency, N=497) was randomly selected by computer from the population of resident licensed drivers that were 20 years of age or older. The potential population of drivers in Kalkaska and Montmorency was 7,882 and 5,644,

respectively, or approximately 7.5 percent of the available populations. While this sampling method does exclude non-drivers from the survey process, it was found to be the only feasible method to sample a resident population on a county-wide level, especially considering that a large portion of the countys' landholders were not permanent residents.

Political office holders (Kalkaska, N=29; Montmorency, n=20) were also surveyed because this group is expected to be more influential in, and responsible for, decisions regarding natural resource issues and problems. The political office holders selected included County Commissioners, township supervisors, and township clerks. These represent the highest level elected officials in the two counties. All of these officials from each county received the survey.

The public officials were administered the same instrument received by the random public sample. The resulting data from public officials were used only for comparison with the general public's opinions, and were not incorporated into the public's data base.

Administration of the Instrument

The survey, "Kalkaska (Montmorency) Public Opinion Survey on Natural Resource Management", was administered using a series of three mailings. The mailings included an initial mailing of the survey (sent July 6, 1982), a reminder postcard to non-respondents (July 13), and a second survey mailing to the remaining non-respondents (July 30). The initial and third (second survey) mailings consisted of three

enclosures (Appendix A): 1) a survey; 2) a cover letter; and 3) a response envelope to return the survey.

The identical instrument was sent for both the initial and third mailings. However, a different cover letter was sent with each of the survey mailings. In general, the letter explained the importance of the survey, the value of their opinion, a reassurance of confidentiality, and identified the source from which the survey originated.

Dillman (1978) recommends that to increase response rates, surveys should be mailed and returned using first-class postage. In this situation, the researchers decided against this suggestion due to the large survey sample, a low anticipated response rate due to the nature of the issue, and due to the additional expense of first-class postage. Instead, the survey was sent using the bulk mail system. Return postage on the bulk mailings was guaranteed to provide a better estimate of non-response due to undeliverable questionnaires. Return envelopes were the business reply format, with postage paid upon delivery to the researchers.

The researchers decided not to conduct a non-respondent follow-up survey. However, because this survey closely paralled a survey developed by Gigliotti (1983), and contained many identical items, it was assumed the results of his non-respondent telephone survey could be generalized to this situation. In general, Gigliotti found that non-respondents were younger and tended to be less opinionated than respondents. However, most key variables compared showed no significant difference between these groups.

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Description of the Survey Instrument

In an attempt to increase the response rate, the researchers rsonalized the surveys to each specific county. That is, any ferences to a county in the survey would address that county by name. ıer than use of county names within the instrument, the surveys were ntical. Each questionnaire identified Michigan State University, artment of Fisheries and Wildlife, as the project administrator.

The survey was designed with five major content sections. These tions attempted to obtain a different type of information or view- nt. Below is a description of each section and the rationale for items which were included. The complete survey is included in endix B.

Public Involvement in Natural Resource Decisions

This section assessed respondents' opinions about the public icipation process and their perceived accuracy of information ces.

More specifically, questions 1 and 2 asked respondents whether felt involved enough in natural resource decisions and whether cies should change the methods used to involve the public. tion 6 asked the level and type of involvement that respondents the public should have. Questions 3 through 5 asked individuals ate the level of influence they can have on local, state, and ral agencies.

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The first series of questions (1-5) were designed to be easy to wer and to be of concern to respondents, as recommended by Dillman 78). He further suggests that researchers might design these ning questions with no intent of analyzing them. It is important egin with questions that attract interest and cause individuals to t answering the survey. Individuals who respond to the first few tions are more likely to complete and return the survey (Dillman,).

The remaining questions in this section (7 through 19) asked ondents to rate the accuracy of information sources. The response e ranged from "always accurate" to "never accurate." A "no ion" response was also provided. These questions were designed to e the level of trust that the public has for various information ces. This will identify potential avenues through which rmation/education programs could be disseminated to, and received a more trusting audience.

Knowledge of the Proposed Sludge Application Project

In the opening portion of this section, the concept of sewage e was introduced and explained to participants. Respondents were med that in 1981 a proposal was made to apply sludge to state t lands in their county.

The first question in this section, number 20, asked respondents ey were aware of the proposal before receiving this questionnaire. ndents that were unaware of the proposal are asked to move ahead e next section, question 31.

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The remaining questions in this section asked those respondents aware of the project to indicate their attitude toward the proposal. They were also asked to identify actions taken to block or promote the project, their familiarity with the details of the project, and their sources of information about the proposal.

The question on actions taken (number 22) will help the researchers to determine what type of person is more likely to take action. The researchers related action to knowledge of the issue, and to attitudes toward the issue.

As mentioned, this section also assessed knowledge specific to the proposal (questions 24 through 29) to determine how well the public understood its details. Respondents were asked whether they agreed or disagreed with statements related to the proposed source of the sludge to be applied, the magnitude of the acreage involved, the funding source, and the townships affected, among others. A response of "Don't know" was also provided. The six questions were scored and given one point for each correct answer. The resulting knowledge score allowed the researchers to relate level of familiarity with an issue to attitudes toward that issue.

In the analysis of this survey, a slight distinction was made between knowledge and beliefs. Beliefs were considered to be something which an individual accepts as true, and knowledge as a judgement of an individual's beliefs by "authorities" in the field.

The final portion of this section (question 30) asks respondents that were aware of the proposal to check all the sources from which they received information. These results helped to determine the most frequently used communication channels which provide information to the public about a local natural resource issue.

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3) Opinions About Sludge Disposal

This section measured the respondent's knowledge (beliefs) and opinions about sludge disposal and their environmental/economic value orientation.

The section began with a block of 19 questions (numbers 31 through 49) which were scored using a Likert scale. The scale ranged from: Strongly Agree - Agree - Don't Know - Disagree - Strongly Disagree. Within this block of questions, eleven were combined to form a sludge knowledge score. This score was analyzed against attitudes, preferences, and personality characteristics of the individual to determine what role knowledge had in this specific resource management issue.

Also included in the block of opinion questions were four statements (numbers 37, 42, 45, 48) which determine a person's environmental/economic value orientation. Respondents were asked to respond to statements such as: "Although environmental considerations are important, the environmental considerations should not stand in the way of progress and economic growth" (question 42). A Likert scale was scored for the four environmental/economic value items using +2 for a strong environmental orientation and -2 for a strong economic orientation. The individual's score for each item was totaled to give the respondent an overall environmental/economic value orientation.

In addition, the block of 19 questions also included statements which were not included in any scales, yet helped to further define the complex attitude/behavior relationship. For example, question 39 states that "I would be skeptical of most management programs proposed by the Michigan DNR." Pettus (1976) feels that some environmental attitudes influence or preclude the development of other attitudes.

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This item, along with questions 41 and 43, helped to gauge the degree of influence that other attitudes had on a respondent's attitude toward the sludge application. The assessment of potentially conflicting attitudes has important implications for any attempt to involve the public in sludge disposal issues.

In another part of the opinion section (questions 50 through 58), respondents were asked to assess the overall effect of applying non-industrial sludge to state forest lands. The anticipated effects considered ranged from the impact of sludge on forest growth, on public health, and on long-term environmental quality. A scale was established by adding an individual's responses over the nine effect questions. The response scale ranged from: Very Beneficial (+1), Beneficial (+2), No Impact (+3), Harmful (+4), Very Harmful (+5), and Don't Know (0).

Question 59 asks respondents if they felt that a program of sludge application to state forests would be properly managed by local and state agencies. Responses to this question were compared with attitudes toward application to forest lands and attitudes toward the Michigan Department of Natural Resources.

The final series of questions in this section (questions 60 through 65) asked respondents to rate the four possible methods of sludge disposal. These include landfilling, incineration, application to agricultural lands, and application to forest lands. Respondents were asked to list the method that they felt had the least and greatest threat to human health, and to the environment, and which they felt were the least and most expensive methods.

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4) Attitudes and Concerns About Sludge Disposal

The questions in this section asked respondents to rank disposal methods, to state their attitude toward future application proposals, and to rate concerns. Concerns were rated according to the value each should be given when a sludge-forest application project is being considered.

In questions 66 through 68, respondents were asked to rank the four disposal methods (listed above) in order of their first, second, and third preference. The importance of this question is in its ability to determine how forest application compares with other methods of disposal.

Question 69 measured the respondent's attitude toward future sludge application to state forest lands. This question was broken down and analyzed two ways: 1) specific attitudes toward a forest proposal (opposed, favor, or undecided); and 2) the level of action that respondent's anticipated taking. The measure of attitude and action, and the earlier preference question, were compared with beliefs, value measures, awareness of the previous proposal, and personality characteristics.

Question 70 asks respondents to place a numerical value on the four major concerns that they might have regarding sludge application to forest lands. Respondents are asked to divide 100 points among the four listed concerns (human health, economic costs, environmental quality and wildlife, and beauty of the area) according to the amount of importance each should receive when making sludge management decisions. This question was analyzed to determine how these specific central values impact attitudes and what personality characteristics

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are related to the different central values. More importantly, these items will provide an indication of the value priorities which will be used by publics to evaluate future sludge disposal and other natural resource proposals.

5) Personal Information

This final section categorized and described respondents and related demographics to responses throughout the questionnaire. Specifically, respondents were asked their sex, age, education level, income level, occupation, what (if any) political offices they held, their use of state forest lands, their most important forest use, residency (township and years in the county), and memberships in environmental organizations.

Instrument Validity and Reliability

Items used in the survey instrument were generated after a thorough review of literature relating to sludge disposal and survey research. Consultation with experts in both sludge disposal and survey research were made periodically throughout the instrument development process.

Item questions were reviewed by peers for clarity and understanding. The draft questionnaire was submitted to a face validity panel consisting of six members associated with sludge disposal and/or forest application of sludge. Each member reviewed the questions dealing with beliefs about sludge and indicated which response best answered the question. Ambiguous questions were either reworded or omitted.

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Responses by the face validity panel were used as a basis for comparison with the responses received from the public samples.

The instrument was also submitted to a panel for evaluation of its overall design and readability. This panel consisted of four MSU researchers with expertise in the field of survey design. Comments from this review panel were incorporated into the final revision.

The revised draft instrument was field tested using a senior level college class. Subjects were observed as they completed the survey to detect attitudes toward various sections. They were also encouraged to discuss their reactions to specific parts of the survey. The instrument was again revised accordingly.

Data Analysis

Data were punched onto computer cards and verified by Michigan State University key punch services. Analysis utilized descriptive and inferential statistics offered by the Statistical Package for the Social Sciences (SPSS) computer software. A discussion of the statistical treatments used will be included with the description of the results.

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Chapter 4

ANALYSIS OF SURVEY RESULTS

The following chapter begins with a summary of the response rates of the four survey populations. This is followed by a brief description of the sample population's demographic characteristics, a discussion of the descriptive data, and a comparison of the sample populations. The final sections of this chapter analyze the influences that affect knowledge, values, attitudes, and behaviors.

Survey Response Rates

A detailed breakdown of the response rates for Kalkaska and Montmorency and the public officials are provided in Table 4.1. The three mailings produced a combined response rate of 62.4 percent. Note that the reported response rate excludes undeliverable surveys and includes surveys that were returned blank.

Table 4.1. Response Rates of the Four Survey Populations.

	Kalkaska Sample	Montmorency Sample	Kalkaska Officials	Montmorency Officials
Total individuals sampled	497	497	29	20
Undeliverable surveys	62	39	0	1
Adjusted sample size	435	458	29	19
Total surveys returned	255	292	26	14
Percent response rate	58.6%	63.8%	89.7%	73.7%
Blank or spoiled surveys	10	7	0	1
Tot. individuals analyzed	245	285	26	13

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Summary of Demographics

The discussion in this section only encompasses the highlights of the data for the random sample populations. A complete presentation of the descriptive demographic data is provided in Appendix C, Questions 71 through 83.

In general, the demographics for the randomly selected populations were quite similar (Table 4.2). In both counties the sexes were represented fairly evenly (52.5% male and 47.5% female). About 80 percent of the respondents (Kalkaska, 81.2%; Montmorency, 79.6%) had at least a high school education. Income in both counties was also similar (Table 4.2) with the largest concentration of incomes in the $8,000 to $15,999 range. About 25 percent of the population in the counties reported incomes of less than $8,000, and 77.4 percent of the listed incomes were below $24,000. Respondents lived in the county an average of 16.6 years, however, more than half were residents less than 10 years.

Two categories of the demographics did show statistically significant differences. These categories were Age and Work Group. In Kalkaska, the respondents' mean age of 46.76 years (S.D.=16.75) was significantly different from 51.22 years (S.D.=16.60) for Montmorency County ($t=3.05$; $df=521$; $p<.01$). The reader should note that the mean ages reflect only licensed drivers 20 years of age or older, and are therefore not comparable with census data.

This difference in age was also reflected in the Occupation question (number 74, Appendix C). The initial nine response choices were combined to form five broader occupation categories. Semi-skilled, sales/clerical, and skilled workers were joined to form a "Skilled or Semi-Skilled Worker" category. Managers and professionals were also

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Table 4.2. Demographic Comparisons for the General Populations.

		Kalkaska Sample		vs. Montmorency Sample T-Test		
		$\bar{X}$	S.D.	value	df	Probability
Age	Kal.	46.76	16.75	3.05	521	.002*
	Mont.	51.22	16.60			
Forest use	Kal.	6.72	3.85	.34	528	.737
	Mont.	6.83	4.06			
Membership count	Kal.	.28	.62	.86	526	.389
	Mont.	.33	.77			
Years of residency	Kal.	16.26	17.15	.57	504	.570
	Mont.	17.14	17.35			

	Chi-Square Test		
	χ^2	df	Probability
Education**	1.19	4	.880
Income**	8.86	5	.114
Work group***	12.25	4	.015*

* α=.05
** See Appendix C for breakdowns
***See Table 4.3 for breakdown

combined. The "Homemaker" and "Retired" classifications were left intact. Finally, farmers and unemployed were combined due to their small numbers to form an "Other" category. No generalizations will be made using the "Other" category. The results of the classification of occupations are provided in Table 4.3.

Table 4.3. Combined Occupational Classifications.

Work Group	Kalkaska Sample (n=241)	Montmorency Sample (n=277)
Skilled or Semi-Skilled Worker	37.3%	26.0%
Manager or Professional	15.4%	18.1%
Homemaker	19.1%	15.9%
Retired	25.3%	34.7%
Other	2.9%	5.4%

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The analysis of the work group variable shows a significant difference between the counties (x^2=12.25; df=4; p<.05). The most prevalent occupational status in Montmorency was retired persons (34.7%), and skilled or semi-skilled workers made up 26 percent. In Kalkaska, those percents were reversed, with 37.3 percent of the respondents in the skilled or semi-skilled classification, and 25.3 percent retired.

Two other demographic variables measured were the use of state forests and memberships in environmental organizations. The forest use question (number 76, Appendix C) listed 17 categories of utilization and asked respondents to list all the activities that they had done on state forest lands in the past two years. Both counties averaged about 6.8 forest uses per person over the two-year period.

Membership in environmental organizations (question 83, Appendix C) was low in both counties, with only 21.8 percent of the populations belonging to any of the 15 listed groups. A breakdown of the number of memberships is provided in Table 4.4. Local landholder associations held the highest memberships in both counties (Kalkaska, 6.5%; Montmorency, 14.0%). Michigan United Conservation Clubs, the National Wildlife Federation, Ducks Unlimited, and An ORV Club were the only other organizations to have more than 2 percent membership in the counties.

Table 4.4. Count of Environmental Organization Memberships.

	Kalkaska Sample (n=245)	Montmorency Sample (n=285)
No environmental memberships	79.6%	76.8%
1 environmental membership	15.1%	17.5%
2 environmental memberships	3.3%	3.5%
3 environmental memberships	2.0%	1.4%
More than 3 environmental memberships	0	0.8%

Summary and Comparison of Opinions

A complete descriptive analysis of belief, value, attitude, and behavior items is presented in Appendix C, questions 1 through 70.

Public Involvement Opinions

To establish a point of reference for this research effort, respondents were asked whether they felt they were involved enough in natural resource policy and planning decisions (question 1, Appendix C). The response to this question was quite consistent for both counties. Approximately 90 percent of the sample respondents felt that they were not involved enough. The combined public officials response was similar, with 82.8 percent of all officials agreeing that the public is not involved enough in natural resource decisions.

In question 2 (Appendix C), respondents were asked if public agencies should change the way they involve the public in natural resource decisions. The results were comparable to question 1, with 85.1 percent of the general public of the opinion that a change should be made. Public officials also agreed, with a combined 82.8 percent holding that opinion. The public attitude for increased involvement seems to be also supported by question 6 (Table 4.5).

Questions 3 through 5 (Appendix C) further analyze the public's perceived level of influence on local, state, and federal natural resource planning agencies. The results show a definite trend by the public. More than half (52.0%) of the randomly selected respondents indicated that they had much or some influence on local government agencies, but only 27.8 percent that felt they had much or some influence on state agencies, and 18.1 percent on federal agencies. About half (51.0%) of the general public respondents felt they had no

Table 4.5. Preferred Level of Involvement in Natural Resource Planning and Policy (question 6).

	Kal. Sample (n=240)	Mont. Sample (n=279)	Kal. Offic. (n=25)	Mont. Offic. (n=13)
I feel that the planning and decision-making should be left totally to the experts.	3.3%	1.8%	0	7.7%
Experts should first obtain the views of the affected citizens and then proceed to do the planning and make the final decision.	40.0%	42.3%	40.0%	38.5%
Experts should only do the early planning and provide the alternatives from which citizens can select.	40.8%	41.2%	40.0%	38.5%
Citizens should control the entire planning and decision-making process and use experts only as consultants and to implement their final plan.	15.8%	14.7%	20.0%	15.4%

influence on federal government agencies. Public officials had similar perceived levels of influence on state and federal agencies (Table 4.6). However, they understandably perceived more influence on local agencies than did the general public (X^2=38.56, df=3; p<.001).

Questions 7 through 19 (Appendix C) asked respondents to rate the accuracy of 13 informational sources. A collapsed summary of the general public's reponses is provided in Table 4.7. This data suggests that the most trusted sources of information would be university sources, and the Michigan Department of Agriculture. Interestingly, the Michigan Department of Natural Resources was also perceived as having a high level of accuracy. Repondents seemed to have the least trust in the information from industrial sources and local government officials.

Table 4.6. Comparisons of Public Involvement Responses.

Group Comparisons	Chi-Square Test X^2	df	Probability
Influence on Local Government			
Kal. Sample vs. Mont. Sample	2.37	3	.498
Gen. Sample vs. Public Offic.	38.56	3	.000*
Influence on State Government			
Kal. Sample vs. Mont. Sample	2.23	3	.525
Gen. Sample vs. Public Offic.	1.85	3	.603
Influence on Federal Government			
Kal. Sample vs. Mont. Sample	3.08	3	.378
Gen. Sample vs. Public Offic.	.39	3	.941
Preferred Level of Involvement			
Kal. Sample vs. Mont. Sample	1.50	3	.681
Gen. Sample vs. Public Offic.	.28	3	.962

* α=.05

Table 4.7. General Public's Perceived Accuracy of Information Sources.

Information Source	n	Always/ Usually Accurate	Sometimes Accurate	Seldom/ Never Accurate	No Opinion
		Percent of respondents			
Univ. Sources	506	55.7	28.1	5.1	11.1
MI Dept. Agric.	502	49.0	34.3	8.4	8.4
MDNR	507	41.8	38.5	16.0	3.7
MI Dept. Pub. Health	500	40.6	40.6	13.2	5.6
Sporting Organizations	502	36.9	38.2	12.4	12.5
Env. organizations	501	34.5	34.3	16.8	14.4
MUCC	501	34.1	37.5	9.4	19.0
EPA	500	23.6	41.0	24.4	11.0
TV/Radio	504	20.2	44.4	28.8	6.5
Newspapers	506	19.0	48.2	25.9	6.9
Magazines	504	18.8	50.4	22.4	8.3
Local Gov't. officials	499	16.4	41.5	34.7	7.4
Industrial sources	501	13.8	32.5	40.1	13.6

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Awareness and Knowledge of the Proposed Sludge-Forest Project

Approximately half of the general public respondents indicated that they were aware of the sludge-forest application project before receiving the survey (Kalkaska, 48.6%; Montmorency, 50.9%). Public officials were considerably more familiar with the proposal than the general public, with 84.6 percent of the officials aware.

A major point of difference between the two general population samples was their attitude toward the forest application project when it was proposed in 1981 (question 21, Appendix C; $X^2=7.52$, df=2, $p<.05$). Of the Kalkaska County residents aware of the proposal, 43.2 percent were opposed, compared to 28.1 percent in Montmorency. However, the 23.7 percent approval rating in Montmorency still is quite low. A large majority in both counties were undecided (Kalkaska, 42.4%; Montmorency, 48.2%). Public officials that were aware of the project were significantly more in favor and less undecided than general public respondents ($X^2= 12.08$; df=2; $p<.01$). Combined officials' responses were 45.5 percent in favor of the proposal.

Question 22 (Appendix C) asked respondents familiar with the 1981 sludge-forest proposal to check any action that they took to block or promote it. The Kalkaska sample primarily talked with friends or relatives (53.4%) or read materials on the subject (47.5%). Only 27.1 percent took no action. In contrast, the highest response category for aware Montmorency residents was no action (45.7%). Other Montmorency actions were similar, but in lower percentages than for Kalkaska; with 43.5 percent indicating they talked with friends or relatives, and only 26.8 percent read materials on the subject. The mean number of actions taken was significantly different for the two counties (t=2.19; df=256;

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$p<.05$). Aware Kalkaska residents took an average 1.27 actions (S.D.= 1.13) and aware Montmorency residents averaged .96 actions (S.D.=1.11).

Public officials from both counties indicated that they took significantly more actions than the general public ($t=2.94$; $df=289$; $p<.001$). The mean was 1.85 actions per official (S.D.=1.39). In addition to having talked with friends or relatives, and having read materials on the subject, officials also had a larger percentage of high effort actions, such as attending meetings.

Regarding the status of the proposal (question 23, Appendix C), 50.7 percent of Montmorency's aware sample correctly responded that sludge had been applied. However, only 23.1 percent of the Kalkaska sample knew that the project had been dropped. Most (48.7%) in Kalkaska indicated they did not know the proposal's current status.

Questions 24 through 29 (Appendix C) were included to assess the public's knowledge of the proposal's details. In general, the sampled publics had a low awareness of specifics. The six questions had "Don't know" responses which ranged from a low of 41.4 percent to a high of 79.4 percent. Correct answers were generally less than one-third of the total responses.

The score created by combining these six items further reveals this trend. The average score for aware Kalkaska residents was 1.66 (S.D.=1.71), compared to 1.42 for the aware Montmorency public (S.D.=1.37). These scores for the sample populations were not significantly different ($t=1.16$; $df=202$; $p>.05$). Public officials were significantly more knowledgeable than the combined samples ($t=4.92$; $df=262$; $p<.001$), with an average score of 3.03 (S.D.=1.45).

The final question in this section asked respondents familiar with the proposal to indicate their sources of information. The general public most frequently utilized newspapers (Kalkaska, 86.1%; Montmorency, 78.8%), TV or Radio (Kalkaska, 61.7%; Montmorency, 35.8%), and friends or relatives (Kalkaska, 42.6%; Montmorency, 47.4%). All other information sources were utilized by less than 13 percent of the general population. Kalkaska residents indicated significantly more sources utilized than the Montmorency sample ($t=3.27$; $df=211$; $p<.001$). Kalkaska residents averaged 2.24 information sources (S.D.=1.30), compared to 1.77 sources for Montmorency residents (S.D.=.97).

In addition to the above information sources, public officials more frequently utilized pamphlets and brochures, public hearings, and workshops or lectures. However, the combined officials did not utilize significantly more information sources than the general public ($t=1.44$; $df=36$; $p>.05$). As a group, the public officials averaged 2.39 information sources (S.D.=1.58).

Public Beliefs and Concerns Regarding Sludge Disposal

This section opened with 19 statements about sludge and environmental management. Two scales were constructed from items within this block of statements. Other items were compared individually, and they will be discussed first.

Question 31 (Appendix C) asked respondents whether sludge disposal was a significant problem for many cities in Michigan. More than 72 percent of each surveyed population agreed or strongly agreed with this statement.

Question 39 (Appendix C) states "I would be skeptical of most management programs proposed by the Michigan DNR." A collapsed version

of the responses is presented in Table 4.8. The results seem to indicate slightly less trust of the Department of Natural Resources by the general public in Kalkaska County than in Montmorency County. Public officials in the two counties had opposite responses, with Kalkaska officials much less trusting of the MDNR than Montmorency officials.

Table 4.8. Public Skepticism Toward Most Proposals of the Michigan Department of Natural Resources (question 39).

	Kalkaska Sample (n=230)	Montmorency Sample (n=270)	Kalkaska Officials (n=25)	Montmorency Officials (n=13)
Skeptical of programs	46.5%	36.7%	60.0%	38.5%
Don't know	24.3%	27.0%	8.0%	7.7%
Not skeptical of programs	29.1%	36.3%	32.0%	53.8%

Respondents were asked in question 41 (Appendix C) to react to the statement: "If sludge is going to be applied to state forests near me, it should not be brought in from other parts of Michigan." This statement evoked a strong agreement from the surveyed populations. The general public averaged 37.1 percent strongly agree, and 35.3 percent agree. The combined disagree and strongly disagree accounted for only 11.6 percent of the general public response. Public officials were also opposed to bringing in sludge, but not as strongly as the public. That is, 28.9 percent of the officials disagreed or strongly disagreed with this statement.

Question 43 made the following statement: "Regardless of whether or not any bad effects result, it is wrong for society to dump sludge in the forest." Responses are presented in Table 4.9. The results seem to indicate a fairly even split in opinion among the general public, while public officials tended more toward disagreement with the statement.

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Table 4.9. It Is Wrong for Society to Dump Sludge in the Forest. (question 43)

	Kalkaska Sample (n=234)	Montmorency Sample (n=274)	Kalkaska Officials (n=25)	Montmorency Officials (n=13)
Strongly agree	20.1%	19.3%	8.0%	7.7%
Agree	22.6%	19.3%	24.0%	7.7%
Don't know	22.2%	25.9%	12.0%	30.8%
Disagree	27.8%	31.0%	44.0%	38.5%
Strongly disagree	7.3%	4.4%	12.0%	15.4%

Eleven questions in the series of 19 items were scored to form a knowledge scale regarding the sludge disposal issue. The questions included in this scale were numbers 32 through 36, 38, 40, 44, 46, 47, and 49. Responses to individual items are presented in Appendix C. Items were scored one point for a correct response, and zero for an incorrect or don't know response. The highest possible total score was eleven. Only individuals that answered all eleven items were scored. Approximately 12 respondents were omitted on that basis.

The resulting knowledge scores averaged 3.47 for the Kalkaska sample (S.D.=2.65), and 3.25 for Montmorency's public (S.D.=2.51). The average scores were not significantly different for the two counties ($t=.92$; $df=478$; $p>.05$). A significant difference was detected when the combined general public was compared with the combined public officials ($t=3.63$; $df=41$; $p<.001$). Officials had an average score of 5.34 (S.D.=3.29).

An environmental/economic value (e/e value) scale was constructed from items 37, 42, 45, and 48 (Appendix C). A positive score was given for individuals with an environmental orientation, and a negative score for an economic orientation. The scale had a potential range of +8 to -8.

The mean e/e value scores showed no significant difference between the two general populations ($t=1.67$; $df=491$; $p>.05$). The averages for both counties showed a greater concern for the environment than for the economy. The Kalkaska sample had a 3.00 average score (S.D.=2.68). Montmorency public averaged 2.56 (S.D.=2.99). Public officials had a slightly lower e/e value score ($\bar{X}=2.43$; S.D.=3.09), however this difference was not significant ($t=.68$; $df=528$; $p>.05$).

In the next series of questions (50 through 58, Appendix C), respondents were asked to select the anticipated effect of applying non-industrial sludge to state forest lands. The combined responses (Table 4.10) indicate an overall public belief that application has more potential harms than benefits. The impact on forest growth is the only category with a sizeable beneficial response.

A scale was constructed from these nine effect items. The score could potentially range from 1 to 45. The average score for the Kalkaska County sample was 24.87 (S.D.=10.63), and 24.18 (S.D.=11.54) for Montmorency general public. No significant difference was detected ($t=.62$; $df=417$; $p>.05$).

Respondents were asked in question 59 (Appendix C) if they felt a sludge-forest application project would be properly managed by local and state agencies. The responses were nearly split, with 44.5 percent of the Kalkaska sample and 50.6 percent in Montmorency of the opinion

Table 4.10. Anticipated Effects of Sludge Application to State Forest Lands (questions 50-58).

Table 4.10. Anticipated Effects of Sludge Application to State Forest Lands (questions 50-58).

	Kalkaska Sample and Montmorency Sample Combined						
Anticipated Effect on:	n	Very Beneficial	Beneficial	No Impact	Harmful	Very Harmful	Don't Know
Forest growth	499	9.8%	41.1%	5.0%	11.6%	3.2%	29.3%
Surface water quality	498	0.2%	1.2%	10.4%	38.4%	14.5%	35.3%
Ground water quality	500	0.2%	0.8%	22.0%	27.6%	13.2%	36.2%
Public health	501	0.6%	0.2%	27.3%	24.2%	11.2%	36.5%
Wildlife habitat	499	1.0%	9.6%	14.6%	27.5%	14.2%	33.1%
Recreation	498	0.2%	1.6%	18.7%	31.3%	19.7%	28.5%
Adjacent property values	500	0.2%	1.6%	15.4%	27.8%	25.4%	29.6%
Wildlife species	499	1.0%	6.4%	13.6%	26.7%	15.4%	36.9%
Long-term environmental quality	499	2.2%	17.8%	9.6%	13.8%	10.6%	45.9%

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that it would be properly managed. Public officials in Kalkaska agreed with 54.2 percent responding "Yes", and Montmorency officials showed the greatest trust of the four groups, with 66.7 percent agreeing. This question does have a limitation, because it is impossible to tell if respondents are reacting to management by state agencies, local agencies, or both.

The next series of questions (60 through 65, Appendix C), deal with beliefs concerning the consequences of the four sludge disposal alternatives (landfilling, incineration, agricultural application, and forest application). The combined results of the general population and public officials are presented in Table 4.11.

The results of Table 4.11 indicate that the general sample viewed incineration as the least threat to human health (44.0%) and to the environment (31.7%). Public officials viewed incineration and forest application as the least threats. Agricultural application was viewed by the general sample as the greatest threat to human health. Forest application was viewed by the general public as the least expensive disposal method (20.6%), while public officials viewed forest application (30.8%) and agricultural application (28.2%) as the least costly. Both groups chose incineration as the most expensive method (general sample, 30.2%; public officials, 51,3%).

Attitudes and Concerns About Sludge Disposal

The first questions in this section (numbers 66 through 68, Appendix C) asked respondents to rank the four disposal choices according to first, second, and third preference. The results (Table 4.12) indicate that incineration is most often the first

Table 4.11. Beliefs About Sludge Disposal Methods (questions 60 through 65).

Table 4.11. Beliefs About Sludge Disposal Methods (questions 60 through 65).

	Landfill*	Incineration*	Agricultural Application*	Forest Application*	No Opinion*
The least threat to human health					
General sample	14.2%	44.0%	6.8%	15.7%	19.4%
Public officials	15.4%	38.5%	3.8%	35.9%	7.7%
The greatest threat to human health					
General sample	24.0%	9.4%	35.5%	5.5%	25.7%
Public officials	33.3%	11.5%	30.8%	0	20.5%
The least threat to environmental quality					
General sample	16.2%	31.7%	9.8%	14.7%	27.5%
Public officials	15.4%	33.3%	10.3%	28.2%	12.8%
The greatest threat to environmental quality					
General sample	19.1%	12.6%	17.2%	19.1%	32.1%
Public officials	28.2%	25.6%	0	15.4%	30.8%
The least economic cost (cheapest)					
General sample	16.4%	16.4%	12.9%	20.6%	33.6%
Public officials	17.9%	2.6%	28.2%	30.8%	20.5%
The greatest economic cost (most expensive)					
General sample	20.9%	30.2%	3.6%	7.5%	37.7%
Public officials	7.7%	51.3%	2.6%	7.7%	30.8%

*Percent of all returned questionnaires. Blanks coded as "no opinion" (sample n=530; officials n=39).

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Table 4.12. Comparison of First Preference for Sludge Disposal (question 66).

Disposal Method	Kalkaska Sample (n=245)*	Montmorency Sample (n=285)*	Kalkaska Officials (n=26)*	Montmorency Officials (n=13)*
Landfill	20.0%	14.0%	11.5%	7.7%
Incineration	38.8%	47.7%	34.6%	15.4%
Agri. Application	19.6%	10.5%	23.1%	15.4%
Forest Application	12.2%	18.2%	30.8%	53.8%
No Opinion	9.4%	9.5%	0	7.7%

*Percent of all returned questionnaires. Blanks coded as "No Opinion".

preference of the Kalkaska sample (38.8%), the Montmorency sample (47.7%), and the Kalkaska public officials (34.6%). Montmorency public officials preferred forest application (53.8%). Responses by the sample populations were significantly different (X^2=15.63; df=4; $p<.01$), and a difference existed between the sample population and public officials (X^2=16.95; df=4; $p<.01$).

For descriptive purposes, the three preference responses were weighted to obtain an overall preference rating. Respondent's first choice was given 3 points, second choice 2 points, and third choice 1 point. No opinion responses were excluded. The results of this weighting are presented in Table 4.13.

The results of preference weighting indicate that incineration is still the most preferred choice for Kalkaska (32.6%) and Montmorency (36.6%) County residents. Public officials in Montmorency also maintained their preference for forest application (36.1%). Kalkaska

Table 4.13. Weighted Rating of Sludge Disposal Preferences (Questions 66 through 68).

	Kalkaska Sample*	Montmorency Sample*	Kalkaska Officials*	Montmorency Officials*
Landfill	25.5%	23.0%	17.6%	16.7%
Incineration	32.6%	36.6%	24.8%	19.4%
Agricultural Application	20.6%	15.3%	27.5%	27.7%
Forest Application	21.9%	25.1%	30.1%	36.1%

*Percent of all returned questionnaires. Blanks coded as "No Opinion".

public officials' highest weighted preference became forest application (30.1%) as opposed to their first preference of incineration.

In question 69 (Appendix C), respondents were asked their attitude and disposition toward action if another proposal was made to apply sludge to state forest lands near them. This question was broken down into attitude components and action components in Table 4.14.

Table 4.14. Attitudes and Anticipated Actions Toward Future Sludge-Forest Application Proposals.

	Kalkaska Sample (n=237)	Montmorency Sample (n=275)	Kalkaska Officials (n=26)	Montmorency Officials (n=12)
Oppose future projects	44.3%	43.6%	38.5%	8.3%
Favor future projects	19.0%	19.3%	46.2%	50.0%
I would get involved	37.6%	37.8%	65.4%	50.0%
I would <u>not</u> get involved	25.7%	25.1%	19.2%	8.3%
Undecided*	36.7%	37.1%	15.4%	41.7%

*Since the two components were combined in the original question, "Undecided" cannot be interpreted for opposition or predicted involvement separately.

Kalkaska and Montmorency general public attitude responses (Table 4.14) were quite similar (X^2=.023; df=2; p>.05), with about 19 percent in favor of future projects. Public official attitudes were significantly different from the general public (X^2=16.93; df=2; p<.001), with about 48 percent of all officials in favor of future forest application projects.

Again, the involvement responses for Kalkaska and Montmorency publics were quite similar (X^2=.028; df=2; p>.05). In Kalkaska, 37.6 percent of the general public said they would get involved, and 37.8 percent in Montmorency indicated they would. As might be expected, public officials responded significantly different than the general public (X^2=7.73; df=2; p<.05), with 65.4 percent of Kalkaska officials indicating they would get involved, and 50.0 percent of Montmorency officials indicating that they would.

Question 70 (Appendix C) asked respondents to prioritize the importance of four concerns related to sludge application to forest land. Respondents were to divide 100 points among the four listed concerns: Human Health, Economic Costs, Environmental Quality and Wildlife, and Aesthetics (Beauty) of the Area. The mean responses for both the sample populations and the public officials were similar, and are displayed in Table 4.15.

Concern for human health was rated highest for all groups, with an average of more than half the available points allocated to this concern. Environmental quality received the second highest level of concern, with about 22 points allocated. Economic costs and aesthetics were virtually equal with about 13 points each.

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Table 4.15. Comparison of Concerns Related to Sludge Application to Forest Lands (question 70).

Concern	$\bar{X}$	SD	t value	df	probability
Human Health					
Kalkaska sample	51.76	19.64			
Montmorency sample	52.46	20.68	.38*	476	.705
Public officials	49.68	19.72	.72**	514	.470
Economic Costs					
Kalkaska sample	12.45	9.97			
Montmorency sample	12.58	10.07	.14*	476	.890
Public officials	15.63	16.85	1.12**	39	.269
Environmental Quality and Wildlife					
Kalkaska sample	22.39	12.93			
Montmorency sample	21.98	12.54	.35*	476	.727
Public officials	22.68	13.13	.24**	514	.814
Aesthetics (Beauty) of the Area					
Kalkaska sample	13.38	10.91			
Montmorency sample	12.90	10.28	.51*	476	.609
Public officials	12.00	8.16	.66**	514	.509

* t-test of Kalkaska sample vs. Montmorency sample.
**t-test of combined general sample vs. combined public officials.

Influences on Opinion Variables

The next portion of this chapter analyzes possible relationships that might influence public opinion. Knowledge, values, and attitudes related to the sludge issue were analyzed with demographic and non-demographic variables.

Influences on Knowledge

A multiple regression analysis was used to estimate the total variance in knowledge that was due to combined demographic characteristics (Table 4.16) and to combined non-demographic variables (Table 4.17). A general regression analysis was performed using SPSS software. The analysis further examined individual variables to determine the contribution of each to the regression equation. Stepwise regression was not performed so that the maximum relationship of each variable could be established.

Demographic variables analyzed were sex, age, income, education level, a count of memberships in environmental organizations, and a count of the number of different types of forest uses in the past two years. Non-demographic variables analyzed were: favoring forest application of sludge, opposition to forest application, perceived influence on local, state, and federal agencies, environmental/economic value orientation score, and awareness of the 1981 proposed sludge-forest project.

The results of the multiple regression analysis (Table 4.16) indicate that demographics do not explain much of the variance found in knowledge (Kalkaska sample, R^2=.129; Montmorency sample, R^2=.091). Sex and education had significant linear relationships with the knowledge score. A breakdown of the means for sex and education is

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Table 4.16. Multiple Regression Results: Influence of Demographic Variables On Knowledge Scores.

Kalkaska Sample (n = 183)

Multiple R	.360	Overall F Value	4.37
R^2	.129	Significance of F	.000*

Values for Individual Demographic Variables

	Standardized Beta	F Value	Significance of F
Sex	-.238	10.38	.002*
Age	.084	1.20	.273
Income	.127	2.93	.088
Education Level	.143	3.63	.058
Count of Memberships	.043	.34	.559
Count of Forest Uses	.081	1.01	.315

Montmorency Sample (n = 226)

Multiple R	.302	Overall F Value	3.68
R^2	.091	Significance of F	.002*

Values For Individual Demographic Variables

	Standardized Beta	F Value	Significance of F
Sex	-.133	3.90	.050*
Age	.049	.44	.507
Income	.098	1.89	.170
Education Level	.235	9.95	.002*
Count of Membership	-.008	.02	.901
Count of Forest Uses	-.009	.02	.896

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Table 4.17. Breakdown of Mean Knowledge Scores for Significant Demographic Variables.

Mean knowledge score for variable components	Kalkaska Sample $\bar{X}$	SD	n	Montmorency Sample $\bar{X}$	SD	n
Sex	(t=4.38;df=218;p<.000*)			(t=1.75;df=255;p<.082)		
Male	4.18	2.63	120	3.52	2.63	134
Female	2.67	2.45	100	2.98	2.35	123
Education Level	(F=3.56;df=218;p<.015*)			(F=4.85;df=256;p<.002*)		
<H.S. grad	2.97	2.27	37	2.62	2.12	50
H.S. grad	3.29	2.56	88	2.91	2.43	104
Some college	3.46	2.62	64	3.67	2.57	65
College grad	4.90	3.03	30	4.34	2.77	38
Significant variables, not included in regression analysis						
Work Group	(F=1.57;df=218;p<.182)			(F=2.41;df=252;p<.049*)		
Skilled, semi-skilled	3.35	2.62	82	3.19	2.30	66
Manager or professional	4.31	2.76	35	3.84	2.78	45
Homemaker	2.90	2.62	42	2.33	2.14	39
Retired	3.64	2.55	53	3.27	2.43	88
Other	2.85	2.73	7	4.13	3.56	15

* α=.05

included in Table 4.17. This table indicates that males had greater knowledge of the sludge issue than females, and that knowledge increases with educational level. Also included in this table is a breakdown of knowledge scores for the five work groups.

A larger amount of the variance in the knowledge score can be attributed to non-demographic variables (Kalkaska sample, R^2=.340; Montmorency sample, R^2=.404, Table 4.18). Favorable forest

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application attitudes and awareness of the proposed project had significant linear relationships in both counties. The environmental/economic value orientation was significant in Montmorency County.

A breakdown of the means for the attitude and awareness variables and for information sources used are provided in Table 4.19. Higher knowledge scores were associated with favoring sludge application to forest and with awareness. It should be noted that three items included in the knowledge scale (questions 32, 36, and 49) also have a valuative nature which could influence the association between high knowledge and favorable attitudes. However, the data in Table 4.36 demonstrates that activists in Kalkaska County had high average knowledge scores even though they were overwhelmingly opposed to forest application.

An additional breakdown of preferred disposal method demonstrates that higher knowledge scores are associated with preference for some type of land application. Knowledge scores above the county average are associated with all the major information sources. Those who attended public hearings or workshops, or contacted a university or government agency had the highest knowledge scores.

A final knowledge analysis was done to determine the correlation between general sludge knowledge and knowledge of the details of the proposed 1981 forest application project. A significant Pearson correlation coefficient was calculated for both counties (Kalkaska, $r=.356$; $p<.001$; Montmorency, $r=.384$; $p<.001$).

Table 4.18. Multiple Regression Results: Influence of Non-Demographic Variables On Knowledge Scores.

Kalkaska Sample (n=216)

Multiple R	.583	Overall F Value	21.67
R^2	.340	Significance of F	.000*

Values for Individual Variables

	Standardized Beta	F Value	Significance of F
Favor forest application	.483	60.54	.000*
Against forest application	.008	.01	.894
Influence score	-.022	.15	.690
E/E value orientation	-.066	1.28	.259
Aware of 1981 proposal	.276	23.89	.000*

Montmorency Sample (n=245)

Multiple R	.636	Overall F Value	32.52
R^2	.404	Significance of F	.000*

Values For Individual Variables

	Standardized Beta	F Value	Significance of F
Favor forest application	.622	125.05	.000*
Against forest application	.045	.67	.413
Influence score	-.024	.24	.618
E/E value orientation	.127	6.26	.013*
Aware of 1981 proposal	.140	7.69	.006*

* α=.05

Table 4.19. Breakdown of Mean Knowledge Scores for Significant Non-Demographic Variables.

Mean knowledge score per variable component	Kalkaska Sample $\bar{X}$	SD	n	Montmorency Sample $\bar{X}$	SD	n
Attitude toward forest application:	(F=39.41;df=219;p<.000*)			(F=67.27;df=253;p<.000*)		
Against forest app.	2.75	1.92	94	2.63	1.83	111
Favor forest app.	6.30	2.48	42	6.28	2.27	50
Undecided	2.91	2.54	84	2.40	2.16	93
Aware of 1981 proposed project:	(t=4.82;df=220;p<.000*)			(t=3.72;df=248;p<.000*)		
Aware	4.43	2.71	106	3.77	2.71	134
Not aware	2.68	2.35	116	2.65	2.11	123
Significant Variables Not Included in Regression Analysis						
First disposal preference:	(F=18.17;df=221;p<.000*)			(F=23.83;df=257;p<.000*)		
Landfill	2.71	2.38	45	3.05	2.13	38
Incineration	2.67	2.00	87	2.52	1.89	126
Agri. application	5.00	2.75	48	4.70	2.72	27
Forest application	5.64	2.49	28	5.40	2.64	48
No opinion	1.28	1.97	14	1.00	1.56	19
Frequent information sources (Public aware of proposal only)	**			**		
Newspapers	4.43	2.69	89	3.94	2.69	104
Friend or relative	4.44	2.47	47	4.29	2.69	61
TV/radio	4.85	2.59	63	3.54	2.88	44
Meetings, contact agency	5.64	2.06	14	5.92	3.04	13
Total population mean knowledge scores	3.48	2.65	221	3.26	2.52	255

* $\alpha \leq .05$

**Could not be tested because respondents had multiple information sources.

Influences on Values

A multiple regression analysis was used to estimate the total variance in value measures due to the demographic variables. Value items analyzed were environmental/economic value orientation (e/e value) scores (Table 4.20), the importance of human health concerns (Table 4.21), the importance of economic concerns (Table 4.22), the importance of environmental quality and wildlife concerns (Table 4.23), and the importance of aesthetic concerns (Table 4.24). Each regression equation was further examined to determine which individual variables contributed significantly to the regression equation.

The results of the value-demographic regressions indicate that demographics do not explain much of the variance found in values. The relationship between demographics and environmental quality concerns for Kalkaska County (Table 4.23) had the largest R^2 value of all groups, yet it could only explain 11.5 percent of the variance (R^2=.115).

Age was the only individual variable that seemed to show some linear relationship with values. The linear trend for age with human health concerns was significant for both counties with a positive relationship (Kalkaska, beta=.212; Montmorency, beta=.164). This indicates an increasing concern for human health with age. Conversely, environmental quality concerns and aesthetic concerns decreased as age increased.

Table 4.20. Multiple Regression Results: Influence of Demographic Variables On the Publics' Environmental/Economic Value Orientation.

Kalkaska Sample (n=187)

Multiple R	.259	Overall F Value	2.15
R^2	.067	Significance of F	.049*

Values for Individual Demographic Variables

	Standardized Beta	F Value	Significance of F
Sex	.027	.13	.714
Age	-.155	3.86	.051
Income	-.044	.33	.562
Education Level	.085	1.22	.270
Count of Memberships	.129	2.94	.088
Count of Forest Uses	.069	.71	.399

Montmorency Sample (n=230)

Multiple R	.287	Overall F Value	3.34
R^2	.082	Significance of F	.004*

Values For Individual Demographic Variables

	Standardized Beta	F Value	Significance of F
Sex	.081	1.47	.225
Age	-.048	.40	.526
Income	.000	.00	.997
Education Level	-.015	.04	.835
Count of Memberships	-.008	.01	.904
Count of Forest Uses	.267	12.83	.000*

* α=.05

Table 4.21. Multiple Regression Results: Influence of Demographic Variables on the Importance of Health Concerns.

Kalkaska Sample (n=181)

Multiple R	.239	Overall F Value	1.76
R^2	.057	Significance of F	.108

Values for Individual Demographic Variables

	Standardized Beta	F Value	Significance of F
Sex	-.033	.18	.668
Age	.212	6.99	.009*
Income	-.083	1.14	.286
Education Level	.028	.13	.713
Count of Memberships	-.046	.36	.548
Count of Forest Uses	.007	.01	.924

Montmorency Sample (n=226)

Multiple R	.173	Overall F Value	1.13
R^2	.030	Significance of F	.344

Values For Individual Demographic Variables

	Standardized Beta	F Value	Significance of F
Sex	.056	.66	.417
Age	.164	4.49	.035*
Income	.074	1.05	.305
Education Level	-.016	.04	.825
Count of Memberships	-.038	.28	.593
Count of Forest Uses	.033	.19	.659

* α=.05

Table 4.22. Multiple Regression Results: Influence of Demographic Variables on the Importance of Economic Cost Concerns.

Kalkaska Sample (n=181)

Multiple R	.216	Overall F Value	1.42
R^2	.046	Significance of F	.206

Values for Individual Demographic Variables

	Standardized Beta	F Value	Significance of F
Sex	.020	.67	.795
Age	.039	.23	.625
Income	-.048	.38	.537
Education Level	-.068	.77	.380
Count of Memberships	-.126	2.70	.102
Count of Forest Uses	-.085	1.06	.305

Montmorency Sample (n=226)

Multiple R	.132	Overall F Value	.64
R^2	.017	Significance of F	.692

Values For Individual Demographic Variables

	Standardized Beta	F Value	Significance of F
Sex	-.058	.69	.405
Age	-.049	.40	.525
Income	-.065	.79	.372
Education Level	.092	1.46	.227
Count of Memberships	.054	.56	.454
Count of Forest Uses	-.070	.84	.359

Table 4.23. Multiple Regression Results: Influence of Demographic Variables on the Importance of Environmental Quality Concerns.

Kalkaska Sample (n=181)

Multiple R	.339	Overall F Value	3.78
R^2	.115	Significance of F	.001*

Values for Individual Demographic Variables

	Standardized Beta	F Value	Significance of F
Sex	-.104	1.95	.164
Age	-.189	5.90	.016*
Income	.089	1.41	.236
Education Level	.060	.64	.424
Count of Memberships	.155	4.37	.038*
Count of Forest Uses	.073	.84	.359

Montmorency Sample (n=226)

Multiple R	.145	Overall F Value	.78
R^2	.021	Significance of F	.583

Values For Individual Demographic Variables

	Standardized Beta	F Value	Significance of F
Sex	-.026	.14	.708
Age	-.102	1.70	.192
Income	-.057	.61	.434
Education Level	.020	.07	.789
Count of Memberships	.002	.00	.970
Count of Forest Uses	.044	.33	.565

* α=.05

Table 4.24. Multiple Regression Results: Influence of Demographic Variables on the Importance of Aesthetic Concerns.

Kalkaska Sample (n=181)

Multiple R	.300	Overall F Value	2.88
R^2	.090	Significance of F	.011*

Values for Individual Demographic Variables

	Standardized Beta	F Value	Significance of F
Sex	.178	5.61	.019*
Age	-.206	6.87	.010*
Income	.094	1.52	.218
Education Level	-.064	.70	.401
Count of Memberships	.016	.47	.828
Count of Forest Uses	-.024	.08	.766

Montmorency Sample (n=226)

Multiple R	.148	Overall F Value	.81
R^2	.021	Significance of F	.557

Values For Individual Demographic Variables

	Standardized Beta	F Value	Significance of F
Sex	-.025	.13	.713
Age	-.158	4.10	.044*
Income	-.017	.05	.810
Education Level	-.079	1.08	.299
Count of Memberships	.021	.09	.761
Count of Forest Uses	-.053	.49	.483

* α=.05

Influences on Attitudes/Behaviors

In questions 66 through 68 respondents were asked to rank their first three disposal preferences. A continuous scale was later created by assigning three points to respondents that marked forest application as their first choice down to zero points if it was their last preference. Regression analysis was used to determine variance in the preference variables attributable to demographic (Table 4.25) and non-demographic variables (Table 4.26).

Multiple regression (Table 4.25) indicates that combined demographic variables explain little of the variance associated with forest application preference (Kalkaska, R^2=.052; Montmorency, R^2=.121). Individually, no demographic variable had a significant linear relationship with forest preference in Kalkaska County. In Montmorency County, however, education level ($F=19.07$; $p>.001$) and the count of forest uses ($F=4.20$; $p<.05$) had significant linear relationships. The beta weights indicate that preference for forest application increased with years of education, and decreased as the number of different forest uses increased.

The non-demographic multiple regression analysis (Table 4.26) provided a slight explanation of variance in preference for forest application (Kalkaska, R^2=.202; Montmorency, R^2=.210). In both counties, knowledge had a strong linear relationship with forest preference (Kalkaska, $F=36.33$, $p<.001$; Montmorency, $F=37.04$, $p<.001$). As knowledge of the sludge issue increased, preference for forest application increased. In Montmorency County, an increase in economic value orientation also had a significant linear relationship with preference for forest application ($F=8.66$; $p<.01$).

Table 4.25. Multiple Regression Results: Influence of Demographic Variables on Preference Toward Forest Application.

Kalkaska Sample (n=185)

Multiple R	.229	Overall F Value	1.64
R^2	.052	Significance of F	.137

Values for Individual Demographic Variables

	Standardized Beta	F Value	Significance of F
Sex	-.118	2.44	.120
Age	-.067	.69	.405
Income	.099	1.67	.197
Education Level	.125	2.58	.110
Count of Memberships	.075	.97	.324
Count of Forest Uses	-.110	1.71	.192

Montmorency Sample (n=226)

Multiple R	.349	Overall F Value	5.06
R^2	.121	Significance of F	.000*

Values For Individual Demographic Variables

	Standardized Beta	F Value	Significance of F
Sex	-.061	.86	.354
Age	-.054	.55	.457
Income	-.078	1.26	.261
Education Level	.317	19.07	.000*
Count of Memberships	.091	1.80	.181
Count of Forest Uses	-.148	4.20	.042*

* α=.05

Table 4.26. Multiple Regression Results: Influence of Non-Demographic Variables on Preference Toward Forest Application.

Kalkaska Sample (n=199)

Multiple R	.450	Overall F Value	8.14
R^2	.202	Significance of F	.000*

Values for Individual Variables

	Standardized Beta	F Value	Significance of F
Knowledge score	.414	36.33	.000*
Aware of 1981 proposal	.094	1.90	.169
E/E value orientation	-.058	.63	.426
Human health concerns	.089	.48	.486
Economic concerns	.162	2.51	.114
Env. quality concerns	.122	1.25	.265

Montmorency Sample (n=226)

Multiple R	.459	Overall F Value	9.74
R^2	.210	Significance of F	.000*

Values For Individual Variables

	Standardized Beta	F Value	Significance of F
Knowledge score	.381	37.04	.000*
Aware of 1981 proposal	-.050	.63	.425
E/E value orientation	-.192	8.66	.004*
Human health concerns	.097	.63	.426
Economic concerns	.073	.59	.442
Env. quality concerns	.160	2.35	.127

* α=.05

The survey also measured respondent attitudes toward future sludge application proposals. This attitude was analyzed with demographic (Tables 4.27, 4.28 and 4.29) and non-demographic variables (Tables 4.30 and 4.31) to estimate the relationships of combined and individual variables.

In Table 4.27, multivariate and univariate F-tests of significance for demographics are presented for respondents which favored or opposed future forest application proposals. Those undecided were not included in this analysis which categorized variables influencing decided respondents. The results for Kalkaska County indicate no relationship between combined and individual demographics with the dichotomous attitude. Montmorency County attitudes, however, had a significant relationship with combined demographic variables ($F=3.49$; $p<.01$), and with the individual variables education level ($F=9.00$; $p<.019$) and count of different forest uses ($F=8.31$; $p<.01$).

A further inspection of demographic means broken down by forest application attitude (Table 4.28) indicates that respondents that formed an opinion have few differences in age, memberships, and forest uses. However, the undecided tend to be significantly younger in Montmorency, to have significantly fewer environmental memberships in Kalkaska, and to have non-significant trends toward fewer different forest uses in both counties.

Table 4.29 shows a trend in which higher eduction is related to increased favoritism toward future proposals. Similarly, the highest income levels and job status levels (manager or professional) were also more favorable to future proposals. Retired respondents were less undecided.

Table 4.27. Influences of Demographic Variables on Attitudes Toward Future Forest Application Proposals.

Kalkaska Sample (n=190)

Multivariate Test of Significance: Favor vs. Against Future Proposals

Canonical Cor	.240	Overall F Value	1.87
Eigenvalue	.061	Significance of F	.087

Univariate F-Tests with (1,189 df)

Favor Vs. Against	F-Value	Sig. of F	Standardized Discriminate Function Coefficient	Correlations: Dependent with Canonical Variables
Sex	3.17	.076	.643	.524
Age	.52	.468	-.270	-.213
Income	2.51	.114	-.435	-.466
Education Level	3.69	.056	-.609	-.565
Count of Memberships	.01	.898	.077	.037
Count of Forest Uses	.22	.633	.383	.140

Montmorency Sample (n=236)

Multivariate Test of Significance: Favor vs. Against Future Projects

Canonical Cor	.289	Overall F Value	3.49
Eigenvalue	.091	Significance of F	.002*

Univariate F-Tests with (1,235 df)

Favor Vs. Against	F-Value	Sig. of F	Standardized Discriminate Function Coefficient	Correlation Dependent with Canonical Variables
Sex	.02	.885	-.185	.031
Age	.68	.410	.055	.178
Income	1.10	.295	-.010	.226
Education Level	9.00	.003*	.832	.648
Count of Memberships	.00	.993	-.200	.001
Count of Forest Uses	8.31	.004*	-.737	-.622

* α=.05

Table 4.28. Breakdown of Demographic Variables by Attitude Toward Future Proposals to Apply Sludge to Forest Lands.

Breakdown of Demographic Variables by Attitude	Demographic Means					
	Kalkaska Sample			Montmorency Sample		
	$\bar{X}$	SD	n	$\bar{X}$	SD	n
Age	(F=1.23;df=235;p<.291)			(F=3.06;df=271;p<.048*)		
Opposed to application	45.92	15.94	104	52.02	16.09	119
Favor the application	49.86	14.97	45	53.94	15.52	52
Undecided	45.21	18.17	87	47.72	17.14	101
Count of memberships	(F=3.70;df=236;p<.026*)			(F=.21;df=274;p<.806)		
Opposed to application	.371	.76	105	.358	.95	120
Favor the application	.355	.60	45	.358	.73	53
Undecided	.137	.40	87	.294	.53	102
Count of Forest Uses	(F=2.99;df=236;p<.052)			(F=2.22;df=278;p<.085)		
Opposed to application	7.29	3.87	105	7.74	4.07	120
Favor the application	7.15	3.75	45	6.71	3.80	53
Undecided	6.01	3.67	87	6.11	3.98	102

* $\alpha = .05$

Table 4.29. Public Attitudes To Future Forest Application Projects Broken Down by Demographic Variables.

Demographic Variables	Kalkaska Sample: Against Proposal	Favor Proposal	Undecided	n	Montmorency Sample: Against Proposal	Favor Proposal	Undecided	n
Sex	(X^2=3.98; df=2; p<.136)				(X^2=.83; df=2; p<.657)			
Male	42.1%	23.8%	34.1%	126	44.6%	20.9%	34.5%	139
Female	46.4%	13.6%	40.0%	110	42.5%	17.9%	39.6%	134
Education Level	(X^2=12.99; df=6; p<.043*)				(X^2=14.46; df=6; p<.024*)			
Less than high school	46.5%	14.0%	39.5%	43	48.1%	11.1%	40.7%	54
High school graduate	42.4%	17.4%	40.2%	92	52.3%	13.5%	34.2%	111
Some college or post H.S. training	55.9%	16.2%	27.9%	68	35.3%	27.9%	36.8%	68
College graduate	22.6%	35.5%	41.9%	31	29.3%	29.3%	41.5%	41
Income	(X^2=7.45; df=8; p<.488)				(X^2=14.60; df=8; p<.067)			
Less than $8,000	51.1%	15.6%	33.3%	45	47.8%	14.9%	37.3%	67
$8,000 - $15,999	45.5%	18.2%	36.4%	55	37.1%	20.2%	42.7%	89
$16,000 - $23,999	46.5%	25.6%	27.9%	43	37.1%	25.7%	37.1%	35
$24,000 - $31,999	37.5%	12.5%	50.0%	24	47.8%	8.7%	43.5%	23
$32,000 or more	32.0%	32.0%	36.0%	25	42.3%	42.3%	15.4%	26
Work Groups	(X^2=13.49; df=8; p<.095)				(X^2=9.96; df=8; p<.267)			
Skilled, semi-skilled	53.4%	11.4%	35.2%	88	38.6%	14.3%	47.1%	70
Managers or professionals	29.7%	27.0%	43.2%	37	42.9%	24.5%	32.7%	49
Homemaker	43.7%	15.2%	41.3%	46	47.7%	13.6%	38.6%	44
Retired	43.9%	24.6%	31.6%	57	48.9%	21.7%	29.3%	92
Other	14.3%	42.9%	42.9%	7	26.7%	33.3%	40.0%	15
Overall Attitude Responses	44.3%	19.0%	36.7%	237	43.6%	19.3%	37.1%	275

* α=.05

Non-demographic multivariate and univariate F tests of significance with forest application attitude (favor or opposed) are presented in Table 4.30. In both counties the combined non-demographic variables have a significant relationship with forest application attitude (Kalkaska, $F=10.36$, $p<.001$; Montmorency, $F=15.84$, $p<.001$). Examination of univariate F-tests for both counties indicate a strong relationship for knowledge with attitude (Kalkaska, $F=49.19$, $p<.001$; Montmorency, $F=75.15$, $p<.001$). Other significant relationships include skepticism for Michigan Department of Natural Resources (MDNR) programs, environmental/economic (e/e) value orientation, and economic concerns.

A breakdown of non-demographic variable means by attitude (Table 4.31) further reveal the above relationships. Respondents favoring forest application of sludge had significantly higher knowledge scores than did respondents opposed or undecided. The e/e value orientation and economic concern measure indicates that Montmorency respondents with economic orientations tended to favor forest application. In Kalkaska, respondents with low economic orientations were significnatly more opposed. Respondents in favor of forest application also tended to be less skeptical of MDNR programs. Respondents in Montmorency County that favored future forest application proposals tended to be more aware of the previous proposal. A similar trend (not significant) for attitude and awareness was reported for Kalkaska County.

Another analysis was performed to determine what relationship attitude toward the previous forest application proposal had with knowledge of the proposal's details, number of different information sources, and the number of actions taken to block or promote the proposal. The multivariate and univariate F-tests of significance for these variables are presented in Table 4.32.

Table 4.30. Influences of Non-Demographic Variables on Attitudes Toward Future Forest Application Proposals.

Kalkaska Sample (n=202)

Multivariate Test of Significance: Favor vs. Against Future Proposals

Canonical Cor	.520	Overall F Value	10.36
Eigenvalue	.372	Significance of F	.000*

Univariate F-Tests with (1,201 df)

Favor Vs. Against	F-Value	Sig. of F	Standardized Discriminate Function Coefficient	Correlations: Dependent with Canonical Variables
Knowledge Score	49.19	.000*	.862	.810
Aware of 1981 prop.	1.49	.222	.032	-.141
Skeptical of MDNR programs	8.16	.005*	.481	.330
E/E value orientat'n	7.97	.005*	-.156	-.326
Human health concerns	.03	.849	.416	.022
Economic concerns	4.23	.041*	.393	.238
Env. quality concerns	.35	.550	.115	-.069

Montmorency Sample (n=227)

Multivariate Test of Significance: Favor vs. Against Future Projects

Canonical Cor	.578	Overall F Value	15.84
Eigenvalue	.504	Significance of F	.000*

Univariate F-Tests with (1,226 df)

Favor Vs. Against	F-Value	Sig. of F	Standardized Discriminate Function Coefficient	Correlation Dependent with Canonical Variables
Knowledge Score	75.15	.000*	.841	.812
Aware of 1981 prop.	6.25	.013*	.002	-.234
Skeptical of MDNR programs	22.30	.000*	.417	.442
E/E value orientat'n	7.22	.008*	-.300	-.251
Human health concerns	7.81	.006*	.032	-.261
Economic concerns	10.61	.001*	.166	.305
Env. quality concerns	1.64	.201	.120	.120

* α=.05

Table 4.31. Breakdown of Non-Demographic Variable Means by Attitude Toward Future Proposals to Apply Sludge to Forest Lands.

Breakdown of Non-Demographic Variables by Attitude	Non-Demographic Means: Kalkaska $\bar{X}$	Kalkaska SD	Kalkaska Sample n	Montmorency $\bar{X}$	Montmorency SD	Montmorency Sample n
Knowledge score	(F=39.41;df=219;p<.000*)			(F=67.27;df=253;p<.000*)		
Oppose for. app.	2.75	1.92	92	2.63	1.83	111
Favor forest app.	6.30	2.48	42	6.28	2.27	50
Undecided	2.91	2.54	84	2.40	2.16	93
Aware of 1981 Prop (1=aware; 2=unaware)	(F=.70;df=236;p<.493)			(F=3.97;df=273;p<.019*)		
Oppose for. app.	1.52	.50	105	1.55	.49	120
Favor forest app.	1.42	.49	45	1.32	.47	52
Undecided	1.51	.50	87	1.50	.50	102
Skeptical of MDNR Programs (1=S. Agree; 5=S. Disagree)	(F=4.81;df=227;p<.009*)			(F=10.79;df=265;p<.000*)		
Oppose for. app.	2.46	1.12	100	2.59	1.13	117
Favor forest app.	3.00	1.15	43	3.32	1.09	50
Undecided	2.84	1.01	85	3.12	.92	99
E/E value orientat'n (+8 env. to -8 econ.)	(F=7.98;df=224;p<.000*)			(F=4.54;df=260;p<.011*)		
Oppose for. app.	3.75	2.45	98	3.14	3.01	115
Favor forest app.	2.95	2.72	42	1.70	3.15	51
Undecided	2.21	2.71	85	2.35	2.83	95
Human health concerns	(F=.21;df=221;p<.809)			(F=4.47;df=250;p<.012*)		
Oppose for. app.	52.56	22.07	94	55.71	20.92	109
Favor forest app.	52.11	17.23	45	45.27	22.00	51
Undecided	50.67	18.05	83	52.63	19.30	91
Economic concerns	(F=3.71;df=221;p<.025*)			(F=7.33;df=250;p<.000*)		
Oppose for. app.	10.35	9.49	94	10.55	10.36	109
Favor forest app.	14.11	9.90	45	16.96	10.29	51
Undecided	13.93	10.22	83	12.78	8.98	91
Env. quality concerns	(F=.54;df=221;p<.578)			(F=1.09;df=250;p<.336)		
Oppose for. app.	23.27	13.65	94	21.36	12.94	109
Favor forest app.	22.66	14.04	45	24.15	13.83	51
Undecided	21.25	11.47	83	21.13	11.18	91

*α =.05

Table 4.32. Influences of Selected Non-Demographic Variables on Attitude Toward the 1981 Forest Application Proposal.

Kalkaska Sample (n=107)

Multivariate Test of Significance: Favor vs. Against Future Proposals

Canonical Cor	.229	Overall F Value	1.88
Eigenvalue	.055	Significance of F	.137

Univariate F-Tests with (1,104 df)

Favor Vs. Against	F-Value	Sig. of F	Standardized Discriminate Function Coefficient	Correlations: Dependent with Canonical Variables
Knowledge of proposal details	1.94	.166	-.191	-.580
Count of information sources	2.09	.151	-.115	-.602
Count of actions taken	5.51	.021*	-.838	-.977

Montmorency Sample (n=125)

Multivariate Test of Significance: Favor vs. Against Future Projects

Canonical Cor	.065	Overall F Value	.17
Eigenvalue	.004	Significance of F	.915

Univariate F-Tests with (1,122 df)

Favor Vs. Against	F-Value	Sig. of F	Standardized Discriminate Function Coefficient	Correlation Dependent with Canonical Variables
Knowledge of proposal details	.46	.495	.964	**
Count of information sources	.00	.956	-.365	
Count of actions taken	.10	.745	.266	

* α=.05

**Not calculated by computer at low significances.

The multivariate results indicate that the three variables had no significant combined relationship with the favor vs. opposed attitude measure (Kalkaska, $F=1.88$, $p>.05$; Montmorency, $F=.17$, $p>.05$). The only measure with a significant relationship with the favor or against attitude was the count of actions taken for Kalkaska County ($F=5.51$, $p<.05$).

Further examination of all attitude means (Table 4.33) indicate similar average scores for favor and opposed. However, respondents that were undecided about the previous sludge proposal tended to have less knowledge of the project's details, and tended to take fewer actions. Information sources utilized were similar for all groups.

In Table 4.34 a breakdown of attitudes toward the 1981 forest application proposal is presented by specific actions taken to block or promote it. Actions were classified in the following hierarchical categories: 1) took no action, 2) read materials on the subject and/or talked with friends or relatives, and 3) attended hearings or workshops, and/or contacted a university or government agency, and/or took a leadership role or some other action.

The breakdown of actions with attitude in Table 4.34 indicate that a majority of Kalkaska respondents that were involved in the public participation process (attended meetings, contacted agencies, or took leadership roles) were strongly opposed to the proposal. In contrast, Montmorency residents that participated were slightly more favorable of the proposal.

Table 4.33. Breakdown of Non-Demographic Variable Means by Attitude Toward the 1981 Forest Application Proposal.

Breakdown of Non-Demographic Variables by Proposal Attitude	Non-Demographic Means: Kalkaska Sample $\bar{X}$	SD	n	Montmorency Sample $\bar{X}$	SD	n
Knowledge of details	(F=5.69;df=106;p<.004*)			(F=1.25;df-125;p<.289)		
Against proposal	2.18	1.65	43	1.47	1.15	36
Favored proposal	2.00	1.87	17	1.75	1.66	28
Undecided	1.06	1.53	47	1.25	1.35	62
Count of Different Information						
Sources about project	(F=.97;df=117;p<.379)			(F=.32;df=138;p<.725)		
Against proposal	2.43	1.50	51	1.84	1.22	39
Favored proposal	2.00	1.06	17	1.87	.85	33
Undecided	2.14	1.16	50	1.73	.84	67
Count of Different Actions Taken						
Block or promote	(F=5.07;df=117;p<.007*)			(F=12.12;df=136;p<.000*)		
Against proposal	1.62	1.26	51	1.30	1.23	39
Favored proposal	1.17	.72	17	1.50	1.13	32
Undecided	.94	.99	50	.53	.84	66

* $\alpha = .05$

Table 4.34. Public Attitudes Toward the 1981 Forest Application Proposal Broken Down by Specific Actions Taken to Block or Promote the Project.

Kalkaska Sample	1981 Proposal Attitude			
	Against Proposal	Favor Proposal	Undecided	n
Specific Actions Taken	(X^2=21.55; df=6; sig=.001*)			
Took no action	21.9%	9.4%	68.8%	32
Read materials and/or talk with friends or relatives	45.5%	18.2%	36.4%	66
Attend meetings/contact agency/or took leadership role	70.0%	10.0%	20.0%	20
Total attitude percents	43.2%	14.4%	42.4%	118

Montmorency Sample	1981 Proposal Attitude			
	Against Proposal	Favor Proposal	Undecided	n
Specific Actions Taken	(X^2=29.84; df=6; sig=.000*)			
Took no action	18.0%	11.5%	70.5%	61
Read materials and/or talk with friends or relatives	36.5%	23.1%	40.4%	52
Attend meetings/contact agency/or took leadership role	40.9%	50.0%	9.1%	22
Total attitude percents	28.9%	22.2%	48.9%	135

* α=.05

Examination of demographic variables as they relate to actions taken to block or promote the 1981 forest application proposal (Table 4.35) show some interesting trends. In Montmorency County, individuals that became more involved (attended meetings, contacted agencies, or took leadership roles) had significantly higher average incomes and education levels. Additionally, they had significantly more environmental memberships and tended (not significant) to have more forest uses. Sex and age had no relationship with higher level actions.

The most noticeable difference in Kalkaska respondents was the discrepancy of sexes that were involved in this issue. Seventy-five percent of respondents taking higher level actions were males. The two variables which had significant trends similar to Montmorency's were education and forest uses. Both increased with higher level actions.

Further examination of the relationships between specific actions and continuous non-demographic variables are presented in Table 4.36. Many of the tested variables demonstrate similar trends for both counties. However, divergent trends for several variables were noted, and may help to explain the different county reactions to the 1981 forest application proposal.

For Kalkaska County respondents, skepticism of MDNR programs varies from neutral ($\bar{X}$=2.96) for those that took no action, to skeptical ($\bar{X}$=2.05) for those that attended meetings, made contact with agencies, or took a leadership role. The trend in Kalkaska respondents' attitudes toward the MDNR was not found in Montmorency where all respondents were generally neutral toward MDNR programs.

Another divergent trend between the counties regarded economic concerns (Table 4.36). Montmorency's economic means were higher than Kalkaska's and they showed no relationship with the different action categories.

Table 4.35. Breakdown of Demographic Variables by Actions Taken to Block or Promote the 1981 Forest Application Proposal.

Breakdown of Demographic Variables by Actions Taken	Demographic Means: Kalkaska Sample $\bar{X}$	SD	n	Montmorency Sample $\bar{X}$	SD	n
Age (years)	(F=.29,df=117;p<.748)			(F=2.31;df=136;p<.103)		
Took no action	36.56	16.47	32	53.41	14.74	62
Read or talked with others	46.39	14.70	66	47.09	16.85	52
Attend meetings/ contact agency	49.25	13.52	20	50.95	15.28	23
Income (thousands)	(F=.03;df=94;p<.963)			(F=3.57;df=123;p<.031*)		
Took no action	19.37	10.53	24	14.85	10.53	55
Read or talked with others	20.21	13.85	55	16.22	9.89	48
Attend meetings/ contact agency	19.81	11.66	16	22.47	15.21	21
Educat'n level (years)	(F=4.56;df=116;p<.012*)			(F=3.77;df=136;p<.025*)		
Took no action	12.06	2.50	31	12.34	2.42	63
Read or talked with others	12.72	2.40	66	12.96	2.79	51
Attend meetings/ contact agency	14.15	2.34	20	14.04	2.30	23
Count of memberships	(F=1.05;df=117;p<.210)			(F=5.48;df=137;p<.005*)		
Took no action	.250	.56	32	.269	.44	63
Read or talked with others	.469	.78	66	.365	.86	52
Attend meetings/ contact agency	.350	.67	20	1.00	1.70	23
Count of forest uses	(F=4.14; df=117;p<.018*)			(F=2.39;df=137;p<.095)		
Took no action	6.28	4.04	32	6.25	4.34	63
Read or talked with others	7.71	3.79	66	7.11	3.38	52
Attend meetings/ contact agency	9.30	2.71	20	8.30	3.88	23

	Male	Female	n	Male	Female	n
Sex	(X^2=2.99;df=2;p<.223)			(X^2=1.69;df=2;p<.428)		
Took no action	51.6%	48.4%	31	60.3%	39.7%	63
Read or talked with others	56.1%	43.9%	66	50.0%	50.0%	52
Attend meetings/ contact agency	75.0%	25.0%	20	47.8%	52.2%	23

*α =.05

Table 4.36. Breakdown of Non-Demographic Variables Means by Actions Taken to Block or Promote the 1981 Forest Application Proposal.

Breakdown of Non-Demographic Variables by Actions Taken	Non-Demographic Means: Kalkaska Sample $\bar{X}$	SD	n	Montmorency Sample $\bar{X}$	SD	n
Knowledge Score	(F=5.15;df=105;p<.007*)			(F=8.18;df=128;p<.000*)		
Took no action	3.03	2.57	28	2.75	2.40	58
Read or talked with others	4.63	2.77	60	4.08	2.51	49
Attend meetings/ contact agency	5.33	2.02	18	5.13	2.81	22
Knowledge of Details	(F=17.70;df=106;p<.000*)			(F=10.57;df=124;p<.000*)		
Took no action	.56	.97	30	.94	1.11	58
Read or talked with others	1.76	1.64	60	1.56	1.31	46
Attend meetings/ contact agency	3.23	1.67	17	2.42	1.66	21
Skeptical of MDNR Programs (1=S. Agree; 5=S. Disagree)	(F=4.33;df=114;p<.015*)			(F=.41;df=133;p<.663)		
Took no action	2.96	1.09	32	3.00	1.04	62
Read or talked with others	2.49	1.16	63	3.18	.96	50
Attend meetings/ contact agency	2.05	.99	20	3.00	1.54	22
Count of Information Sources Used	(F=26.89;df=117;p<.000*)			(F=9.23;df=137;p<.000*)		
Took no action	1.37	.83	32	1.46	.66	63
Read or talked with others	2.24	1.06	66	1.90	.84	52
Attend meetings/ contact agency	3.65	1.46	20	2.39	1.52	23
E/E Value Orientation (+8 env to -8 econ)	(F=.58;df=110;p<.559)			(F=2.95;df=132;p<.055)		
Took no action	2.66	3.05	30	1.63	2.63	61
Read or talked with others	2.85	2.69	62	2.98	3.15	50
Attend meetings/ contact agency	3.52	2.73	19	2.77	3.75	22

Table 4.36. (con't).

Breakdown of Non-Demographic Variables by Actions Taken	Non-Demographic Means: Kalkaska Sample $\bar{X}$	SD	n	Montmorency Sample $\bar{X}$	SD	n
Human Health Concerns	(F=1.08;df=110;p<.341)			(F=.75;df=128;p<.474)		
Took no action	54.33	21.36	30	52.73	18.55	57
Read or talked with others	48.32	19.05	62	50.78	19.28	50
Attend meetings/ contact agency	51.84	12.71	19	46.68	23.42	22
Economic Concerns	(F=6.71;df=110;p<.010*)			(F=.28;df=128;p<.748)		
Took no action	9.33	10.40	30	14.03	9.41	57
Read or talked with others	14.87	10.41	62	13.62	10.02	50
Attend meetings/ contact agency	10.21	8.70	19	15.54	11.20	22
Env. Quality Concerns	(F=1.87;df=110;p<.158)			(F=1.16;df=128;p<.315)		
Took no action	23.83	17.50	30	19.91	10.63	57
Read or talked with others	22.54	11.69	62	21.74	11.68	50
Attend meetings/ contact agency	29.63	14.75	19	24.31	14.20	22
Aesthetic Concerns	(F=2.38;df=110;p<.096)			(F=.09;df=128;p<.906)		
Took no action	12.50	12.08	30	13.05	8.37	57
Read or talked with others	14.25	10.24	62	13.86	9.03	50
Attend meetings/ contact agency	8.31	7.56	19	13.45	12.46	22

* $\alpha = .05$

The two knowledge scores had similar predictable trends for the counties, with knowledge significantly increasing with higher order actions. A final significant relationship in both counties was an increase in the number of information sources as action levels increased.

Involvement was another important dependent variable assessed in the opinion survey. This disposition toward future action was analyzed with demographic (Tables 4.37 and 4.38) and non-demographic variables (Tables 4.39 and 4.40) to estimate the relationship of the combined and individual variables.

The multivariate F-test for demographic variables with will or will not get involved is presented in Table 4.37. The results indicate no relationship between involvement and combined demographic variables (Kalkaska, $F=.65$, $p>.05$; Montmorency, $F=1.96$, $p>.05$). The only individual variable demonstrating a significant relationship with involvement was education level in Montmorency County ($F=5.13$, $p<.05$).

The breakdown of demographic means by involvement (Table 4.38) indicate that respondents more likely to be involved had more years of education and individuals with a larger number of forest uses are more likely to indicate involvement.

Table 4.39 presents the results of multivariate and univariate F-tests for non-demographic variables with a respondent's disposition to get involved or not get involved. The results indicate that these combined variables also have no significant relationship with involvement (Kalkaska, $F=1.35$, $p>.05$; Montmorency, $F=1.59$, $p>.05$). Skepticism of MDNR programs was the only individual Kalkaska respondent variable that had a significant relationship with will or will not get involved ($F=3.97$, $p<.05$). In Montmorency, e/e value orientation had a significant relationship ($F=5.48$, $p<.05$). A breakdown of nondemographic variable means by anticipated future involvement is presented in Table 4.40.

Table 4.37. Influences of Demographic Variables on Anticipated Behavior Toward Future Forest Application Proposals.

Kalkaska Sample (n=192)

Multivariate Test of Significance: Will vs. Will Not Get Involved

Canonical Cor	.144	Overall F Value	.65
Eigenvalue	.021	Significance of F	.686

Univariate F-Tests with (1,189 df)

Will Vs. Will Not Get Involved	F-Value	Sig. of F	Standardized Discriminate Function Coefficient	Correlations: Dependent with Canonical Variables
Sex	.48	.485	.271	**
Age	.74	.390	.175	
Income	.28	.595	-.018	
Education Level	1.59	.209	-.609	
Count of Memberships	.59	.443	.555	
Count of Forest Uses	1.21	.272	-.419	

Montmorency Sample (n=238)

Multivariate Test of Significance: Will vs. Will Not Get Involved

Canonical Cor	.220	Overall F Value	1.96
Eigenvalue	.051	Significance of F	.072

Univariate F-Tests with (1,235 df)

Will Vs. Will Not Get Involved	F-Value	Sig. of F	Standardized Discriminate Function Coefficient	Correlation Dependent with Canonical Variables
Sex	.89	.345	.322	.272
Age	.79	.375	.134	-.256
Income	.05	.819	-.358	-.066
Education Level	5.13	.024*	.662	.653
Count of Memberships	2.28	.132	.286	.435
Count of Forest Uses	3.82	.052	.647	.564

*α=.05

**Not calculated by computer at low significances.

Table 4.38. Breakdown of Demographic Variable Means by Anticipated Behavior Toward Future Forest Application Proposals.

Breakdown of Demographic Variables by Behavior	Demographic Means: Kalkaska Sample $\bar{X}$	SD	n	Montmorency Sample $\bar{X}$	SD	n
Age	(F=.90;df=235;p<.405)			(F=3.52;df=271;p<.030*)		
Will get involved	45.92	16.03	88	51.42	16.19	104
Won't get involved	48.83	15.21	61	54.44	15.39	67
Undecided	45.21	18.17	87	47.72	17.14	101
Income (in thousands)	(F=.40;df=191;p<.666)			(F=1.52;df=239;p<.219)		
Will get involved	18.13	11.16	73	16.82	11.11	92
Won't get involved	16.90	10.46	51	17.58	13.17	58
Undecided	18.75	11.60	68	14.63	9.18	90
Education level (years)	(F=1.69;df=233;p<.186)			(F=3.75;df=273;p<.024*)		
Will get involved	13.01	2.12	89	13.03	2.41	104
Won't get involved	12.33	2.63	59	12.00	2.28	68
Undecided	12.52	2.36	86	12.62	2.53	102
Count of Memberships	(F=3.70;df=236;p<.026*)			(F=1.40;df=274;p<.248*)		
Will get involved	.370	.75	89	.432	1.03	104
Won't get involved	.360	.65	61	.246	.62	69
Undecided	.137	.40	87	.294	.53	102
Count of Forest Uses	(F=4.61;df=236;p<.010*)			(F=4.70;df=274;p<.009*)		
Will get involved	7.70	3.45	89	7.81	3.91	104
Won't get involved	6.59	4.26	61	6.84	4.10	69
Undecided	6.01	3.67	87	6.11	3.98	102

	Male	Female	Male	Female
Sex	(X^2=1.09;df=2;p<.577)		(X^2=2.31;df=2;p<.314)	
Will get involved	40.5%	34.5%	36.7%	39.6%
Won't get involved	25.4%	25.5%	28.8%	20.9%
Undecided	34.1%	40.0%	34.5%	39.6%
n =	126	110	139	134

*α=.05

Table 4.39. Influences of Non-Demographic Variables on Anticipated Behavior Toward Future Forest Application Proposals.

Kalkaska Sample (n=204)

Multivariate Test of Significance: Will vs. Will Not Get Involved

Canonical Cor	.215	Overall F Value	1.35
Eigenvalue	.048	Significance of F	.227

Univariate F-Tests with (1,201 df)

Will Vs. Will Not Get Involved	F-Value	Sig. of F	Standardized Discriminate Function Coefficient	Correlations: Dependent with Canonical Variables
Knowledge Score	.08	.772	-.300	**
Aware of 1981 prop.	.02	.885	-.195	
Skeptical of MDNR programs	3.97	.048*	.709	
E/E value orientat'n	3.66	.057	-.619	
Human health concerns	.26	.608	.461	
Economic concerns	1.51	.220	.448	
Env. quality concerns	.04	.834	.453	

Montmorency Sample (n=229)

Multivariate Test of Significance: Will vs. Will Not Get Involved

Canonical Cor	.219	Overall F Value	1.59
Eigenvalue	.050	Significance of F	.138

Univariate F-Tests with (1,226 df)

Will Vs. Will Not Get Involved	F-Value	Sig. of F	Standardized Discriminate Function Coefficient	Correlation Dependent with Canonical Variables
Knowledge Score	.00	.994	-.061	-.002
Aware of 1981 prop.	.68	.409	-.449	-.244
Skeptical of MDNR programs	1.74	.188	-.350	-.389
E/E value orientat'n	5.48	.020*	.505	.691
Human health concerns	.07	.781	.360	.082
Economic concerns	3.47	.064	-.194	-.550
Env. quality concerns	2.22	.138	.608	.439

*α=.05
**Not calculated by computer at low significances.

Table 4.40. Breakdown of Non-Demographic Variable Means by Anticipated Behavior Toward Future Forest Application Proposals.

Breakdown of Non-Demographic Variables by Behavior	Non-Demographic Means: Kalkaska Sample X	SD	n	Montmorency Sample X	SD	n
Knowledge score	(F=3.32;df=219;p<.037*)			(F=9.06;df=253;p<.000*)		
Will get involved	3.80	2.40	80	3.76	2.32	96
Won't get involved	3.92	3.03	56	3.78	2.98	65
Undecided	2.91	2.54	84	2.40	2.19	93
Aware of 1981 Prop (1=aware; 2=unaware)	(F=.06;df=236;p<.939)			(F=.54;df=273;p<.582)		
Will get involved	1.49	.50	89	1.45	.50	103
Won't get involved	1.49	.50	61	1.53	.50	69
Undecided	1.51	.50	87	1.50	.50	102
Skeptical of MDNR Programs (1=S. Agree; 5=S. Disagree)	(F=3.00;df=227;p<.051)			(F=3.20;df=265;p<.042*)		
Will get involved	2.47	1.18	86	2.73	1.22	101
Won't get involved	2.84	1.08	57	2.93	1.07	66
Undecided	2.84	1.01	85	3.12	.97	99
E/E value orientat'n (+8 env. to -8 econ.)	(F=8.05;df=224;p<.000*)			(F=4.15;df=260;p<.016*)		
Will get involved	3.82	2.35	84	3.22	3.10	100
Won't get involved	3.05	2.79	56	1.92	2.99	66
Undecided	2.21	2.71	85	2.35	2.83	95
Human health concerns	(F=.56;df=221;p<.570)			(F=.15;df=250;p<.859)		
Will get involved	53.59	23.35	82	53.10	20.82	98
Won't get involved	50.71	17.75	57	51.25	23.28	62
Undecided	50.67	18.05	83	52.63	19.30	91
Economic concerns	(F=2.44;df=221;p<.088)			(F=2.29;df=250;p<.051)		
Will get involved	10.59	9.13	82	11.05	9.35	98
Won't get involved	12.96	10.50	57	15.03	12.30	62
Undecided	13.93	10.22	83	12.78	8.98	91
Env. quality concerns	(F=.65;df=221;p<.521)			(F=1.17;df=250;p<.310)		
Will get involved	22.59	13.57	82	25.33	13.23	98
Won't get involved	23.77	14.05	57	20.54	13.21	62
Undecided	21.25	11.47	83	21.13	11.18	91

*α =.05

Table 4.41 reports the affect proximity to the issue has on a respondent's awareness, attitudes, and actions. The results indicate that proximity is an influence on Kalkaska opinions and actions, however, it had no influence on residents in Montmorency's affected respondents. Residents living in the Kalkaska affected townships were more aware, more opposed, and took more high level actions. Montmorency's counterparts were more undecided and took less actions than the out-township respondents.

Table 4.41. Influence of Proximity to Application Sites on Respondent Awareness, Attitudes, and Actions Toward the 1981 Forest Application Proposal.

	Kalkaska Sample		Montmorency Sample	
	Affected Townships	Unaffected Townships	Affected Townships	Unaffected Townships
Awareness of 1981 proposal				
Aware	62.1%	48.0%	51.4%	51.7%
Not aware	37.9%	52.0%	48.6%	48.3%
Total n	29	204	37	232
Attitude toward the 1981 proposal				
Against the proposal	61.1%	40.8%	22.2%	29.3%
Favor the proposal	5.6%	15.3%	16.7%	25.0%
Undecided	33.3%	43.9%	61.1%	45.7%
Total n	18	98	18	116
Actions taken				
Took no action	11.1%	28.6%	73.7%	39.5%
Read or talked w/others	55.6%	57.1%	15.8%	42.1%
Attended meetings/ contacted agency	33.3%	14.3%	10.5%	18.4%
Total n	18	98	19	114

The final analysis in this section compares the pulics' attitudes toward future forest application and the MDNR with their attitude about proper forest application management by state and local agencies. The results in Table 4.42 indicate that repondents in both counties opposed to a future forest application project are also doubtful that such a project will be properly managed (Kalkaska=78.0%; Montmorency=73.7%). The converse, however, also holds true. That is, those that favor such a project also tend to believe that it will be properly managed (Kalkaska=81.4%; Montmorency=82.7%). Respondents undecided about future projects tended to be slightly more trusting of the mangement agencies (Kalkaska=52.4%; Montmorency=61.2%).

Skepticism of MDNR programs when analyzed by trust in state and local forest application management produced very similar results to those reported above (Table 4.42). Respondents that are skeptical of MDNR programs doubted that forest application would be properly managed (Kalkaska=75.0%; Montmorency=69.5%). Respondents not skeptical of MDNR programs predominately felt that mismanagement would not occur (Kalkaska=72.7%; Montmorency=63.8%).

Table 4.42. Public Attitude of Whether State and Local Agencies Will Properly Manage Forest Application Broken Down by Attitude Toward Future Application Projects and Skepticism of MDNR Programs.

Attitude Variables	Properly Managed? Kalkaska Sample Yes	Kalkaska Sample No	Montmorency Sample Yes	Montmorency Sample No
Future Forest Application Attitude	(n=101)	(n=126)	(n=133)	(n=131)
Opposed	22.0%	78.0%	26.3%	73.7%
Favor	81.4%	18.6%	82.7%	17.3%
Undecided	52.4%	47.6%	61.2%	38.8%
Skeptical of MDNR Programs	(n=100)	(n=119)	(n=130)	(n=130)
Agree	25.0%	75.0%	30.5%	69.5%
Disagree	72.7%	27.2%	63.8%	36.2%
Don't know	50.9%	49.1%	57.7%	42.3%

Chapter 5

DISCUSSION AND RECOMMENDATIONS

Discussion of Findings

Research Question 1

What variables may be inferred to explain the sludge application proposal's acceptance by Montmorency County residents and its rejection by Kalkaska County residents?

As a whole, Kalkaska and Montmorency general samples were similar on the majority of the measured variables. One of the more important differences regarded the public's attitudes toward the 1981 forest application proposal.

In Kalkaska County, a majority of respondents who were aware of the proposal were opposed (43.0%). However, of the aware group that took high effort actions (attended meetings, contacted agency officials, or took some leadership role), 70.0 percent were opposed and only 10.0 percent favored (Table 4.34). It appears that, though the negative attitude of Kalkaska County activists was reflective of public opinion, the disproportionally high representation of this attitude among activists was responsible for rejection of the proposal.

In Montmorency County, the strong negative reaction of activists was absent. In fact, 50.0 percent of the activists were in favor of the project and 40.9 percent opposed. Attitudes of the aware public were similar in proportion but slightly reversed, with 28.1 percent opposed and 23.7 percent in favor of the 1981 forest application proposal. These split opinions by residents resulted in no organized opposition to the project which was favored by a 6:1 ratio of decided officials.

The important question now becomes, "What variables influenced the negative reaction in Kalkaska'a activist respondents?" Knowledge of sludge management and of the project's details was significantly higher for activists than for other aware publics in both counties. Thus, knowledge cannot explain Kalkaska's reaction. Other significant relationships which had similar trends for both counties were education, number of forest uses, and number of information sources.

Attitude toward the MDNR's programs is the one measured variable that demonstrates a significantly different trend between Kalkaska activitsts and both aware Kalkaska respondents and Montmorency activists. For this variable, Kalkaska responses ranged from neutral for respondents that took no action to skeptical for activists. In contrast, Montmorency responses showed no significant difference and activists had neutral attitudes toward MDNR programs.

This skepticism of the MDNR in Kalkaska is understandable when past events are considered. In 1974, the MDNR approved a section of state land for the mass burial of PBB-contaminated cattle. This was done against the objections of the county and its citizens (Norton, 1981). Also, some Kalkaska residents have water wells contaminated by

oil well by-products. This contamination was attributed to the MDNR's lax control of drilling in this county.

As discussed by Helmreich (1972), the relationship between communicator credibility and attitudes is a very stable and replicable effect. It seems quite possible that the negative public sentiment toward the MDNR could have significantly biased reaction to the proposal. Residents expressed the fear of being set up by the MDNR as a "dumping ground" for toxic wastes (Norton, 1981). Thus, county skepticism of the MDNR, especially among the most active publics, was probably a major cause of the forest application proposal's rejection.

The method in which the MDNR sought approval for the proposal may have also influenced its rejection or approval. In Kalkaska County, the MDNR first requested, and received, the county commissioners' approval to apply sludge to state forest lands. Officials and residents in the affected townships objected. They felt it was their right to negotiate and decide local issues. The MDNR approached Montmorency County differently, and introduced the proposal through the Northeast Michigan Council of Governments, which includes county, township, and municipal government representatives.

A final factor that may have contributed to the proposal's rejection was the source of the sludge. The proposed sludge for Kalkaska was to come from Jackson, a southern Michigan city. However, over 70 percent of the respondents in both counties were opposed or strongly opposed to bringing sludge in from other parts of Michigan. Residents expressed fear at the Kalkaska public hearing that their county would become the dumping ground for industrialized southern Michigan. Therefore, for the Montmorency proposal, the MDNR decided to use sludge from

two northern Michigan cities that were adjacent to this sparsely populated county.

Thus, it appears that the three most important factors influencing Kalkaska's rejection and Montmorency's acceptance of the proposal were the MDNR's credibility, the method of introducing the proposal, and the source of the sludge which was to be applied. Any future forest application proposals should carefully consider these mechanisms in the initial planning.

Research Question 2

How do the following selected demographic variables compare between random samples of Kalkaska and Montmorency county residents?

a) age
b) sex
c) education level
d) income level
e) occupation level
f) affiliation with organizations (national or local)
g) usage of state forest lands

Respondents from the two counties appear to be similar on measures of sex, education levels, income levels, affiliation with organizations, and usage of state forests.

Respondents of the two counties were different on age and occupation (work grouping) variables. Mean age for Kalkaska residents was 46.7 years and for Montmorency residents it was 51.22 years. This difference can be partially explained by the prevalence of retired workers in Montmorency County (37.4%, Table 4.3). In contrast, skilled and semi-skilled worker was the predominant occupation for Kalkaska respondents (37.3%).

Research Question 3

What relationships exist between the above demographic variables and

a) beliefs concerning sludge treatment and its alternatives...
b) values and concerns pertaining to sludge treatment alternatives...
c) attitudes toward the use of sludge treatment alternatives...
d) behaviors toward the proposed sludge treatment demonstration project...

...within and between Montmorency County and Kalkaska County residents?

Demographic influences on beliefs (knowledge). The combined group of continuous demographic variables (sex, age, income, education level, number of environmental memberships, and number of different forest uses) had a significant relationship with the knowledge score in both counties.

Individual demographic variables that were associated with knowledge were sex, education level, and occupation. Males tended to have higher knowledge scores in both counties. In Montmorency, higher knowledge scores were also associated with education level and the manager or professional work category. Homemakers had the lowest knowledge of sludge technology. Similar results for education and occupation in Kalkaska County were not significant. The variables age, income, memberships, and forest uses were not significantly associated with knowledge scores.

Demographic influences on values (concerns). Five value scales were assessed: 1) environmental/economic value (e/e value) orientation, 2) importance of human health concerns as they relate to forest

application of sludge, 3) importance of economic concerns, 4) importance of environmental quality concerns, and 5) importance of aesthetic concerns. These value measures were compared to the continuous demographic variables.

In general, respondent values had little association with the combined grouping of demographic variables. Exceptions were relationships with the e/e value measure for both counties, and with environmental quality and aesthetic concerns for Kalkaska County.

Age was the demographic variable most consistently related to the value measures. Age was significantly related to e/e value orientation (Kalkaska, $r=-.157$, $p<.01$; Montmorency, $r=-.144$, $p<.01$) and environmental quality concerns (Kalkaska, $r=-.261$, $p<.001$; Montmorency, $r=-.125$, $p<.05$). Economic value orientation increased and environmental quality concerns decreased with age. This trend for increased utilitarianism with age was also reported by Kellert (1980), when he studied the association of wildlife values with age. The relationship between age and environmental concern also concurs with the review of literature by Van Liere and Dunlap (1980). However, the relationship they reported between higher education and greater environmental concern was not found in this study.

Demographic influences on sludge application attitudes. Combined demographics had no significant influence on Kalkaska respondent attitudes toward forest application, but they did have a significant relationship with Montmorency attitudes.

The analysis of demographic means by forest application attitudes (Tables 4.28 and 4.29) revealed some important trends. Respondents

opposed to future application proposals were predominantly in lower education levels, while those favoring proposals were predominantly in the highest education level. A trend (not significant) also existed for the opposed group to report the highest number of state forest uses.

Respondents who were undecided about either their position on future proposals, or their probable involvement reported a significantly younger mean age in Montmorency County, and significantly fewer environmental memberships in Kalkaska County. The undecided respondents also reported the lowest number of state forest uses (not significant). This relationship between fewer forest uses and indecision may reflect a lower interest in the sludge issue by this group.

Demographic influences on behaviors. Several demographic variables did have significant relationships with actions taken to block or promote the 1981 forest application proposal. In both counties, respondents that took high level actions tended to have higher education levels and a higher number of state forest uses. Montmorency activists also had the highest average incomes and more environmental memberships. Kalkaska activists were predominantly male, but no difference between sexes existed in Montmorency. Aware publics that took no action had the lowest number of forest uses, and they were predominantly undecided about the proposal.

From the forest use data, it appears that attitudes/actions can be related to self-interest or to an individual's immunity to the consequences as suggested by Tichenor et al. (1971) and Force et al. (1977). In the sludge opinion study, repondents who either took action or

anticipate taking action had a significantly higher number of forest uses. Thus it seems that information/education programs related to forest-sludge proposals should target specific forest users which have a greater stake in the issue, such as environmental and recreational organizations.

Research Question 4
How does the extent and accuracy of the belief systems compare between Kalkaska and Montmorency County residents?

Three types of knowledge scales were included in the survey instrument: 1) a knowledge score of project details, 2) a knowledge score of the sludge problem and its management, and 3) a series of nine belief items assessing anticipated effects of forest application.

In general, overall responses by residents of each county were quite similar. The means of the two knowledge scores were not significantly different for the counties. These scores tended to be low, with an average 1.5 correct out of six questions covering project details, and 3.4 correct out of eleven sludge management questions. Respondents more accurately answered management questions that were not technical in nature. The counties were also similar in their beliefs of the harmful or beneficial effects of sludge application to state forests.

A final knowledge question asked respondents who were aware of the 1981 forest application project to check its current status. Over half of Montmorency's respondents correctly marked that sludge had been applied to the sites. In Kalkaska, however, only 23.1 percent knew that the project had been dropped. Most (48.7%) indicated that they did not know what the current status was in Kalkaska. This discrepancy

may have been caused by the follow-up media coverage in Montmorency County.

More than three-fourths of respondents that were aware of the proposal indicated that they received some of their information from newspapers. In Kalkaska County, the proposal was quietly dropped with no known follow-up newspaper coverage. Montmorency, in contrast, had a full page article and pictorial printed in the county newspaper in conjunction with application. From this it appears that mass media communications do play an important role in keeping the public current about management plans.

Research Question 5

What relationships exists among

a) beliefs...
b) values...
c) attitudes...
d) behaviors...
e) information sources...

...concerning land application of sludge within and between residents of Kalkaska and Montmorency counties?

Beliefs (knowledge). In both counties, combined non-demographic variables were significantly related to the general knowledge score (Table 4.18). Individually, higher knowledge was related to awareness of the 1981 forest application proposal, and to high effort actions to block or promote that proposal. Knowledge was also positively related to environmental concerns (e/e value orientation) in Montmorency County.

The strongest relationship reported, however, was between knowledge and favoring future forest application proposals. Respondents who favored forest application averaged 6.29 correct out of eleven questions. In contrast, those opposed averaged 2.75, and those undecided averaged 2.91. This finding concurs with Zajonc (1968) who noted that initial conflict and discomfort in an individual is often due to unfamiliarity with that object. In this case it is quite possible that opposed or undecided repondents took their position due to unfamiliarity with this new and technical issue.

As mentioned, respondents in both counties that used high effort actions to block or promote the 1981 forest application proposal had significantly higher knowledge scores. This supports the contention of Bultena et al. (1977) that those who know more about a project hold more intense attitudes, either for or against. However, it conflicts with the above finding in which high knowledge was only related to favoritism.

This discrepancy appears to follow Ableson's (1972) contention that informational strategies do not always impact attitudes/behavior as expected. Findings in this study indicate that the small, more polarized groups of activists may have been responding to strong value or attitude cues (e.g., MDNR lack of competence, mistrust) and knowledge may have played a smaller role in influencing their attitudes about forest application. However, for the general public which has not taken a strong value position, knowledge about the issue may allow a more favorable attitude to develop, as suggested by Young (1980). This would support the relationship between higher knowledge scores and

favorable attitudes in the general public, and has important implications for future I and E programs.

Values. Value relationships are incorporated into the discussions of other non-demographic variables in research question 5.

Attitudes. A strong significant relationship was detected between combined non-demographic variables and attitudes toward future forest application proposals (Table 4.30).

As mentioned previously, a strong relationship existed between high knowledge of sludge management and favoritism. Further, respondents favoring forest application had significantly higher economic concerns than those opposed. In Montmorency, favorable respondents were also more aware of the 1981 proposal, and had lower human health concerns than respondents opposed or undecided.

Respondents in both counties that opposed future forest application proposals were significantly more skeptical of MDNR programs. Those favoring or undecided were generally neutral toward the MDNR. Opposed respondents also had significantly higher environmental value orientations than those in favor of application or undecided.

Generally, respondents that were undecided about either their position on future proposals or their probable future involvement had near mean scores on most non-demographic variables.

Behaviors. The relationships between actions taken to block or promote the 1981 forest application proposal and important non-demographic

variables are quite helpful in characterizing activists and non-activists. In general, repondents that participate in high effort actions to block or promote the proposal had significantly higher knowledge of sludge management and the details of the proposal, and a significantly larger number of information sources than aware, less active respondents.

In addition, Kalkaska County activists also differed on several specific items from Montmorency County activists. Kalkaska respondents who took high effort actions were significantly more skeptical of the MDNR, and used more information sources than Montmorency County activists. Kalkaska activists also tended to have lower economic concerns regarding sludge management (not significant).

Respondents with a predisposition to get involved in future forest application proposals were significantly more skeptical of MDNR programs and had higher environmental value orientations (Table 4.40). An interesting aspect of this question was that it related behavior directly with attitude (question 69, Appendix C). Respondents opposed to future proposals were twice as likely to get involved in blocking the proposal as respondents favorable toward future proposals. This greater tendency for opposed to become more involved underscores the importance of finding public involvement models which fairly represent all attitude positions of a population.

Information sources. Higher knowledge scores were compared with each of the major information sources (Table 4.19). High effort information

sources, such as public hearing or contacting agency officials, were associated with the highest mean knowledge scores. These activist publics also used significantly more sources of information. The number of different information sources, however, was not significantly related to attitudes toward the 1981 forest application proposal.

The most frequently utilized information sources were the mass media (newspapers especially) and talking with friends or relatives. This follows the findings of Stamm and Bower (1972), O'Riordan (1971), Borton and Warner (1971), and Arbuthnot (1977).

Research Question 6

How does proximity (township) to the proposed sites influence public...

a) awareness of...
b) attitude towards...
c) behavior towards...

...the sludge application project?

Proximity to the application sites appears to have had an influence on Kalkaska residents living in the affected townships, but no influence on their Montmorency counterparts. Affected Kalkaskan respondents tended to have greater awareness, to be more opposed and less undecided, and one of three indicated thay undertook a high effort action. Residents in Montmorency's affected township showed no difference in awareness, and they were more undecided and less active than other residents. It should be noted, however, that Montmorency's affected township encompasses roughly one-quarter of the county, yet it is sparsely populated, particularly in the areas surrounding the

application sites. Thus, it is difficult to determine if the residents of this township are truly the most affected by the proposal.

Implications and Recommendations

The survey of Kalkaska and Montmorency residents has demonstrated the importance of public assessment as a part of natural resource planning and policy making. An assessment of Kalkaska residents before introduction of the forest application plan would have predicted the difficulties that the MDNR eventually encountered. The agency learned too late that Kalkaska residents distrusted it, sludge should not be brought in from other parts of the state, and local governments and affected citizens should be involved in the plans' approval.

This survey determined the important variables which relate to the sludge application issue, and substantiate the recommendations made about public involvement strategies and information and education programs. The following paragraphs will discuss these variables and their application to a comprehensive I & E program.

Several relationships exist in both Kalkaska and Montmorency counties which differentiate supporters of forest application from those opposed. Specifically, residents that supported future proposals were likely to have more knowledge of sludge management, to place greater importance on economic concerns, and to have higher education levels. In contrast, opposed residents were likely to have a greater mistrust of MDNR programs, a greater predisposition to take action toward forest-sludge proposals, a higher environmental value orientation, and to report more forest uses.

Two of the above variables, knowledge of sludge management and mistrust of the MDNR, seem to be key components for acceptance of future proposals. Respondents with a low understanding of the sludge problem were typically opposed or undecided about sludge management. Further, they predominantly favored incineration, even though they perceived it to be an expensive alternative. In contrast, respondents who favored forest application had significantly higher knowledge scores. These results suggest that unfamiliarity with this new, technically-based issue and its ramifications likely contributed to the initial skepticism of this program. An I & E program needs to be developed which increases public understanding of this issue.

Mistrust of the managing agency, the MDNR, also significantly influenced forest application attitudes. This research determined that skepticism of MDNR programs among activists significantly contributed to the eventual rejection of the 1981 forest-sludge proposal in Kalkaska County. Thus, even though the activists had high knowledge of the sludge management issue, their strong mistrust of the MDNR prevented a favorable attitude from developing. Additional information about the project to these activists probably would have had little impact on their attitude toward forest application. More appropriate for these individuals (and perhaps the entire county) would be a long term program to rebuild the MDNR's trust.

An interesting paradox in the survey results was the high degree of skepticism concerning MDNR programs by many residents, yet they perceived the agency as being the third most accurate information source among the 13 listed. This indicates that the public in these counties trust what the MDNR says, but not what they do. Again, this

finding points to a need for the agency to attempt to rebuild its credibility by informing the residents of the successful programs that the MDNR have managed and how they are increasing the quality of life.

The impact of sludge application on public health was identified as the primary concern of residents and should be specifically addressed by an I & E program. On the average, respondents from all attitude groupings allocated human health concerns approximately half of the 100 points to be divided among four sludge related values. Further, over 40 percent of all residents were of the opinion that a sludged forest should be fenced to protect the public. For sludge application alternatives to be acceptable to the public, information should be provided of the possible effects of application on human health, and the management steps that will be taken to safeguard the public.

Another important concern of respondents that should be addressed is the impact of sludge application on environmental quality. Residents in both of these northern Michigan counties report a high use of, and concern for, their local forest and natural resources. This is demonstrated by their large number of forest uses, a 60 percent response rate to this "natural resources" survey, and a 50 percent awareness of this small scale, demonstration forest application proposal. Specific environmental variables that should be covered by an I & E program include the anticipated effects of sludge application on water quality, wildlife species and their habitat, recreation, and adjacent property values.

It was also determined that the public is less concerned with the economic costs of sludge disposal. As mentioned earlier, incineration

was preferred by many respondents, even though the public also perceived it to be the most expensive alternative. When given the choice between human health, environmental quality, and economic costs, the public placed significantly less priority on the economic impacts of sludge application.

A comprehensive I & E program should also compare the impacts and limitations of forest application with other available sludge disposal alternatives. In this survey, many respondents preferred other disposal methods such as incineration and landfilling. However, residents who chose these methods generally had the lowest knowledge of the sludge issue and its management. It seems that greater familiarity with sludge disposal alternatives will help the public to rationally select from the available options.

A final concern of respondents was the source of sludge to be applied. In this study, over 70 percent of the respondents objected to bringing sludge in from other parts of the state. Future proposals have a higher probability of success if they consider using sludge that is of local or regional origin. Certainly, this aspect should be anticipated in an I & E program.

Another important variable in the development of an I & E program on forest application is communicator credibility. It is important that communication to the public about a new resource issue such as sludge management utilize an information source perceived as credible by the public. Several of the potential information sources listed in the survey (e.g., local officials and industry) were perceived by many respondents as having low credibility. The most accurate sources perceived by the public were university sources, state agencies, and sporting or environmental organizations.

Mass media were not evaluated as highly accurate but were without question the most utilized public communication source. Thus, to reach the largest audience, newspapers, radio, and television must be used. To improve their credibility regarding a specific resource issue, managers should attempt to have acceptable sources incorporated into articles. It is imperative managers/planners need to find ways to cooperate with the mass media to insure accurate, adequate coverage.

A final communicator consideration suggested by Ableson (1972) is the use of repetition in an I & E strategy. Information should be released as often as possible, and through as many sources as possible. Repetition should increase both awareness and understanding of a technically-based issue.

The lessons learned from this public assessment survey can also be generalized to other natural resource planning and policy applications. When properly administered, an opinion survey can become an effective first step in a public participation strategy. The survey is important because it gauges public understanding and sentiment, increases public awareness and involvement, increases the representativeness of non-vocal residents, and allows managers to make adjustments in a plan before large amounts of time and money are expended on a flawed plan.

In addition to the public assessment survey, a comprehensive public participation strategy should be adopted by a resource agency in the early stages of planning. In this way the plan could incorporate public input or at least inform the public of the progress in planning. This participation strategy should make an effort to communicate with both the general public and with those most directly affected by a future proposal. In the case of forest application, forest users and

residents in the affected application areas should be targeted. However, managers/planners must exercise care when dealing with affected publics. In many cases their attitudes do not accurately reflect the attitudes of the general population.

Several public involvement strategies have been developed which go beyond the post hoc public hearing. Examples of tested strategies include an advance I & E program which lays an informational foundation for future programs (Pelz and Gannon, 1979), contacting and planning with local opinion leaders (Borton and Warner, 1971), or placing public projects in a highly visible position and involving the affected from the start of planning (Sargent, 1972; Sargent, 1978). Although further discussion of these involvement techniques is beyond the scope of this study, it is strongly recommended that participation strategies in the literature be researched by managers/planners and incorporated into the program's design.

In closing, it is recommended that the MDNR develop a follow-up I & E strategy specifically for each affected county. For Montmorency this program should regularly inform the public of the demonstration project's status, and should also incorporate information about the concepts of sludge management and its alternatives. Kalkaska also needs an I & E program which provides the conceptual information about forest application. In addition, their program should include information about the success of the Montmorency project and a program to rebuild the MDNR's credibility in this county. It is necessary to show Kalkaska residents that the earlier proposal was not a sinister plot to further degrade their county, and that the Montmorency project is being competently managed.

Summary of Major Findings

- The rejection of the sludge application proposal in Kalkaska County was caused primarily by mistrust of the MDNR, the method used to introduce the proposal, and the proposed source of sludge to be applied.

- Other than age and occupation, no differences were found in demographics or knowledge levels between respondents in Kalkaska and Montmorency counties.

- Supporters of forest application proposals tended to have more knowledge of sludge management, placed greater importance on economic concerns, and had higher education levels.

- Opponents of forest application tended to have greater mistrust of MDNR programs, a higher environmental orientation, more forest uses, and a greater predisposition to take action on this issue.

- The positive association between support of forest application and knowledge of sludge management was the strongest relationship found in this study. However, the presence of strong value and attitude cues (e.g., lack of trust in MDNR) can potentially prevent a favorable attitude from developing in publics which have high knowledge of the sludge issue.

- The effect of sludge application on human health was the greatest concern of respondents.

- Kalkaska and Montmorency residents are closely associated with their environment and have strong concerns for the effects that sludge application would have on their area resources.

- Economic costs of sludge application was not the major concern of most respondents.

- Sex, education level, and occupation were associated with higher knowledge scores. Age, income, number of environmental memberships, and number of forest uses were not significantly associated with knowledge scores.

- Economic value orientation increased and environmental quality concerns decreased with age.

- High level actions regarding the sludge application proposal were related to knowledge of the sludge issue, more information sources, higher education levels, and a higher number of forest uses.

APPENDIX A

Survey Mailings

MICHIGAN STATE UNIVERSITY

DEPARTMENT OF FISHERIES AND WILDLIFE
NATURAL RESOURCES BUILDING
(517) 355-4477

EAST LANSING • MICHIGAN • 48824

July 6, 1982

Dear Kalkaska County Resident,

In the past few years there has been much discussion about how our natural resources should be managed. "Public Participation" has become a key phrase in resource decision-making. This study will ask for your opinions regarding natural resource policy and planning. It will also address a specific natural resource issue that recently occurred in Kalkaska County.

You represent one of a small number of Kalkaska County residents who are being asked to give their opinion on how natural resource problems should be solved. In order that the results truly represent the thinking of your county, it is important that each questionnaire be completed and returned. Your cooperation is critical to our study, even if you have no strong feelings of interest about this subject.

You may be assured of complete confidentiality. The questionnaire has an identification number for mailing purposes only. This is to allow us to check your name off the mailing list when your questionnaire is returned. Your name will never be placed on the questionnaire.

This study is being conducted by Michigan State University so that recommendations can be made to state and local resource management agencies. This research will help to estimate the levels of public concern and the extent to which the public wants to be involved in solving natural resource problems.

If you have any questions about the survey, I will be happy to answer them; please write or call. If you choose to call, please dial (517) 355-4477 and ask for Tom Lagerstrom.

We know your time is valuable, and we would like to express our thanks for your cooperation.

Sincerely,

R. Ben Peyton

R. Ben Peyton
Project Director

July 13, 1982

Last week a questionnaire seeking your opinion about natural resource planning was mailed to you.

If you have already completed and returned it to us, please accept our sincere thanks. If not, please do so today. The survey has been sent to only a small, but representative, sample of residents in your county. Thus, it is extremely important that YOUR VIEWS are also included in this study if the results are to accurately represent the opinions of your county.

If by some chance you did not receive the questionnaire, or if it got misplaced, please call me now, (517-355-4477) and I will get another one in the mail to you today.

R. Ben Peyton

R. Ben Peyton
Project Director

MICHIGAN STATE UNIVERSITY

DEPARTMENT OF FISHERIES AND WILDLIFE
NATURAL RESOURCES BUILDING
(517) 355-4477

EAST LANSING · MICHIGAN · 48824

July 27, 1982

Dear Kalkaska County Resident:

About three weeks ago I wrote to you seeking your opinion about natural resource management decisions. As of today we have not received your completed questionnaire.

We are encouraged by the number of questionnaires already returned, but we need your response to be able to accurately describe the opinions of Kalkaska County residents. This is because our past experiences suggest that those of you who have not yet sent in your questionnaire may hold quite different opinions from those that have already responded.

The issue we cover in the questionnaire, application of sludge to state and forest lands, is a relatively new problem for Michigan. This study is an attempt to consider the views of citizens in the initial planning stages for not only sludge disposal, but for other natural resource problems in Michigan as well. The usefulness of our survey results depends on how accurately we are able to describe what the people of Kalkaska County think.

In the event that your questionnaire has been misplaced, a replacement is enclosed.

Your cooperation is greatly appreciated.

Sincerely,

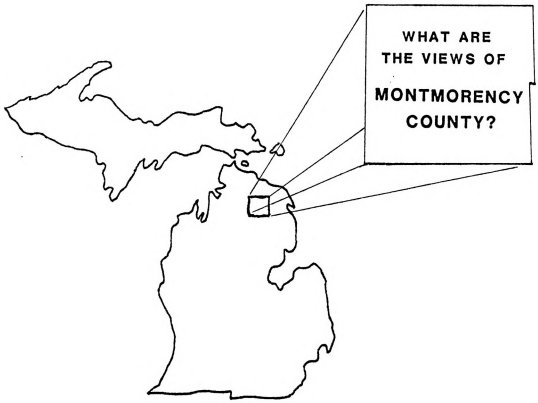
R. Ben Peyton

R. Ben Peyton
Project Director

APPENDIX B

Complete Survey Instrument

MONTMORENCY
PUBLIC OPINION SURVEY ON NATURAL RESOURCE MANAGEMENT



A PROJECT OF:

Michigan State University
Department of Fisheries and Wildlife
Natural Resources Building
East Lansing, Mich. 48824

DIRECTIONS FOR FILLING OUT THE QUESTIONNAIRE

- Please answer all questions as best you can.
- It is important that the person to whom this questionnaire is addressed fills it out. This will ensure representativeness.
- Do not write your name on the questionnaire.
- Return the questionnaire using the addressed, pre-paid return envelope provided.

THANK YOU FOR YOUR COOPERATION!

MONTMORENCY PUBLIC OPINION SURVEY
ON NATURAL RESOURCE MANAGEMENT

PUBLIC INVOLVEMENT IN NATURAL RESOURCE DECISIONS

1. In general, do you feel citizens are involved enough in natural resource policy and planning decisions?

   ☐ YES

   ☐ NO

2. Should public agencies change the way they involve the public in natural resource decisions?

   ☐ YES

   ☐ NO

MUCH INFLUENCE	SOME INFLUENCE	LITTLE INFLUENCE	NO INFLUENCE	Please circle the number at the left which best answers each question. How much influence do you feel you can have on the natural resource planning and policy of...
1	2	3	4	3. ...local government agencies (e.g., county commissioners)?
1	2	3	4	4. ...state government agencies (e.g., Department of Natural Resources)?
1	2	3	4	5. ...federal government agencies (e.g., U.S. Forest Service)?

6. Please check (✓) the one statement which best describes the level of involvement that you would prefer to have if a natural resource problem were identified in your area.

☐ A. I FEEL THAT THE PLANNING AND DECISION-MAKING SHOULD BE LEFT TOTALLY TO THE EXPERTS.

☐ B. EXPERTS SHOULD FIRST OBTAIN THE VIEWS OF THE AFFECTED CITIZENS AND THEN PROCEED TO DO THE PLANNING AND MAKE THE FINAL DECISION.

☐ C. EXPERTS SHOULD ONLY DO THE EARLY PLANNING AND PROVIDE THE ALTERNATIVES FROM WHICH CITIZENS CAN SELECT.

☐ D. CITIZENS SHOULD CONTROL THE ENTIRE PLANNING AND DECISION-MAKING PROCESS AND USE EXPERTS ONLY AS CONSULTANTS AND TO IMPLEMENT THEIR FINAL PLAN.

ALWAYS ACCURATE	USUALLY ACCURATE	SOMETIMES ACCURATE	SELDOM ACCURATE	NEVER ACCURATE	NO OPINION	Please indicate how accurate you feel information from the following sources would be by circling the appropriate number on the left.
1	2	3	4	5	6	7. University Sources
1	2	3	4	5	6	8. Michigan Department of Natural Resources (DNR)
1	2	3	4	5	6	9. Michigan Department of Public Health
1	2	3	4	5	6	10. Environmental Organizations (e.g., Audubon, Sierra Club, etc.)
1	2	3	4	5	6	11. Michigan United Conservation Club (MUCC)
1	2	3	4	5	6	12. Federal Environmental Protection Agency (EPA)
1	2	3	4	5	6	13. A Sporting Organization (e.g., Ducks Unlimited, Trout Unlimited)
1	2	3	4	5	6	14. Michigan Department of Agriculture
1	2	3	4	5	6	15. Industrial Sources
1	2	3	4	5	6	16. Local Government Officials
1	2	3	4	5	6	17. TV/Radio
1	2	3	4	5	6	18. Newspapers
1	2	3	4	5	6	19. Magazines

The remainder of this questionnaire will focus on a natural resource issue that occurred in Montmorency County in 1981. In that year, a proposal was made to apply sludge to state forests in your county.

Sludge refers to the settled materials that are a by-product of the municipal wastewater treatment process. In recent years, disposal of increased amounts of sludge has become an important state problem. Researchers are now studying the impacts of our present disposal methods, which include burning, landfilling, and application to agricultural and forest lands.

20. Were you aware of the forest-sludge application project proposed in 1981 for Montmorency County before receiving this questionnaire?

☐ YES

☐ NO

If no, please go the question 31.

21. Which of the following best describes your attitude toward the forest-sludge project when it was proposed for Montmorency County?

☐ A. I WAS AGAINST THE SLUDGE APPLICATION PROJECT.

☐ B. I WAS IN FAVOR OF THE SLUDGE APPLICATION PROJECT.

☐ C. I WAS UNDECIDED.

22. Please check (✓) or list any action that you took to block or promote the proposed forest-sludge application project.

☐ A. TOOK NO ACTION

☐ B. READ MATERIALS ON THE SUBJECT

☐ C. TALKED ABOUT IT WITH FRIENDS, RELATIVES OR NEIGHBORS

☐ D. CONTACTED OFFICIALS OR NEWSPAPERS BY LETTERS, PHONE, OR VISIT

☐ E. ATTENDED MEETINGS, PUBLIC HEARINGS, OR WORKSHOPS

☐ F. TOOK AN ACTIVE LEADERSHIP ROLE IN ORGANIZING MEETINGS, CIRCULATING PETITIONS, OR OTHER SUCH ACTIVITIES

☐ G. OTHER, PLEASE SPECIFY _____

_____

In the following questions, we would like to determine how familiar you are with the proposed Montmorency project to apply sludge to state forest lands.

23. Which of the following best describes the present status of the forest-sludge project in Montmorency County?

- ☐ A. SLUDGE HAS BEEN APPLIED, AND THE SITES ARE BEING STUDIED.
- ☐ B. THE SITES ARE BEING PREPARED FOR SLUDGE APPLICATION.
- ☐ C. THE PROJECT HAS BEEN PLACED ON HOLD.
- ☐ D. THE PROJECT HAS BEEN DROPPED IN MONTMORENCY COUNTY.
- ☐ E. I DO NOT KNOW.

AGREE	DON'T KNOW	DISAGREE	Please read each statement carefully and circle the number at the left of each statement which best indicates your opinion on that statement.
1	2	3	24. In the Montmorency Forest Application Project, the source of sludge is from Saginaw.
1	2	3	25. The Montmorency Forest-Sludge Project is being funded by the Environmental Protection Agency.
1	2	3	26. In the Montmorency Forest-Sludge Project, sludge will be applied yearly to the sites.
1	2	3	27. Sample plots for the Montmorency Forest-Sludge Project involves several thousands of acres of state forest lands.
1	2	3	28. In the Montmorency Forest-Sludge Project, the application of sludge is taking place in Albert and Loud Township state forests.
1	2	3	29. A public hearing regarding the Montmorency Sludge-Forest Proposal has not been provided for the citizens of affected townships.

30. Please check (✓) all of the sources from which you received information concerning the application of sludge to Montmorency County forest lands.

- ☐ A. NEWSPAPERS
- ☐ B. MAGAZINE OR JOURNAL
- ☐ C. TV/RADIO
- ☐ D. FROM A FRIEND OR RELATIVE
- ☐ E. PAMPHLETS AND BROCHURES
- ☐ F. ATTENDED PUBLIC HEARINGS
- ☐ G. ATTENDED LOCAL WORKSHOPS, SEMINARS, OR SPECIAL LECTURES
- ☐ H. CONTACTED A UNIVERSITY OR GOVERNMENT AGENCY
- ☐ I. ATTENDED ADULT EDUCATION CLASS(ES)
- ☐ J. LIBRARY

YOUR OPINIONS

The following series of questions is intended to obtain your knowledge and opinions about sludge application and other environmental concerns. If you feel that you do not have enough information to answer a question accurately, please respond "DON'T KNOW".

STRONGLY AGREE	AGREE	DON'T KNOW	DISAGREE	STRONGLY DISAGREE	Please read each statement carefully and circle the number at the left of each statement which best indicates how strongly you agree or disagree with that statement.
1	2	3	4	5	31. Sludge disposal is a significant problem for many cities in Michigan.
1	2	3	4	5	32. An application of sludge to a forest site would spoil the aesthetics (beauty) of the area for several years.
1	2	3	4	5	33. Toxic chemical problems associated with forest application of sludge can be avoided with proper management techniques.
1	2	3	4	5	34. Municipal sludge composition can vary greatly from one community to another.
1	2	3	4	5	35. Clay soils would be the best type if sludge is to be applied to land.

(Continued on Next Page)

STRONGLY AGREE	AGREE	DON'T KNOW	DISAGREE	STRONGLY DISAGREE	
1	2	3	4	5	36. The forest areas to which sludge has been applied should be fenced in to protect the public.
1	2	3	4	5	37. Society has a responsibility to dispose of its wastes in the safest possible way regardless of the costs.
1	2	3	4	5	38. If properly managed, sludge can be applied to land without causing water pollution.
1	2	3	4	5	39. I would be skeptical of most management programs proposed by the Michigan DNR.
1	2	3	4	5	40. The application of sludge to forest lands would pose no great threat of disease to the public.
1	2	3	4	5	41. If sludge is going to be applied to state forests near me, it should not be brought in from other parts of Michigan.
1	2	3	4	5	42. Although environmental considerations are important, the environmental considerations should not stand in the way of progress and economic growth.
1	2	3	4	5	43. Regardless of whether or not any bad effects result, it is wrong for society to dump sludge in the forest.
1	2	3	4	5	44. Agricultural land application of sludge could meet all of the nitrogen fertilizer needs of the U.S.
1	2	3	4	5	45. If pollution control standards are shown to be inflationary, they should be relaxed in favor of the economy.
1	2	3	4	5	46. Most of the toxic components in sludge are removed by the wastewater treatment plant.
1	2	3	4	5	47. Sludges contain the essential plant nutrients: nitrogen, phosphorus, and potassium.
1	2	3	4	5	48. Industries should be forced to shut down if they refuse to meet government pollution standards.
1	2	3	4	5	49. Odor problems will persist for a year or more after one application of sludge to a forest area.

VERY BENEFICIAL	BENEFICIAL	NO IMPACT	HARMFUL	VERY HARMFUL	DON'T KNOW	What would you expect to be the overall effect of applying non-industrial sludge to state forest lands for each of the following items. (Please circle your response to each item.)
1	2	3	4	5	6	50. Forest Growth
1	2	3	4	5	6	51. Surface Water Quality
1	2	3	4	5	6	52. Ground Water Quality
1	2	3	4	5	6	53. Public Health
1	2	3	4	5	6	54. Wildlife Habitat
1	2	3	4	5	6	55. Recreation
1	2	3	4	5	6	56. Adjacent Property Values
1	2	3	4	5	6	57. Wildlife Species
1	2	3	4	5	6	58. Long Term Environmental Quality

59. Do you feel that a program to apply sludge to a state forest site would be properly managed by local and state agencies?

☐ YES

☐ NO

Below are four possible methods of non-industrial sewage sludge disposal:

A. BURY IN LANDFILLS

B. INCINERATION (BURNING)

C. APPLICATION TO AGRICULTURAL LAND

D. APPLICATION TO FOREST LAND

E. NO OPINION

From the methods listed above, fill in the letter of the one method which you believe will have...

60. ____ the least threat to human health

61. ____ the greatest threat to human health

62. ____ the least threat to environmental quality

63. ____ the greatest threat to environmental quality

64. ____ the least economic cost (cheapest method)

65. ____ the greatest economic cost (most expensive method)

Please rank the four methods of non-industrial sewage sludge disposal according to your overall preference. (Fill in the appropriate letter.)

66. ____ first choice

67. ____ second choice

68. ____ third choice

A. BURY IN LANDFILLS
B. INCINERATION (BURNING)
C. APPLICATION TO AGRICULTURAL LAND
D. APPLICATION TO FOREST LAND

YOUR ATTITUDES TOWARD SLUDGE APPLICATION

69. Please check (✓) the one statement which best describes what you would do <u>if</u> another proposal was made to apply sludge in an area of state forest lands near you.

☐ A. I WOULD BE OPPOSED TO THE PROPOSAL, AND I WOULD GET INVOLVED.

☐ B. I WOULD BE OPPOSED TO THE PROPOSAL, BUT I WOULD <u>NOT</u> GET INVOLVED.

☐ C. I WOULD FAVOR THE PROPOSAL, AND I WOULD GET INVOLVED.

☐ D. I WOULD FAVOR THE PROPOSAL, BUT I WOULD <u>NOT</u> GET INVOLVED.

☐ E. UNDECIDED.

70. To show how much consideration you feel should be given to each category in making sludge-management decisions (such as how and where it will be disposed), <u>divide 100 points among the four categories</u>. The higher the number of points given to the category, the more importance you feel it should have compared to the other categories - remember that the total is to equal 100.

_____ HUMAN HEALTH

_____ ECONOMICS (COSTS)

_____ ENVIRONMENTAL QUALITY AND WILDLIFE

_____ AESTHETICS (BEAUTY) OF THE AREA

TOTAL = 100

PERSONAL INFORMATION

71. Your Sex: ☐ MALE

☐ FEMALE

72. Your present age: _____ YEARS

73. Which is the highest level of formal education that you have completed?

☐ A. LESS THAN A HIGH SCHOOL GRADUATE
☐ B. COMPLETED HIGH SCHOOL (12th GRADE)
☐ C. SOME COLLEGE OR POST-HIGH SCHOOL TRAINING
☐ D. COMPLETED COLLEGE
☐ E. COLLEGE BEYOND A BACHELOR'S DEGREE

74. How would you classify your primary occupation? (Please check (✓) the one response that best applies.)

☐ A. SEMI-SKILLED WORKER OR APPRENTICE CRAFTSMAN
☐ B. SALESWORKER OR CLERICAL/OFFICE WORKER
☐ C. SKILLED WORKER, CRAFTSMAN, OR FOREMAN
☐ D. FARMER
☐ E. MANAGER OR PROPRIETOR
☐ F. PROFESSIONAL
☐ G. HOMEMAKER
☐ H. UNEMPLOYED
☐ I. RETIRED
☐ J. OTHER (PLEASE SPECIFY) _____

75. Do you currently hold any political office at any level of government?

☐ YES

☐ NO

If yes, please specify_____

76. Please check (✓) all the types of activities you have done on state-owned forest lands in the past two years:

- ☐ 1. FISHING
- ☐ 2. SWIMMING, BOATING OR CANOEING
- ☐ 3. FIREARM DEER HUNTING
- ☐ 4. ARCHERY DEER HUNTING
- ☐ 5. SMALL GAME HUNTING
- ☐ 6. SCENIC DRIVING
- ☐ 7. SNOWMOBILING
- ☐ 8. TRAILBIKE RIDING
- ☐ 9. BERRYPICKING AND/OR MUSHROOM HUNTING
- ☐ 10. HIKING
- ☐ 11. CAMPING
- ☐ 12. GATHERING FUELWOOD
- ☐ 13. LOOKING FOR WILDLIFE
- ☐ 14. PHOTOGRAPHY
- ☐ 15. PICKICKING
- ☐ 16. CROSS-COUNTRY SKIING
- ☐ 17. OTHER, SPECIFY _____

77. Of the uses listed above, which one is the most important to you?

☐ (Fill in the box with the appropriate item number)

78. Are you a permanent resident of Montmorency County?

- ☐ YES
- ☐ NO

If yes, how long have you lived permanently in Montmorency County: _____ YEARS

79. In which township of Montmorency County do you live?

_____

80. In what city is your postal address located? _____

81. Do you live within a city or village limit?

- ☐ YES
- ☐ NO

82. What was your approximate gross family income from all sources before taxes in 1981.

- ☐ A. Less than $8,000
- ☐ B. $8,000 - $15,999
- ☐ C. $16,000 - $23,999
- ☐ D. $24,000 - $31,999
- ☐ E. $32,000 - $39,999
- ☐ F. $40,000 or more

83. Please check (✓) any of the following organizations in which you presently hold a membership.

- ☐ 1. AUDUBON
- ☐ 2. SIERRA CLUB
- ☐ 3. LEAGUE OF WOMEN VOTERS
- ☐ 4. GARDEN CLUB
- ☐ 5. MICHIGAN UNITED CONSERVATION CLUB
- ☐ 6. NATIONAL WILDLIFE FEDERATION
- ☐ 7. TROUT UNLIMITED
- ☐ 8. STEELHEADERS ASSOCIATION
- ☐ 9. RUFFED GROUSE SOCIETY
- ☐ 10. DUCKS UNLIMITED
- ☐ 11. A MICHIGAN TRAPPER'S ASSOCIATION
- ☐ 12. AN ORV CLUB (SNOWMOBILE, 4-WHEEL DRIVE, CYCLE, ETC.)
- ☐ 13. BOATING CLUB
- ☐ 14. WESTERN OR EASTERN MICHIGAN ENVIRONMENTAL ACTION COUNCIL
- ☐ 15. LOCAL LANDOWNER ASSOCIATION

Please specify any other organization of which you are a member and which may be concerned with environmental or natural resource problems: _____

_____

APPENDIX C

Complete Survey Results

Question 1
In general, do you feel citizens are involved enough in natural resource policy and planning decisions?

	Kalkaska Sample (n=239)	Montmorency Sample (n=277)	Kalkaska Officials (n=24)	Montmorency Officials (n=11)
Yes %	7.9	10.8	12.5	27.3
No %	92.1	89.2	87.5	72.7

Question 2
Should public agencies change the way they involve the public in natural resource decisions?

	Kalkaska Sample (n=233)	Montmorency Sample (n=272)	Kalkaska Officials (n=23)	Montmorency Officials (n=12)
Yes %	87.1	83.5	87.0	75.0
No %	12.9	16.5	13.0	25.0

Question 3
How much influence do you feel you <u>can</u> have on the natural resource planning and policy of local government agencies (e.g., county commissioners)?

	Kalkaska Sample (n=235)	Montmorency Sample (n=275)	Kalkaska Officials (n=24)	Montmorency Officials (n=13)
Much influence %	11.5	14.5	45.8	53.8
Some influence %	39.1	38.5	45.8	30.8
Little influence %	30.6	32.4	8.3	7.7
No influence %	18.7	14.5	0	7.7

Question 4
How much influence do you feel you can have on the natural resource planning and policy of state government agencies (e.g., Department of Natural Resources)?

	Kalkaska Sample (n=236)	Montmorency Sample (n=271)	Kalkaska Officials (n=24)	Montmorency Officials (n=13)
Much influence %	5.1	7.7	4.2	7.7
Some influence %	23.3	19.6	20.8	46.2
Little influence %	39.8	40.2	50.0	23.1
No influence %	31.8	32.5	25.0	23.1

Question 5
How much influence do you feel you can have on the natural resource planning and policy of federal government agencies (e.g., U.S. Forest Service)?

	Kalkaska Sample (n=235)	Montmorency Sample (n=269)	Kalkaska Officials (n=29)	Montmorency Officials (n=13)
Much influence %	4.3	5.6	0	7.7
Some influence %	14.0	12.3	12.5	15.4
Little influence %	27.7	33.8	33.3	30.8
No influence %	54.0	48.3	54.2	46.2

Question 6

Please check (✓) the one statement which best describes the level of involvement that you would prefer to have if a natural resource problem were identified in your area.

	Kalkaska Sample (n=240)	Montmorency Sample (n=279)	Kalkaska Officials (n=25)	Montmorency Officials (n=13)
I FEEL THAT THE PLANNING AND DECISION-MAKING SHOULD BE LEFT TOTALLY TO THE EXPERTS %	3.3	1.8	0	7.7
EXPERTS SHOULD FIRST OBTAIN THE VIEWS OF THE AFFECTED CITIZENS AND THEN PROCEED TO DO THE PLANNING AND MAKE THE FINAL DECISION %	40.0	42.3	40.0	38.5
EXPERTS SHOULD ONLY DO THE EARLY PLANNING AND PROVIDE THE ALTERNATIVES FROM WHICH CITIZENS CAN SELECT %	40.8	41.2	40.0	38.5
CITIZENS SHOULD CONTROL THE ENTIRE PLANNING AND DECISION-MAKING PROCESS AND USE EXPERTS ONLY AS CONSULTANTS AND TO IMPLEMENT THEIR FINAL PLAN %	15.8	14.7	20.0	15.4

Question 7
How accurate do you feel the information is from University sources:

	Kalkaska Sample (n=232)	Montmorency Sample (n=274)	Kalkaska Officials (n=25)	Montmorency Officials (n=12)
Always accurate %	3.4	1.5	4.0	0
Usually accurate %	49.1	56.9	56.0	41.7
Sometimes accurate %	30.6	25.9	28.0	33.3
Seldom accurate %	6.0	3.6	4.0	16.7
Never accurate %	0	.7	4.0	0
No opinion %	10.8	11.3	4.0	8.3

Question 8
How accurate do you feel the information is from the Michigan Department of Natural Resources (DNR):

	Kalkaska Sample (n=233)	Montmorency Sample (n=274)	Kalkaska Officials (n=26)	Montmorency Officials (n=12)
Always accurate %	2.6	1.8	0	0
Usually accurate %	39.5	39.8	26.9	50.0
Sometimes accurate %	36.1	40.5	38.5	50.0
Seldom accurate %	15.5	10.9	26.9	0
Never accurate %	3.9	2.2	7.7	0
No opinion %	2.6	4.7	0	0

Question 9
How accurate do you feel the information is from the Michigan Department of Health:

	Kalkaska Sample (n=230)	Montmorency Sample (n=270)	Kalkaska Officials (n=25)	Montmorency Officials (n=12)
Always accurate %	1.7	2.6	4.0	0
Usually accurate %	40.0	37.0	56.0	41.7
Sometimes accurate %	40.0	41.1	20.0	41.7
Seldom accurate %	11.3	8.9	12.0	16.7
Never accurate %	2.6	3.7	4.0	0
No opinion %	4.3	6.7	4.0	0

Question 10
How accurate do you feel the information is from environmental organizations (e.g., Audubon, Sierra Club, etc.):

	Kalkaska Sample (n=229)	Montmorency Sample (n=272)	Kalkaska Officials (n=26)	Montmorency Officials (n=13)
Always accurate %	1.3	2.6	0	0
Usually accurate %	30.1	34.6	42.3	15.4
Sometimes accurate %	33.6	34.9	42.3	53.8
Seldom accurate %	15.3	11.0	0	15.4
Never accurate %	3.1	4.4	7.7	7.7
No opinion %	16.6	12.5	7.7	7.7

Question 11
How accurate do you feel the information is from the Michigan United Conservation Club (MUCC):

	Kalkaska Sample (n=230)	Montmorency Sample (n=271)	Kalkaska Officials (n=26)	Montmorency Officials (n=13)
Always accurate %	1.7	1.5	0	0
Usually accurate %	28.3	36.2	46.2	30.8
Sometimes accurate %	37.8	37.3	42.3	61.5
Seldom accurate %	8.7	7.0	3.8	0
Never accurate %	.9	2.2	0	0
No opinion %	22.6	15.9	7.7	7.7

Question 12
How accurate do you feel the information is from the federal Environmental Protection Agency (EPA):

	Kalkaska Sample (n=230)	Montmorency Sample (n=270)	Kalkaska Officials (n=26)	Montmorency Officials (n=13)
Always accurate %	2.2	1.1	0	0
Usually accurate %	21.7	22.2	7.7	23.1
Sometimes accurate %	40.4	41.5	38.5	23.1
Seldom accurate %	20.0	21.9	38.5	46.2
Never accurate %	3.5	3.3	3.8	0
No opinion %	12.2	10.0	11.5	7.7

Question 13
How accurate do you feel the information is from a sporting organization (e.g., Ducks Unlimited, Trout Unlimited):

	Kalkaska Sample (n=230)	Montmorency Sample (n=272)	Kalkaska Officials (n=26)	Montmorency Officials (n=13)
Always accurate %	2.2	.7	3.8	0
Usually accurate %	31.3	39.0	50.0	15.4
Sometimes accurate %	39.1	37.5	34.6	76.9
Seldom accurate %	13.0	8.5	7.7	0
Never accurate %	1.3	2.2	0	0
No opinion %	13.0	12.1	3.8	7.7

Question 14
How accurate do you feel the information is from the Michigan Department of Agriculture:

	Kalkaska Sample (n=230)	Montmorency Sample (n=272)	Kalkaska Officials (n=26)	Montmorency Officials (n=13)
Always accurate %	4.3	2.6	7.7	0
Usually accurate %	43.9	47.1	53.8	38.5
Sometimes accurate %	34.3	34.2	30.8	46.5
Seldom accurate %	7.4	5.5	7.7	7.7
Never accurate %	2.2	1.8	0	0
No opinion %	7.8	8.8	0	7.7

Question 15
How accurate do you feel the information is from industrial sources:

	Kalkaska Sample (n=230)	Montmorency Sample (n=271)	Kalkaska Officials (n=25)	Montmorency Officials (n=13)
Always accurate %	.4	1.5	0	0
Usually accurate %	12.6	12.9	12.0	7.7
Sometimes accurate %	30.4	34.3	52.0	38.5
Seldom accurate %	34.3	25.8	20.0	38.5
Never accurate %	10.9	10.0	8.0	0
No opinion %	11.3	15.5	8.0	15.4

Question 16
How accurate do you feel the information is from local government officials:

	Kalkaska Sample (n=228)	Montmorency Sample (n=271)	Kalkaska Officials (n=26)	Montmorency Officials (n=13)
Always accurate %	1.3	1.8	3.8	7.7
Usually accurate %	15.4	14.4	73.1	69.2
Sometimes accurate %	41.7	41.3	15.4	23.1
Seldom accurate %	24.6	26.6	3.8	0
Never accurate %	9.6	8.5	0	0
No opinion %	7.5	7.4	3.8	0

Question 17
How accurate do you feel the information is from TV/radio:

	Kalkaska Sample (n=232)	Montmorency Sample (n=272)	Kalkaska Officials (n=26)	Montmorency Officials (n=13)
Always accurate %	1.7	1.1	0	0
Usually accurate %	17.1	19.9	23.1	30.8
Sometimes accurate %	47.0	42.3	42.3	30.8
Seldom accurate %	21.1	22.8	19.2	30.8
Never accurate %	8.2	5.5	7.7	7.7
No opinion %	4.3	8.5	7.7	0

Question 18
How accurate do you feel the information is from newspapers:

	Kalkaska Sample (n=232)	Montmorency Sample (n=274)	Kalkaska Officials (n=26)	Montmorency Officials (n=13)
Always accurate %	.9	.7	0	0
Usually accurate %	16.4	19.7	11.5	30.8
Sometimes accurate %	48.3	48.2	57.7	30.8
Seldom accurate %	22.0	18.2	19.2	23.1
Never accurate %	7.3	4.7	0	15.4
No opinion %	5.2	8.4	11.5	0

Question 19
How accurate do you feel the information is from magazines:

	Kalkaska Sample (n=232)	Montmorency Sample (n=272)	Kalkaska Officials (n=26)	Montmorency Officials (n=13)
Always accurate %	0	1.5	0	0
Usually accurate %	16.4	19.5	19.2	23.1
Sometimes accurate %	51.3	49.6	50.0	38.5
Seldom accurate %	17.7	16.2	19.2	30.8
Never accurate %	6.5	4.8	0	7.7
No opinion %	8.2	8.5	11.5	0

Question 20
Were you aware of the forest-sludge application project proposed in 1981 for Montmorency (Kalkaska) County before receiving this questionnaire? If no, please go to question 31.

	Kalkaska Sample (n=243)	Montmorency Sample (n=283)	Kalkaska Officials (n=26)	Montmorency Officials (n=13)
Yes %	48.6	50.9	88.5	76.9
No %	51.4	49.1	11.5	23.1

NOTE: Questions 21 through 30 were answered only by those responding yes to question 20 (aware of the project).

Question 21
Which of the following best describes your attitude toward the forest-sludge project when it was proposed for Montmorency (Kalkaska) County?

	Kalkaska Sample (n=118)	Montmorency Sample (n=139)	Kalkaska Officials (n=23)	Montmorency Officials (n=10)
Against the sludge project %	43.2	28.1	39.1	10.0
Favor the sludge project %	14.4	23.7	39.1	60.0
Undecided %	42.4	48.2	21.7	30.0

Question 22
Please check (✓) or list any action that you took to block or promote the proposed forest-sludge application project.

(% of total for each category)	Kalkaska Sample (n=118)	Montmorency Sample (n=138)	Kalkaska Officials (n=23)	Montmorency Officals (n=10)
Took no action %	27.1	45.7	21.7	20.0
Read materials on subject %	47.5	26.8	43.5	40.0
Talked with friends, relatives %	53.4	43.5	47.8	60.0
Contacted officials or newspapers %	9.3	5.1	21.7	0
Attended meetings %	11.9	8.7	43.5	30.0
Took leadership role %	1.7	2.2	17.4	10.0
Other %	3.4	8.7	17.4	30.0
Total Actions	182	194	49	19
Mean # of actions	1.271	.964	1.913	1.700
Standard Deviation	1.130	1.115	1.337	1.443

Question 23
Which of the following best describes the present status of the forest-sludge project in Montmorency (Kalkaska) County?

	Kalkaska Sample (n=117)	Montmorency Sample (n=138)	Kalkaska Officials (n=22)	Montmorency Officials (n=10)
Sludge has been applied* %	7.7	50.7	0	90.0
Sites being prepared %	.9	2.9	0	0
Project on hold %	19.7	5.1	9.1	0
Project dropped+ %	23.1	1.4	72.7	0
I do not know %	48.7	39.9	18.2	10.0

* correct for Montmorency
\+ correct for Kalkaska

Question 24
In the Montmorency (Kalkaska) Forest Application Project, the source of sludge is from Saginaw.

	Kalkaska Sample (n=111)	Montmorency Sample (n=133)	Kalkaska Officials (n=19)	Montmorency Officials (n=10)
Agree %	9.0	7.5	10.5	0
Don't Know %	64.0	69.2	36.8	30.0
Disagree* %	27.0	23.3	52.6	70.0

*correct answer

Question 25
The Montmorency (Kalkaska) Forest-Sludge Project is being funded by the Environmental Protection Agency.

	Kalkaska Sample (n=110)	Montmorency Sample (n=131)	Kalkaska Officials (n=19)	Montmorency Officials (n=10)
Agree* %	12.7	6.9	26.3	0
Don't Know %	71.8	79.4	52.6	70.0
Disagree %	15.5	13.7	21.1	30.0

*correct answer

Question 26
In the Montmorency (Kalkaska) Forest-Sludge Project, sludge will be applied yearly to the sites.

	Kalkaska Sample (n=111)	Montmorency Sample (n=132)	Kalkaska Officials (n=20)	Montmorency Officials (n=10)
Agree %	12.6	14.4	10.0	20.0
Don't Know %	51.4	64.4	25.0	60.0
Disagree* %	36.0	21.2	65.0	20.0

*correct answer

Question 27
Sample plots for the Montmorency (Kalkaska) Forest-Sludge Project involves several thousands of acres of state forest lands.

	Kalkaska Sample (n=111)	Montmorency Sample (n=134)	Kalkaska Officials (n=21)	Montmorency Officials (n=10)
Agree %	24.3	24.6	4.8	20.0
Don't Know %	44.1	46.3	9.5	30.0
Disagree* %	31.5	29.1	85.7	50.0

*correct answer

Question 28

In the Montmorency (Kalkaska) Forest-Sludge Project, the application of sludge is taking place in Albert and Loud (Rapid River and Coldsprings) Township state forests.

	Kalkaska Sample (n=111)	Montmorency Sample (n=134)	Kalkaska Officials (n=20)	Montmorency Officials (n=10)
Agree %	25.2	11.9	5.0	10.0
Don't Know %	41.4	54.5	10.0	20.0
Disagree* %	33.3	33.6	85.0	70.0

*correct answer

Question 29

A public hearing regarding the Montmorency (Kalkaska) Sludge-Forest Proposal has <u>not</u> been provided for the citizens of affected townships.

	Kalkaska Sample (n=111)	Montmorency Sample (n=134)	Kalkaska Officials (n=20)	Montmorency Officials (n=10)
Agree* %	21.6	31.3	15.0	60.0
Don't know %	50.0	61.9	15.0	30.0
Disagree+ %	27.9	6.7	70.0	10.0

*correct answer for Montmorency
+correct answer for Kalkaska

Question 30
Please check (√) all of the sources from which you received information concerning the application of sludge to Montmorency (Kalkaska) County forest lands.

(% total respondents to each category)	Kalkaska Sample (n=115)	Montmorency Sample (n=137)	Kalkaska Officials (n=22)	Montmorency Officials (n=10)
Newspapers %	86.1	78.8	81.8	50.0
Magazine/journal %	7.8	5.8	9.1	0
TV/Radio %	61.7	35.8	31.8	0
Friend/relative %	42.6	47.4	54.5	30.0
Pamphlets/brochures %	9.6	5.8	18.2	30.0
Public hearings %	12.2	4.4	59.1	10.0
Workshop/lecture %	2.6	2.9	18.2	40.0
University or government %	3.5	4.4	9.1	10.0
Adult ed class %	.9	.7	0	0
Library %	3.5	0	0	0
Total information sources	265	255	62	17
Mean number of information sources	2.245	1.770	2.695	1.700
Standard deviation	1.307	.973	1.717	.949

Question 31
Sludge disposal is a significant problem for many cities in Michigan.

	Kalkaska Sample (n=231)	Montmorency Sample (n=277)	Kalkaska Officials (n=25)	Montmorency Officials (n=13)
Strongly agree %	23.4	26.7	32.0	46.2
Agree %	49.4	49.1	64.0	30.8
Don't know %	24.2	22.0	4.0	23.1
Disagree %	2.2	1.1	0	0
Strongly disagree %	.9	1.1	0	0

Question 32
An application of sludge to a forest site would spoil the aesthetics (beauty) of the area for several years. (knowledge item)

	Kalkaska Sample (n=230)	Montmorency Sample (n=274)	Kalkaska Officials (n=25)	Montmorency Officials (n=13)
Strongly agree %	14.3	16.4	12.0	0
Agree %	22.2	20.1	12.0	30.8
Don't know %	36.5	38.7	16.0	15.4
Disagree* %	20.9	19.7	44.0	23.1
Strongly disagree* %	6.1	5.1	16.0	30.8

*correct answer

Question 33
Toxic chemical problems associated with forest application of sludge can be avoided with proper management techniques. (knowledge item)

	Kalkaska Sample (n=230)	Montmorency Sample (n=271)	Kalkaska Officials (n=25)	Montmorency Officials (n=13)
Strongly agree* %	8.7	10.3	4.0	0
Agree* %	33.5	31.0	52.0	46.2
Don't know %	38.3	38.0	16.0	38.5
Disagree %	12.6	14.8	24.0	15.4
Strongly disagree %	7.0	5.9	4.0	0

*correct answer

Question 34
Municipal sludge composition can vary greatly from one community to another. (knowledge item)

	Kalkaska Sample (n=231)	Montmorency Sample (n=273)	Kalkaska Officials (n=25)	Montmorency Officials (n=13)
Strongly agree* %	16.9	15.0	28.0	7.7
Agree* %	43.7	49.1	48.0	61.5
Don't Know %	31.2	31.1	16.0	30.8
Disagree %	5.6	4.0	8.0	0
Strongly disagree %	2.6	.7	0	0

*correct answer

Question 35
Clay soils would be the best type if sludge is to applied to land. (knowledge item)

	Kalkaska Sample (n=231)	Montmorency Sample (n=272)	Kalkaska Officials (n=25)	Montmorency Officials (n=13)
Strongly agree %	6.5	3.7	4.0	0
Agree %	14.7	17.3	16.0	7.7
Don't know %	44.2	52.9	36.0	38.5
Disagree* %	20.8	17.6	32.0	30.8
Strongly disagree* %	13.9	8.5	12.0	23.1

*correct answer

Question 36
The forest areas to which sludge has been applied should be fenced in to protect the public. (knowledge item)

	Kalkaska Sample (n=231)	Montmorency Sample (n=270)	Kalkaska Officials (n=25)	Montmorency Officials (n=13)
Strongly agree %	12.1	15.6	12.0	0
Agree %	33.3	24.8	24.0	15.4
Don't know %	27.7	34.8	12.0	30.8
Disagree* %	24.7	21.1	40.0	53.8
Strongly disagree* %	2.2	3.7	12.0	0

*correct answer

Question 37
Society has a responsibility to dispose of its wastes in the safest possible way regardless of the costs. (e/e value item)

	Kalkaska Sample (n=233)	Montmorency Sample (n=272)	Kalkaska Officials (n=25)	Montmorency Officials (n=13)
Strongly agree* %	36.1	27.2	20.0	7.7
Agree* %	38.2	46.2	52.0	61.5
Don't know %	9.9	11.8	0	7.7
Disagree+ %	15.0	10.7	24.0	23.1
Strongly disagree+ %	.9	4.4	4.0	0

*environmental
+economic

Question 38
If properly managed, sludge can be applied to land without causing water pollution. (knowledge item)

	Kalkaska Sample (n=233)	Montmorency Sample (n=273)	Kalkaska Officials (n=25)	Montmorency Officials (n=13)
Strongly agree* %	5.6	7.3	16.0	0
Agree* %	39.9	31.5	44.0	69.2
Don't know %	32.2	40.7	8.0	30.8
Disagree %	12.4	12.1	24.0	0
Strongly disagree %	9.9	8.4	8.0	0

*correct answer

Question 39
I would be skeptical of most management programs proposed by the Michigan DNR.

	Kalkaska Sample (n=230)	Montmorency Sample (n=270)	Kalkaska Officials (n=25)	Montmorency Officials (n=13)
Strongly agree %	15.2	11.5	32.0	15.4
Agree %	31.3	25.2	28.0	23.1
Don't know %	24.3	27.0	8.0	7.7
Disagree %	26.1	31.1	16.0	53.8
Strongly disagree %	3.0	5.2	16.0	0

Question 40
The application of sludge to forest lands would pose no great threat of disease to the public. (knowledge item)

	Kalkaska Sample (n=233)	Montmorency Sample (n=275)	Kalkaska Officials (n=25)	Montmorency Officials (n=13)
Strongly agree* %	2.6	2.5	8.0	7.7
Agree* %	20.6	19.3	32.0	38.5
Don't know %	37.8	44.4	24.0	23.1
Disagree %	26.6	18.2	24.0	30.8
Strongly disagree %	12.4	15.6	12.0	0

*correct answer

Question 41
If sludge is going to be applied to state forests near me, it should not be brought in from other parts of Michigan.

	Kalkaska Sample (n=234)	Montmorency Sample (n=273)	Kalkaska Officials (n=25)	Montmorency Officials (n=13)
Strongly agree %	38.9	35.5	32.0	15.4
Agree %	32.1	38.1	24.0	46.2
Don't know %	16.2	15.8	16.0	7.7
Disagree %	10.7	8.8	28.0	23.1
Strongly disagree %	2.1	1.8	0	7.7

Question 42
Although environmental considerations are important, the environmental considerations should not stand in the way of progress and economic growth. (e/e value item)

	Kalkaska Sample (n=232)	Montmorency Sample (n=270)	Kalkaska Officials (n=25)	Montmorency Officials (n=13)
Strongly agree* %	3.4	4.4	8.0	0
Agree* %	15.5	17.0	16.0	30.8
Don't know %	12.9	17.0	0	7.7
Disagree+ %	35.8	36.3	40.0	30.8
Strongly disagree+ %	32.3	25.2	36.0	30.8

*economic
+environmental

Question 43
Regardless of whether or not any bad effects result, it is wrong for society to dump sludge in the forest.

	Kalkaska Sample (n=234)	Montmorency Sample (n=274)	Kalkaska Officials (n=25)	Montmorency Officials (n=13)
Strongly agree %	20.1	19.3	8.0	7.7
Agree %	22.6	19.3	24.0	7.7
Don't know %	22.2	25.9	12.0	30.8
Disagree %	27.8	31.0	44.0	38.5
Strongly disagree %	7.3	4.4	12.0	15.4

Question 44
Agricultural land application of sludge could meet all of the nitrogen fertilizer needs of the U.S. (knowledge item)

	Kalkaska Sample (n=233)	Montmorency Sample (n=274)	Kalkaska Officials (n=25)	Montmorency Officials (n=13)
Strongly agree %	5.2	4.4	0	0
Agree %	19.7	12.4	12.0	0
Don't know %	59.7	66.1	64.0	53.8
Disagree* %	12.0	10.9	16.0	38.5
Strongly disagree* %	3.4	6.2	8.0	7.7

*correct answer

Question 45
If pollution control standards are shown to be inflationary, they should be relaxed in favor of the economy. (e/e value item)

	Kalkaska Sample (n=232)	Montmorency Sample (n=272)	Kalkaska Officials (n=24)	Montmorency Officials (n=13)
Strongly agree* %	2.2	2.9	4.2	0
Agree* %	17.2	18.0	25.0	30.8
Don't know %	26.3	21.3	4.2	7.7
Disagree+ %	34.9	38.2	45.8	46.2
Strongly disagree+ %	19.4	19.5	20.8	15.4

*economic
+environmental

Question 46
Most of the toxic components in sludge are removed by the wastewater treatment plant. (knowledge item)

	Kalkaska Sample (n=233)	Montmorency Sample (n=271)	Kalkaska Officials (n=25)	Montmorency Officials (n=13)
Strongly agree %	.9	1.1	4.0	0
Agree %	18.5	17.7	44.0	15.4
Don't know %	60.5	61.6	32.0	53.8
Disagree* %	16.3	13.7	20.0	15.4
Strongly disagree* %	3.9	5.9	0	15.4

*correct answer

Question 47
Sludges contain the essential plant nutrients: nitrogen, phosphorus, and potassium. (knowledge item)

	Kalkaska Sample (n=234)	Montmorency Sample (n=271)	Kalkaska Officials (n=25)	Montmorency Officials (n=13)
Strongly agree+ %	3.0	2.2	4.0	0
Agree+ %	27.8	24.0	52.0	23.1
Don't know %	59.0	66.8	36.0	53.8
Disagree %	7.3	4.8	8.0	23.1
Strongly disagree %	3.0	2.2	0	0

+correct answer

Question 48
Industries should be forced to shut down if they refuse to meet government pollution standards. (e/e value item)

	Kalkaska Sample (n=234)	Montmorency Sample (n=273)	Kalkaska Officials (n=25)	Montmorency Officials (n=13)
Strongly agree* %	26.1	22.3	24.0	0
Agree* %	43.2	41.4	44.0	61.5
Don't know %	14.1	14.3	16.0	15.4
Disagree+ %	13.2	19.4	16.0	23.1
Strongly disagree+ %	3.4	2.6	0	0

*environmental
+economic

Question 49
Odor problems will persist for a year or more after one application of sludge to a forest area. (knowledge item)

	Kalkaska Sample (n=234)	Montmorency Sample (n=275)	Kalkaska Officials (n=25)	Montmorency Officials (n=13)
Strongly agree %	4.3	3.3	0	0
Agree %	8.1	10.9	16.0	0
Don't know %	65.8	64.0	36.0	61.5
Disagree*	16.7	17.5	36.0	30.8
Strongly disagree* %	5.1	4.4	12.0	7.7

*correct answer

Question 50
Anticipated effect of non-industrial sludge on: forest growth

	Kalkaska Sample (n=230)	Montmorency Sample (n=269)	Kalkaska Officials (n=26)	Montmorency Officials (n=13)
Very beneficial %	9.1	10.4	15.4	15.4
Beneficial %	37.0	44.6	53.8	53.8
No impact %	5.7	4.5	7.7	0
Harmful %	13.5	10.0	7.7	0
Very harmful %	2.6	3.7	3.8	0
Don't know %	32.2	26.8	11.5	30.8

Question 51
Anticipated effect of non-industrial sludge on: surface water quality

	Kalkaska Sample (n=228)	Montmorency Sample (n=270)	Kalkaska Officials (n=26)	Montmorency Officials (n=13)
Very beneficial %	.4	0	0	0
Beneficial %	2.2	.4	0	0
No impact %	12.7	8.5	23.1	23.1
Harmful %	36.0	40.4	53.8	46.2
Very harmful %	14.5	14.4	7.7	0
Don't know %	34.2	36.3	15.4	30.8

Question 52
Anticipated effect of non-industrial sludge on: ground water quality:

	Kalkaska Sample (n=228)	Montmorency Sample (n=272)	Kalkaska Officials (n=26)	Montmorency Officials (n=13)
Very beneficial %	.4	0	0	0
Beneficial %	1.8	0	0	7.7
No impact %	22.4	21.7	42.3	46.2
Harmful %	25.4	29.4	38.5	7.7
Very harmful %	12.7	13.6	3.8	7.7
Don't know %	37.3	35.3	15.4	30.8

Question 53
Anticipated effect of non-industrial sludge on: public health

	Kalkaska Sample (n=229)	Montmorency Sample (n=272)	Kalkaska Officials (n=26)	Montmorency Officials (n=13)
Very beneficial %	1.3	0	0	7.7
Beneficial %	.4	0	0	0
No impact %	28.4	26.5	46.2	38.5
Harmful %	25.8	22.8	26.9	7.7
Very harmful %	9.6	12.5	7.7	0
Don't know %	34.5	38.2	19.2	46.2

Question 54
Anticipated effect of non-industrial sludge on: wildlife habitat.

	Kalkaska Sample (n=228)	Montmorency Sample (n=271)	Kalkaska Officials (n=26)	Montmorency Officials (n=13)
Very beneficial %	1.4	.7	3.8	15.4
Beneficial %	11.4	8.1	23.1	23.1
No impact %	14.9	14.4	23.1	23.1
Harmful %	27.2	27.7	34.6	7.7
Very harmful %	14.5	14.0	7.7	0
Don't know %	30.7	35.1	7.7	30.8

Question 55
Anticipated effect of non-industrial sludge on: recreation.

	Kalkaska Sample (n=226)	Montmorency Sample (n=272)	Kalkaska Officials (n=26)	Montmorency Officials (n=13)
Very beneficial %	.4	0	0	7.7
Beneficial %	1.8	1.5	15.4	0
No impact %	19.5	18.0	23.1	15.4
Harmful %	27.9	34.2	50.0	38.5
Very harmful %	19.5	19.9	11.5	7.7
Don't know %	31.0	26.5	0	30.8

Question 56
Anticipated effect of non-industrial sludge on: adjacent property value:

	Kalkaska Sample (n=228)	Montmorency Sample (n=272)	Kalkaska Officials (n=26)	Montmorency Officials (n=13)
Very beneficial %	.4	0	0	0
Beneficial %	2.2	1.1	7.7	7.7
No impact %	12.3	18.0	26.9	38.5
Harmful %	25.4	29.8	42.3	23.1
Very harmful %	26.3	24.6	23.1	7.7
Don't know %	33.3	26.5	0	23.1

Question 57
Anticipated effect of non-industrial sludge on: wildlife species:

	Kalkaska Sample (n=228)	Montmorency Sample (n=271)	Kalkaska Officials (n=26)	Montmorency Officials (n=13)
Very beneficial %	.9	1.1	3.8	7.7
Beneficial %	7.0	5.9	23.1	23.1
No impact %	14.9	12.5	19.2	15.4
Harmful %	27.6	25.8	30.8	7.7
Very harmful %	13.6	17.0	11.5	0
Don't know %	36.0	37.6	11.5	46.2

Question 58
Anticipated effect of non-industrial sludge on: long term environmental quality:

	Kalkaska Sample (n=228)	Montmorency Sample (n=271)	Kalkaska Officials (n=26)	Montmorency Officials (n=13)
Very beneficial %	3.1	1.5	11.5	15.4
Beneficial %	14.9	20.3	30.8	30.9
No impact %	12.7	7.0	7.7	15.4
Harmful %	16.2	11.8	23.1	7.7
Very harmful %	10.1	11.1	3.8	0
Don't know %	43.0	48.3	23.1	30.8

Question 59
Do you feel that a program to apply sludge to a state forest site would be properly managed by local and state agencies?

	Kalkaska Sample (n=227)	Montmorency Sample (n=271)	Kalkaska Officials (n=24)	Montmorency Officials (n=12)
Yes %	44.5	50.6	54.2	66.7
No %	55.5	49.4	45.8	33.3

Question 60
Which disposal method do you believe will have the least threat to human health?

	Kalkaska Sample (n=245)	Montmorency Sample (n=285)	Kalkaska Officials (n=26)	Montmorency Officials (n=13)
Bury in landfills %	18.8	10.2	15.4	15.4
Incineration %	40.4	47.0	42.3	30.8
Agri. application %	10.2	3.9	3.8	0
Forest application %	13.1	17.9	26.9	53.8
No opinion %	17.6	21.2	11.3	0

Question 61
Which disposal method do you believe will have the greatest threat to human health?

	Kalkaska Sample (n=245)	Montmorency Sample (n=285)	Kalkaska Officials (n=26)	Montmorency Officials (n=13)
Bury in landfills %	23.3	24.6	30.8	38.5
Incineration %	8.6	10.2	11.5	23.1
Agric. application %	34.7	36.1	30.8	30.8
Forest application %	8.2	3.2	0	0
No opinion %	25.3	26.0	26.9	7.7

Question 62
Which disposal method do you believe will have the least threat to environmental quality?

	Kalkaska Sample (n=245)	Montmorency Sample (n=285)	kalkaska Officials (n=26)	Montmorency Officials (n=13)
Bury in landfills %	17.1	15.4	11.5	23.1
Incineration %	30.2	33.0	34.6	30.8
Agric. application %	13.1	7.0	7.7	15.4
Forest application %	12.7	16.5	26.9	30.8
No opinion %	26.9	28.1	19.2	0

Question 63
Which disposal method do you believe will have the greatest threat to environmental quality?

	Kalkaska Sample (n=245)	Montmorency Sample (n=285)	Kalkaska Officials (n=26)	Montmorency Officials (n=13)
Bury in landfills %	18.8	19.3	30.8	23.1
Incineration %	14.3	11.2	19.2	38.5
Agric. application %	18.0	16.5	0	0
Forest application %	18.4	19.6	19.2	7.7
No opinion %	30.6	33.3	30.8	30.8

Question 64
Which disposal method do you believe will have the least economic cost (cheapest method)?

	Kalkaska Sample (n=245)	Montmorency Sample (n=284)	Kalkaska Officials (n=26)	Montmorency Officials (n=13)
Bury in landfills %	18.0	15.1	19.2	15.4
Incineration %	16.7	16.2	0	7.7
Agric. application %	16.3	9.9	26.9	30.8
Forest application %	15.5	25.0	30.8	30.8
No opinion %	33.5	33.8	23.1	15.4

Question 65
Which disposal method do you believe will have the greatest economic cost (most expensive method)?

	Kalkaska Sample (n=245)	Montmorency Sample (n=285)	Kalkaska Officials (n-26)	Montmorency Officials (n=13)
Bury in landfills %	18.8	22.8	7.7	7.7
Incineration %	29.4	30.9	46.2	61.5
Agric. application %	4.9	2.5	0	7.7
Forest application %	8.2	7.0	11.5	0
No opinion %	38.8	36.8	34.6	23.1

Please rank the four methods of non-industrial sewage sludge disposal according to your overall preference.

Question 66
First disposal choice

	Kalkaska Sample (n=245)	Montmorency Sample (n=285)	Kalkaska Officials (n=26)	Montmorency Officials (n=13)
Bury in landfills %	20.0	14.0	11.5	7.7
Incineration %	38.8	47.7	34.6	15.4
Agric. application %	19.6	10.5	23.1	15.4
Forest application %	12.2	18.2	30.8	53.8
No opinion %	9.4	9.5	0	7.7

Question 67
Your second disposal choice

	Kalkaska Sample (n=245)	Montmorency Sample (n=285)	Kalkaska Officials (n=26)	Montmorency Officials (n=13)
Bury in landfills %	26.5	27.7	15.4	23.1
Incineration %	18.0	15.8	7.7	15.4
Agric. application %	16.3	17.2	38.5	46.2
Forest application %	22.4	21.8	38.5	7.7
No opinion %	16.7	17.5	0	7.7

Question 68
Your third disposal choice

	Kalkaska Sample (n=245)	Montmorency Sample (n=285)	Kalkaska Officials (n=26)	Montmorency Officials (n=13)
Bury in landfills %	18.0	21.4	38.5	23.1
Incineration %	15.5	14.4	26.9	30.8
Agric. application %	11.8	13.3	15.4	15.4
Forest application %	31.0	31.6	7.7	23.1
No opinion %	23.7	19.3	11.5	7.7

Question 69
Please check (√) the one statment which best describes what you would do if another proposal was made to apply sludge in an area of state forest lands near you.

	Kalkaska Sample (n=237)	Montmorency Sample (n=275)	Kalkaska Officials (n=26)	Montmorency Officials (n=12)
A. I would be opposed to the proposal, and I would get involved %	29.1	29.1	34.6	8.3
B. I would be opposed to the proposal, but I would not get involved %	15.2	14.5	3.8	0
C. I would favor the proposal, and I would get involved %	8.4	8.7	30.8	41.7
D. I would favor the proposal, but I would not get involved %	10.5	10.5	15.4	8.3
E. Undecided %	36.7	37.1	15.4	41.7

Question 70
To show how much consideration you feel should be given to each category in making sludge-management decisions (such as how and where it will be disposed), divide 100 points among the following four categories: Human Health, Economics, Environmental Quality, and Wildlife Aesthetics.

HUMAN HEALTH	Kalkaska Sample (n=222)	Montmorency Sample (n=256)	Kalkaska Officials (n=26)	Montmorency Officials (n=12)
0 to 10 points	.5%	2.3%	3.8%	16.7%
11 to 20 "	2.3%	.8%	0	8.3%
21 to 30 "	14.0%	13.3%	3.8%	0
31 to 40 "	16.7%	18.4%	19.2%	16.7%
41 to 50 "	35.1%	29.3%	46.2%	25.0%
51 to 60 "	9.9%	9.0%	7.7%	0
61 to 70 "	4.5%	5.1%	0	8.3%
71 to 80 "	9.5%	15.2%	19.2%	25.0%
81 to 90 "	3.2%	1.6%	0	0
91 to 100 "	4.5%	5.1%	0	0
Mean score	51.766	52.469	50.962	46.917
Standard deviation	19.646	20.684	16.972	25.343

ECONOMICS	Kalkaska Sample (n=222)	Montmorency Sample (n=256)	Kalkaska Officials (n=26)	Montmorency Officials (n=12)
0 to 10 points	58.6%	60.5%	61.5%	41.7%
11 to 20 "	23.0%	19.5%	15.4%	33.3%
21 to 30 "	17.1%	17.6%	15.4%	16.7%
31 to 40 "	.9%	1.6%	3.8%	0
41 to 50 "	.5%	.8%	3.8%	0
51 to 60 "	0	0	0	0
over 60 "	0	0	0	8.3%
Mean score	12.455	12.582	13.846	19.500
Standard deviation	9.976	10.079	13.062	23.322

ENVIRONMENTAL QUALITY AND WILDLIFE	Kalkaska Sample (n=222)	Montmorency Sample (n=256)	Kalkaska Officials (n=26)	Montmorency Officials (n=12)
0 to 10 points	23.0%	26.6%	26.9%	25.0%
11 to 20 "	30.2%	24.6%	23.1%	50.0%
21 to 30 "	31.1%	33.2%	30.8%	8.3%
31 to 40 "	8.1%	9.8%	11.5%	8.3%
41 to 50 "	6.8%	4.7%	7.7%	0
51 to 60 "	.5%	1.2%	0	8.3%
over 60 "	.5%	0	0	0
Mean score	22.396	21.988	23.077	21.833
Standard deviation	12.939	12.549	12.496	15.087

AESTHETICS (BEAUTY) OF THE AREA	Kalkaska Sample (n=222)	Montmorency Sample (n=256)	Kalkaska Officials (n=26)	Montmorency Officials (n=12)
0 to 10 points	56.8%	56.3%	65.4%	75.0%
11 to 20 "	25.2%	25.4%	15.4%	16.7%
21 to 30 "	14.9%	16.0%	19.2%	8.3%
31 to 40 "	1.4%	1.2%	0	0
41 to 50 "	1.8%	.8%	0	0
51 to 60 "	0	0	0	0
over 60 "	0	.4%	0	0
Mean score	13.383	12.902	12.115	11.750
Standard deviation	10.191	10.289	8.964	6.426

Question 71
Your Sex:

	Kalkaska Sample (n=242)	Montmorency Sample (n=282)	Kalkaska Officials (n=25)	Montmorency Officials (n=13)
Male %	53.7	51.4	56.0	30.8
Female %	46.2	48.6	44.0	69.2

Question 72
Your present age (in years)

	Kalkaska Sample (n=242)	Montmorency Sample (n=281)	Kalkaska Officials (n=24)	Montmorency Officials (n=11)
0-19	0	.4%	0	0
20-29	21.1%	14.9%	0	0
30-39	20.2%	12.1%	25.0%	18.2%
40-49	13.2%	13.9%	8.3%	18.2%
50-59	18.2%	18.5%	37.5%	36.4%
60-69	17.8%	28.1%	25.0%	18.2%
70-79	9.1%	12.1%	4.2%	9.1%
over 80	.4%	0	0	0
Mean Age	46.769	51.228	52.167	54.182
Standard deviation	16.752	16.607	12.648	12.859

Question 73
What is the highest level of formal education that you have completed?

	Kaikaska Sample (n=239)	Montmorency Sample (n=280)	Kaikaska Officials (n=25)	Montmorency Officials (n=12)
Some high school %	18.8	20.4	24.0	25.0
High school grad. %	39.7	40.4	36.0	16.7
Some college %	28.5	24.6	32.0	41.7
College graduate %	7.9	8.6	4.0	16.7
Beyond Bachelor's %	5.0	6.1	4.0	0

Question 74
How would you classify your primary occupation? (Please check ( ) the one response that best applies.)

	Kaikaska Sample (n=241)	Montmorency Sample (n=277)	Kaikaska Officials (n=25)	Montmorency Officials (n=12)
Semi-skilled or apprentice %	12.4	7.6	8.0	0
Sales or clerical/ office %	7.1	6.5	16.0	33.3
Skilled worker, craftsman, foreman %	17.8	11.9	12.0	0
Farmer %	.8	3.2	4.0	8.3
Manager/proprietor %	7.1	7.6	24.0	8.3
Professional %	8.3	10.5	0	16.7
Homemaker %	19.1	15.9	8.0	16.7
Unemployed %	2.1	2.2	0	0
Retired %	25.3	34.7	28.0	16.7

Question 75
Do you currently hold any political office at any level of government?

	Kalkaska Sample (n=240)	Montmorency Sample (n=283)	Kalkaska Officials (n=26)	Montmorency Officials (n=13)
Yes %	2.5	2.8	100	100
No %	97.5	97.2	0	0
Political Office Held	(n=6)	(n=8)	(n=25)	(n=13)
Cty. Commissioner %	0	0	20.0	23.1
Twp. Supervisor %	16.7	0	36.0	30.8
Twp. Clerk %	0	0	44.0	46.2
School Board %	16.7	37.5	0	0
County Level %	0	12.5	0	0
Other %	66.7	50.0	0	0

Question 76
Please check (√) all the types of activities you have done on state-owned forest lands in the past two years:

% of total responding to each category	Kalkaska Sample (n=235)	Montmorency Sample (n=247)	Kalkaska Officials (n=24)	Montmorency Officials (n=12)
1. Fishing %	62.6	62.0	45.8	75.0
2. Swimming, boating, canoeing %	63.0	58.8	50.0	66.7
3. Firearm deer hunting %	44.3	47.1	58.3	58.3
4. Archery deer hunting %	18.3	15.3	4.2	0
5. Small game hunting %	37.0	39.4	37.5	50.0
6. Scenic driving %	79.6	81.8	66.7	91.7
7. Snowmobiling %	28.9	36.9	37.5	41.7
8. Trailbike riding %	10.6	12.4	8.3	16.7
9. Berrypicking/ mushroom hunting %	77.4	81.4	70.8	83.3
10. Hiking %	37.0	34.7	29.2	33.3
11. Camping %	39.6	33.9	29.2	66.7
12. Gathering fuelwood %	44.3	47.4	16.7	75.0
13. Looking for wildlife %	56.6	62.8	58.3	66.7
14. Photography %	25.5	30.3	29.2	33.3
15. Picnicking %	50.2	47.4	41.7	58.3
16. Cross-country skiing %	20.0	13.1	12.5	33.3
17. Other %	6.0	6.6	12.5	16.7
Total forest uses	1,647	1,949	146	104
Mean forest uses	6.722	6.838	5.615	8.000
Standard deviation	3.852	4.057	4.300	3.512

Question 77
Of the uses listed above, which one is the most important to you?

	Kalkaska Sample (n=215)	Montmorency Sample (n=245)	Kalkaska Officials (n=23)	Montmorency Officials (n=11)
Fishing %	12.1	13.5	8.7	9.1
Swimming, boating, canoeing %	7.4	8.2	0	0
Firearm deer hunting %	12.1	12.7	21.7	9.1
Archery deer hunting %	2.3	2.0	0	0
Small game hunting %	1.4	2.9	4.3	0
Scenic driving %	14.0	14.3	26.1	0
Snowmobiling %	2.3	.4	4.3	0
Trailbike riding %	.9	.4	0	0
Berry picking/ mushroom hunting %	8.8	13.5	4.3	9.1
Hiking %	2.8	2.4	4.3	0
Camping %	7.0	6.9	8.7	18.2
Gathering fuelwood %	9.8	7.8	0	9.1
Looking for wildlife %	12.1	9.8	4.3	18.2
Photography %	2.3	.8	4.3	9.1
Picknicking %	.9	.8	0	0
Cross-country skiing %	1.4	2.0	0	0
Other %	2.3	1.6	8.7	18.2

Question 78
Are you a permanent resident of Montmorency (Kalkaska) County?

	Kalkaska Sample (n=241)	Montmorency Sample (n=283)	Kalkaska Officials (n=24)	Montmorency Officials (n=12)
Yes %	99.2	97.5	100	100
No %	.8	2.5	0	0
If yes, how many years have you permanently lived in Montmorency (Kalkaska) County?	(n=233)	(n=273)	(n=24)	(n=11)
1-5	30.9%	27.5%	8.3%	0
6-10	28.3%	24.2%	8.3%	18.2%
11-20	15.0%	19.0%	12.5%	9.1%
21-30	7.3%	9.2%	8.3%	27.3%
31-40	6.9%	8.4%	29.2%	27.3%
41-50	2.6%	5.1%	8.3%	9.1%
51-60	7.3%	2.9%	12.5%	0
Over 60	1.7%	3.7%	12.5%	9.1%
Mean years	16.266	17.143	33.875	29.727
Standard deviation	17.158	17.369	19.822	17.315

Question 79
In which township of Montmorency (Kalkaska) County do you live?

	Kalkaska Sample (n=245)	Kalkaska Officials (n=25)		Montmorency Sample (n=271)	Montmorency Officials (n=12)
Bear Lake* %	7.2	8.0	Albert %	24.7	25.0
Blue Lake %	5.5	8.0	Avery %	7.7	8.3
Boardman %	8.1	4.0	Briley %	19.9	8.3
Clearwater %	11.5	12.0	Hillman %	20.7	8.3
Coldsprings %	7.2	8.0	Montmorency* %	13.7	16.7
Excelsior %	5.1	12.0	Loud %	2.9	8.3
Garfield* %	3.4	8.0	Rust %	6.6	8.3
Kalkaska %	32.8	8.0	Vienna %	3.7	16.7
Oliver* %	2.1	8.0			
Orange %	7.2	8.0			
Rapid River %	4.7	4.0			
Springfield %	5.1	12.0			

*Indicates affected township.

Question 80
In what city is your postal address located?

	Kalkaska Sample (n=240)	Kalkaska Officials (n=25)		Montmorency Sample (n=279)	Montmorency Officials (n=12)
Kalkaska %	57.5	44.0	Lewiston %	25.1	25.0
Mancelona %	5.4	12.0	Atlanta %	41.6	25.0
Rapid City %	10.8	12.0	Hillman %	31.2	33.3
Fife Lake %	10.0	24.0	Johannesburg %	1.4	8.3
S. Boardman %	12.1	4.0	Gaylord %	.4	0
Alden %	1.2	4.0	Comins %	0	8.3
Wmsburg %	2.1	0	Out of County %	.4	0
Grayling %	.8	0			

Question 81
Do you live within a city or village limit?

	Kalkaska Sample (n=239)	Montmorency Sample (n=277)	Kalkaska Officials (n=24)	Montmorency Officials (n=12)
Yes %	21.3	22.7	4.2	8.3
No %	78.7	77.3	95.8	91.7

Question 82
What was your approximate gross family income from all sources before taxes in 1981.

	Kalkaska Sample (n=199)	Montmorency Sample (n=247)	Kalkaska Officials (n=21)	Montmorency Officials (n=10)
less than $8,000 %	23.6	27.1	4.8	20.0
$8,000-15,999 %	29.1	37.7	42.9	30.0
$16,000-23,999 %	22.6	14.2	23.8	20.0
$24,000-31,999 %	12.1	10.5	9.5	10.0
$32,000-39,999 %	7.0	4.5	9.5	10.0
$40,000 or more %	5.5	6.1	9.5	10.0

Question 83
Please check (√) any of the following organizations in which you presently hold a membership.

(% of Total respondent population)	Kalkaska Sample (n=245)	Montmorency Sample (n=285)	Kalkaska Officials (n=26)	Montmorency Officials (n=13)
1. Audubon	1.2%	1.4%	0	7.6%
2. Sierra Club	0.4%	0.7%	0	0
3. League of Women Voters	0.4%	0.4%	0	0
4. Garden Club	0.4%	1.8%	0	0
5. Mich. United Cons. Club	4.1%	4.9%	3.8%	0
6. Natl. Wild. Fed.	4.1%	2.1%	3.8%	15.4%
7. Trout Unlimited	0.8%	0.4%	0	7.6%
8. Steelheaders Assoc.	0.4%	0	0	0
9. Ruffed Grouse Soc.	0.4%	0.7%	0	0
10. Ducks Unlimited	2.9%	3.9%	7.7%	23.1%
11. A Mich. Trapper's Association	1.6%	0	7.7%	15.4%
12. An ORV Club	2.9%	2.1%	3.8%	0
13. Boating Club	0.8%	0.7%	0	7.6%
14. W. or E. Mich. Env. Action Council	0.8%	0	0	0
15. Local Landholders Association	6.5%	14.0%	23.1%	7.6%
Total Env. Memberships	68	94	13	11
Total Individuals Responding	50	66	10	5

DATE CODE - Postmark of Returned Survey

	Kalkaska Sample (n=245)	Montmorency Sample (n=284)	Kalkaska Officials (n=26)	Montmorency Officials (n=13)
1. July 7-14 %	33.1	29.6	53.8	38.5
2. July 15-21 %	22.9	20.1	23.1	23.1
3. July 22-28 %	11.4	16.9	0	15.4
4. July 29-Aug 4 %	3.3	8.1	0	0
5. Aug 5-11 %	20.8	18.7	15.4	15.4
6. Aug 12-18 %	3.7	3.5	3.8	0
7. Aug 19-25 %	2.0	1.8	0	0
8. Aug 26-Sept 1 %	2.4	.7	0	0
9. Sept 2-end %	.4	.7	3.8	7.7

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